School of Public Health

A cohort study of postnatal depression, infant feeding practices and infant growth in Male', the Republic of Maldives

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature: ………………………………………….

Date: ………………………...

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Abstract

Introduction

Maternal and child health is an important priority for all countries. There have been several strategies proposed to improve maternal and child health in the Maldives. Postnatal depression is a serious problem which has adverse effects on the mother and the infant. It affects physical, social, cognitive and emotional development of the infant. Although there have been several studies on postnatal depression in Asia, there are no published data on postnatal depression in the Maldives. Previous studies of infant feeding in Asia have shown high rates of early introduction of complementary feeds and high rates of stunting and wasting (length and weight below two standard deviations based on the length / weight for age growth chart) (World Health Organisation, 2006). It is important to understand the factors that affect postnatal depression, infant feeding practices and growth of children in Male' to improve overall infant health.

The aims of this study were to evaluate the incidence of antenatal and postnatal depression and any associations with demographic factors, infant feeding practices and infant growth patterns in the city of Male', the Republic of Maldives. This included investigating breastfeeding problems which mothers experience within six months postpartum.

Method

A prospective cohort design was used to follow up 458 mothers and their infants, selected from the antenatal clinics of the Reproductive Health Centre in the Indira Gandhi Memorial Hospital (IGMH) and ADK Hospital in Malé between February 2011 and June 2012. The mothers who agreed to participate were interviewed after delivery and each mother was followed up at one month, three months and six months postnatal, when she attended the clinic at IGMH or Malé Health Centre for her child's immunisation. Any mother who was not interviewed at the clinic was followed up by phone or by a home visit. The exclusion criteria were mothers who were under 18, critically ill or unable to give informed consent. The validated research tools used included: the Edinburgh Postnatal Depression Scale (EPDS) (Cox, 1987); Iowa Infant Feeding Attitudinal Scale (De la Mora and Russell, 1999);

and a questionnaire on demographic details and breastfeeding information. Growth of the infants was assessed using standard anthropometry with the WHO (World Health Organisation) Growth references.

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 19 for Windows software (IBM, Chicago, IL, USA). Frequency distributions of the data were generated and the data was checked for outliers and errors. Growth data were transformed into Z-scores based on the WHO growth reference for analysis (World Health Organisation, 2006). Descriptive statistics was used to describe continuous variables. Univariate analyses (including chi-square and t-tests) were used to make comparisons between subgroups of interest. Multivariate logistic regression models then were developed to identify important variables affecting infant feeding, growth faltering and postnatal depression outcomes. Survival analysis was used to explore the associations between the Edinburgh Depression Scale scores and 'exclusive', 'full', or 'any' breastfeeding and infant growth faltering.

Results

The incidence of antenatal depression using an EPDS cut-off score ≥13 was 23.8%. At one month postnatal, the percentage of mothers with depression was similar at 26.7%. At three months, the prevalence of postnatal depression had reduced to 11.9% and at six months the percentage of mothers with postnatal depression was very low, at 2.6% (n=11).

The risk factors for antenatal and postnatal depression in this study included 'not receiving help in looking after the children and household chores' (adjusted OR=2.3; 95% CI, 1.2–4.3), 'having stressful life events' (adjusted OR=6.7.0; 95% CI, 2.5–17.5) and 'having a household annual income less than MVR 90,000 (A$6,209)' (adjusted OR=4.1; 95% CI, 1.3–12.8). Antenatal depression in this study also was significantly associated with 'late initiation of breastfeeding' (adjusted OR= 3.0; 95% CI, 1.3–6.8). A higher proportion of mothers who were depressed at three months stopped 'exclusive breastfeeding' (log rank chi-square 64.4, df 1, p<0.001), 'full breastfeeding' (log rank chi-square 120.6, df 1, p<0.001) and 'any breastfeeding' (log rank chi-square 133.0, df 1, p<0.001) earlier when compared with non- depressed mothers. The survival analysis showed that, when depression was chosen as a status, a larger proportion of mothers whose infants were below two standard deviations on the (World Health Organisation, 2006) z-score weight-for-age growth chart at six months had stopped ‘exclusive breastfeeding’ earlier (log rank chi-square 11.8, df 2, $p<0.03$).

All of the mothers initiated breastfeeding and ‘any breastfeeding’ rates stayed high at six months. However, ‘full breastfeeding’ and ‘exclusive breastfeeding’ rates dropped to 29.7% and 7.5%, respectively by six months. Factors associated with ‘exclusive breastfeeding’ were ‘initiation of breastfeeding less than four hours after giving birth’ (adjusted OR= 0.08; 95% CI, 0.01–0.6), ‘receiving help from a baby sitter’ (adjusted OR= 0.3; 95% CI, 0.01–1.2), ‘receiving help from a family member’ (adjusted OR= 2.2; 95% CI, 1.0–4.8) and ‘health workers supporting breastfeeding’ (adjusted OR= 0.2; 95% CI, 0.04–0.7). Mothers were less likely to ‘fully breastfeed’ if they ‘had decided on a feeding method after the baby was born ’ (adjusted OR= 0.1; 95% CI, 0.05–0.32), ‘had a caesarean section delivery’ (adjusted OR= 0.6; 95% CI, 0.4–0.9) ‘had maternal mothers who did not breastfeed’ (adjusted OR= 0.1; 95% CI, 0.1–0.3), ‘were older than 24 years of age’ (adjusted OR= 0.3; 95% CI, 0.1–0.9), or ‘had initiated breastfeeding four hours or more after delivery’(adjusted OR= 0.2; 95% CI, 0.07–0.5). Mothers who were ‘fully breastfeeding’ were less likely to have infants with acute respiratory infections and respiratory problems (adjusted OR= 0.6; 95% CI, 0.4–0.9), compared with mothers who did not ‘fully breastfeed’.

‘Mothers who gave infant formula as a prelacteal feed’ were six times more likely to stop ‘any breastfeeding’ before six months (adjusted OR= 6.0; 95% CI, 1.6–21.8) when compared with mothers who did not give infant formula as a prelacteal feed. Infants of mothers who stopped ‘any breastfeeding’ before six months were over three times more likely to have diarrhoea (adjusted OR= 7.41; 95% CI, 1.6–33.4) and over seven times more likely to have other health problems (digestive problems, vomiting and constipation) (adjusted OR= 3.6; 95% CI, 1.3–9.9), compared with infants of mothers who ‘any breastfed’ their infants. Some mothers reported several problems they had with breastfeeding, the main one being ‘not having enough breastmilk’. Also some mothers reported that their infants were not growing with breastmilk alone, so they had to introduce infant formula. The other reasons mothers reported were ‘pain while breastfeeding’, ‘mastitis’, ‘mother or infant being sick’, ‘suckling problems’, ‘infant refused to breastfeed’, ‘it is the age to start other food’ and ‘infant crying and not sleeping well’

At one month, the proportion of mothers who had given fruits (dates) and honey were high, (40.5% and 15.7%, respectively) because very small amounts of both of these foods are commonly rubbed onto the infant’s upper palate as a ritual before breastmilk is commenced or in the first week. The proportion of mothers who gave water was high, increasing from 20.5% at one month to 46.5% at four months. Many mothers (17.2%) had given pomegranate juice by four months. About 30% of the mothers introduced solid food at five months and a small percentage (7.7%) at four months.

Factors associated with the introduction of infant formula included, ‘the mother being older than 24 years of age’ (adjusted OR= 2.1; 95% CI, 1.3–3.6), ‘having number of children equal to or less than two’ (adjusted OR= 2.1; 95% CI, 1.1–4.0), ‘being employed’(adjusted OR=1.7; 95% CI, 1.1 –2.6) and ‘having a caesarean section delivery’ (adjusted OR= 2.1; 95% CI, 1.2–3.6). Mothers who started giving infant formula at one month were more likely to have a weight above 65kg at six months after delivery (adjusted OR= 4.4; 95% CI, 1.5–13.0). Infants who were formula fed also were more likely to have ‘other health problems’ (digestive problems, vomiting and constipation) (adjusted OR= 2.1; 95% CI, 1.2–3.6) at three months when compared with infants of mothers who did not give infant formula at three months.

There were few infants with low birthweight in this study. Only 5.1% of the infants had a birthweight less than 2,500 grams. The percentage of infants who were short for their age was highest at three months for girls (11.6%) and at six months for boys (18.3%). An infant being normal weight in this study was inversely associated with ‘living on an island other than Male'’ (adjusted OR= 0.07; 95% CI, 0.01–0.67, ‘birthweight less than 2,500 grams’(adjusted OR= 0.2; 95% CI, 0.09–0.9), ‘socioeconomic factors’ [the infant sleeping in a room with more than three people] (adjusted OR= 0.1; 95% CI, 0.02–0.7), ‘the infant ‘having diarrhoeal episodes’ (adjusted OR= 0.3; 95% CI, 0.1–0.9) and the infant ‘having acute respiratory infections’ (adjusted OR= 0.1; 95% CI, 0.01–0.9).

‘Maternal education level being secondary or higher’ (adjusted OR= 4.6; 95% CI, 1.1 – 17.9) and ‘paternal non-smoking’ (adjusted OR= 4.7; 95% CI, 1.4–17.3) were positively associated with an infant being normal weight.

Conclusion

The prevalence of antenatal depression and postnatal depression in the Maldives is similar to other countries. The ‘any breastfeeding’ rates in the Maldives are high with all mothers in this study initiating breastfeeding. However the ‘full breastfeeding’ and ‘exclusive breastfeeding’ rates fell rapidly in the first months after birth due to the early introduction of complementary feeds. The percentage of infants with measurements below the new WHO weight/length-for-age growth charts weight/length-for-age growth charts (World Health Organisation, 2006) is high in the Maldives. The results show that mothers with depression stop breastfeeding earlier, compared with non-depressed mothers. The infants of few mothers who stopped breastfeeding before six months were more likely to have ‘infant health problems’ (diarrhoeal episodes, acute respiratory infections, breathing difficulties, digestive problems, vomiting and constipation) and growth faltering. Hence there is a great need to treat mothers with postnatal depression and to minimise the risk factors for depression. Further studies need to be undertaken to develop interventions to manage depression. There is also a need to minimise the gap in maternal and health services between the islands, so that the island of Male' does not become so over-populated, and to improve breastfeeding rates and infant growth of the infants living in the islands. The need for caesarean sections should be explored because caesarean sections affect the initiation of breastfeeding, which in turn affects breastfeeding rates. Finally, health professionals and families need to be educated to distinguish between cultural and religious practices in order to reduce the use of early, unnecessary complementary feeding.

Abbreviations

AUS$	Australian dollar
CI	Confidence Interval
DHA	Docosahexaenoic Acid
DHS	Demographic Health Surveys
EPDS	Edinburg Postnatal Depression Scale
HR	Hazard Risk
IQ	Intelligence Quotient
MDG	Millennium Development Goals
NICU	Neonatal Intensive Care Unit
OR	Odds Ratio
PPD	Postpartum depression
RR	Relative Risk
SD	Standard Deviation
UK	The United Kingdom of Great Britain and Northern Ireland
UNICEF	The United Nations Children's Fund
USA	The United States of America
WHO	World Health Organization
USD$	US dollar

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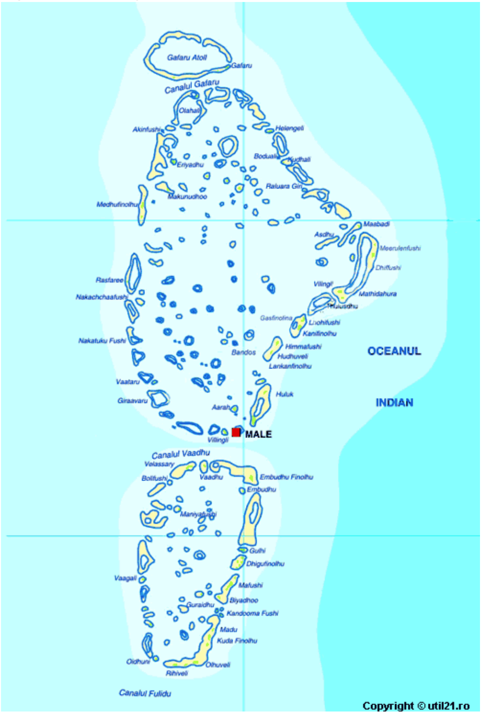
Chapter 1 Introduction

This chapter describes the state of maternal and child health in the Maldives, the aim and objectives of the study, the significance of the study and the outline of the thesis.

1.1 Background

The Republic of Maldives consists of 1,190 small islands out of which 193 are inhabited and a further 91 islands have been developed as tourist resorts (Ministry of Planning and National Development, 2006). The islands are low lying with an average elevation of 1.6 metres above sea-level. Each island is surrounded by shallow, crystal-clear lagoons enclosed by coral reefs. The islands of the Maldives are geographically formed into 26 natural atolls but are grouped into 20 regions for administrative purposes. (Ministry of Planning and National Development, 2006). Maldivians share one common language, culture and religion (Islam) (Ministry of Planning and National Development, 2006). Although the official language is Dhivehi, which is unique to the Maldives, English is spoken by a majority of the people, and is also widely used in education, business and commerce (Ministry of Planning and National Development, 2006). In 2006, the total population of the Maldives was 298,968 with 103,693 living on the city of Malé (Ministry of Planning and National Development, 2006). Approximately 71% of the population is under 35 years of age, and the national literacy rate is 94% (Ministry of Planning and National Development, 2006). Figure 1.1 shows a map of Male' atoll. The land area of the city of Male' where the data was collected from is 5.8 km^2.

Figure 1.1 Map of Malé atoll



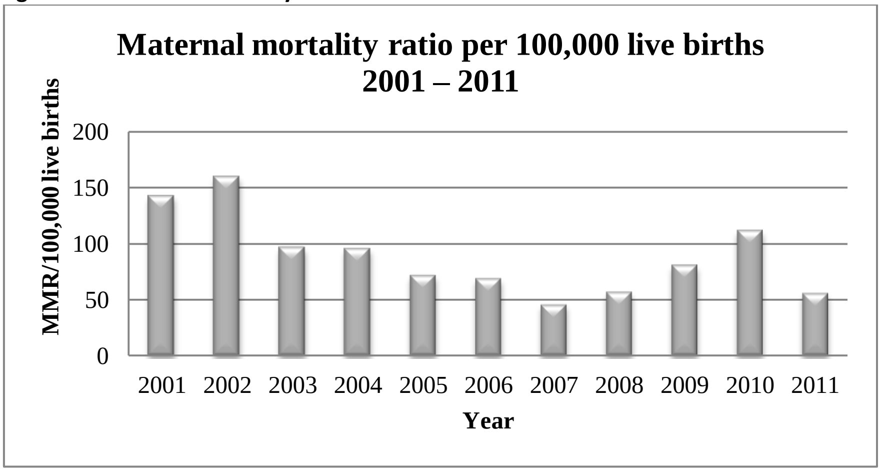
1.2 Maternal and Child Health in the Maldives

Maternal and child health is one of the most crucial health topics around the world. There have been several strategies proposed in order to improve maternal and child health in the Maldives. Maternal and child mortality rate reduction was made one of the priority goals of the Millennium Development Goals (MDG) (Ministry of Health and Family, 2012).

1.2.1 Mortality rates

In 1990 the baseline for maternal mortality ratio was 500/100,000 live births and the Millennium development Goal was to reduce the rate by half (Ministry of Health and Family, 2012). As shown in Figure 1.2, there has been a gradual decrease in maternal mortality ratio from 2002 to 2007 (from 160/100,000 live births to 46/100,000 live births) in the Maldives. There have been some fluctuations in the maternal mortality ratio in more recent years, increasing to 112/100,000 live births in 2010, then dropping again to 56/100,000 live births in 2011. Although the numbers of deaths is accurate, the exact causes of maternal deaths may not have been reported correctly. Hence there is a need to properly establish the causes of deaths in order to plan programs better and to set up priority programs (Ministry of Health and Family, 2012).

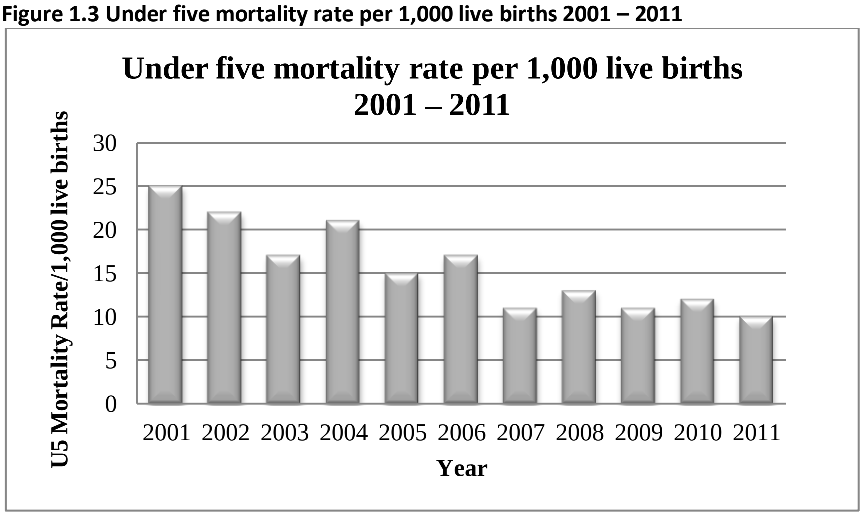
Figure 1.2 Maternal mortality ratio



Source: Vital Statistics System, Ministry of Health, 2011

The MDG target for the Maldives is to reduce Under Five Mortality to 16 per 1,000 live births by the end of 2015 (Ministry of Health and Family, 2012). Under-five mortality has stayed below 16 from 2007-2011 and strategies need to be designed to further sustain or improve these rates (Figure 1.3).

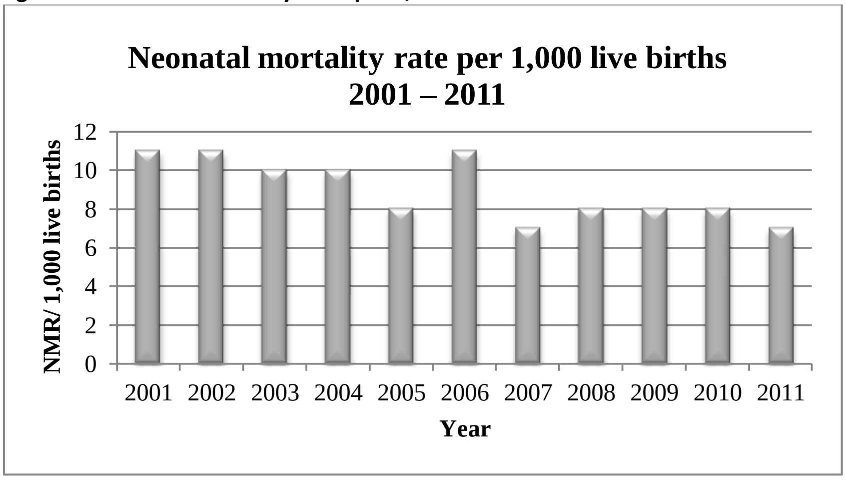
Figure 1.3 Under five mortality rate per 1,000 live births 2001 – 2011



Source: Vital Statistics System, Ministry of Health, 2011

There have been some reductions in neonatal mortality from 11/1,000 live births in 2001 to 8/1,000 live births in 2005 (Figure 1.4). There was an increase in neonatal deaths in 2006 but this gradually decreased to 7/1,000 live births in 2011.

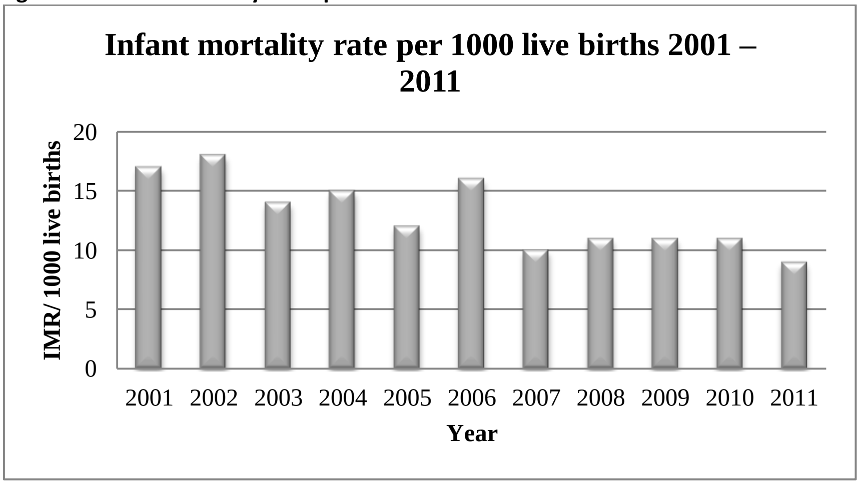
Figure 1.4 Neonatal mortality rates per 1,000 live births 2001 – 2011



Source: Vital Statistics System, Ministry of Health, 2011

Similar trends were seen in infant mortality rates (Figure 1.5). The infant mortality rate dropped from 76 deaths/1000 live births in 1990 to 9 in 2009, one of the lowest in the region. However the Ministry of Health believes that appropriate interventions are needed to stabilise and further reduce neonatal and infant mortality (Ministry of Health and Family, 2012).

Figure 1.5 Infant mortality rates per 1000 live births 2001 – 2011



Source: Vital Statistics System, Ministry of Health, 2011

1.2.2 Nutrition

Maternal nutrition that is less than optimal affects the uterine growth of the foetus. Low birth weight in turn affects nutrition and growth of the infant. The percentage of infants who were born with low birth weight was similar throughout the period 2007 to 2011. The percentage of infants who were born with low birth weight was approximately 10% during the period 2007 to 2011. More than 85% of the infants were born with a weight within the normal range and only about 3% of the babies had a high birth weight (Table1.1) (Ministry of Health and Family, 2012).

Table 1.1 Percentages of low birth weight infants from 2007 to 2011

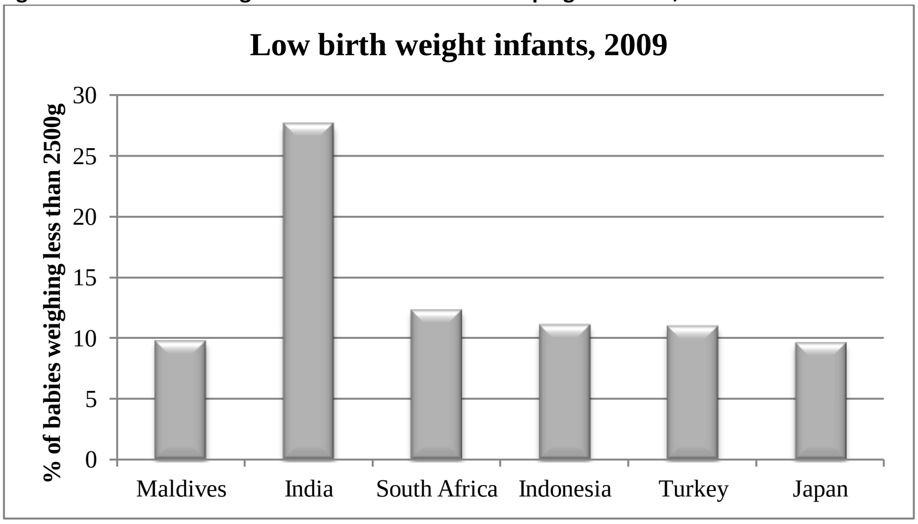
		2007	2008	2009	2010	2011
Low Birth Weight <2500g	Number	667	678	717	697	729
	%	10.15%	9.87%	9.78%	9.83%	10.21%
Normal 2500-4000g	Number	5713	6063	6398	6170	6214
	%	86.92%	87.09%	87.31%	87.02%	86.99%
High Birth Weight >4000g	Number	193	212	213	223	200
	%	2.94%	3.05%	2.91%	3.15%	2.8
Not Stated	Number	4	2	95	0	39
	%	0.06%	0.03%	1.28%	0.00%	0.54

Source: Vital Statistics System, Ministry of Health, 2011

Compared with other South Asian countries and developing countries, the Maldives has a lower percentage of infants born with a low birth weight. The percentage of infants who were born with low birth weight in 2009 in the Maldives was around

10% compared to India where the percentage was much higher at 27%. The percentages of infants with low birth weight were more than 10% in South Africa, Indonesia and Turkey. Japan had a lower percentage of infants with low birth weight compared to the Maldives (Figure 1.6) (OECD, 2011).

Figure 1.6 Low birth weight infants in selected developing countries, 2009



Source: OECD Health Data 2011; Vital Statistics System, Ministry of Health, 2011

However, malnutrition seems to be prevalent in the Maldives. According to the Multiple Indicator Cluster Survey 1 (MICS-1) in 1996 and the Maldivian Demographic Health Survey (MDHS) in 2009, the proportion of stunting in children less than five years of age has been reduced from 30% in 1996 to 18.9% in 2009. The percentage of wasting and underweight has also been reduced from 17% to10.6% and from 43% to17.3%, respectively, during the same period (Ministry of Health and Family, 2012). Breastfeeding provides the best nutrition for an infant especially when breastfed exclusively for around six months. The MICS, in 2001, indicated that 89.6% of mothers were still breastfeeding their infants at six months, while the National Micronutrient Survey 2007 shows that 51.9% of the boys and 50.8% of the girls were exclusively breastfed up to six months. However, being a cross-sectional survey of mothers and children under five years of age, this study could have a greater level of inaccuracy.

1.2.3 Health Financing

The total health expenditure as % GDP in the Maldives was 9.2% in 2011. General government expenditure on health as % of GDP was 4.1% and external resources on health as % of total health expenditure was 3.3% in 2011 (Ministry of Health and

Family, 2012). The total health expenditure as a percentage of national budget has decreased from 12.8% in 2008 to 3.1% in 2011 (Ministry of Health and Family, 2012).

1.2.4 Maternal and Child Health Care Services

The two main hospitals are in Malé; namely, the Indira Gandhi Memorial Hospital (government) and the ADK Hospital (Private). Other hospitals are the Hulhu Malé Hospital, the five regional hospitals and atoll hospitals. Maternal and child health care services also are available in health centres and health posts. Each inhabited island has at least a health post and community health worker (Ministry of Health and Family, 2012).

In 2011, most birth deliveries took place in the two hospitals in Malé: 36.32% in IGM hospital and 17.88% in ADK hospital. There were 0.53% of deliveries which took place either abroad or on dhonis (boats) and ambulances on the way to a better health facility. The rest of the deliveries (45.27%) took place in regional hospitals, atoll hospitals, Hulhu Malé Hospital, health centres and health posts (Ministry of Health and Family, 2012). Out of the 7,225 deliveries that took place in 2011, 54.17% were normal deliveries, 41.11% were caesarean sections, 2.85% were vacuum births, 1.01% were forceps births, 0.29% were others and 0.57% were not stated (Ministry of Health and Family, 2012). In 2011, 71.86% of the total births were attended by doctors, 26.96% were attended by nurses (trained as nurse midwives), 0.01% by a family health care worker and 1.32 % by a traditional birth attendant, with the remaining 0.03% being abroad (Ministry of Health and Family, 2012). For vaginal and caesarean section deliveries the mother and infant stay at the hospital for three and five days respectively. They are given appointments for follow up consultations at one week and at four weeks post-delivery. There is no routine screening for antenatal and postnatal depression in the Maldives. There is also no published data or study undertaken on antenatal and postnatal depression and the contributing risk factors in the Maldives. There are also very little published data on infant feeding practices and infant growth. The vaccination coverage was 98% in the years 2005 to 2009, with a slight drop in 2010 (97%) and 2011(96%) (Ministry of Health and Family, 2012).

1.3 Aim

The aim of this study is to evaluate the incidence of antenatal and postnatal depression and associations with demographic factors, infant feeding practices and infant growth patterns in the city of Malé, the Republic of Maldives. This will include investigating breastfeeding problems which mothers experience within 6 months postpartum.

Research Objectives:

- Assess the incidence of, and the risk factors for, antenatal and postnatal depression in the Maldives.
- Determine the breastfeeding rates, factors and the incidence of breastfeeding problems in the Maldives.
- Describe the types of complementary foods used and their age of introduction to infants in the Maldives.
- Evaluate the factors associated with the introduction of complementary feeding.
- Identify the risk factors for the use of pre-lacteal foods.
- Describe the risk factors associated with growth faltering of infants in the Maldives.
- Evaluate the effects of postnatal depression on infant feeding practices in the Maldives.
- Measure the association between postnatal depression and the use of complementary foods and growth faltering of infants in the Maldives.

1.4 Significance of the study

Although there have been many studies on postnatal depression in Asia, there are no published data on postnatal depression in the Maldives. There are also very few published data on infant feeding practices and infant growth. The nature of the small islands of the Maldives - the small community in each island, the religion, culture and traditions - bind the people in the islands by a 'community love'. The Maldives is now undergoing economic transition and one third of the population have moved to the capital island, Malé, for better opportunities, education and health care for their families. This has brought about a big change to the traditions of family and community support. The people living in Malé frequently do not know their neighbours because people move from place to place in a short time. In addition, to cover the higher living costs, mothers also have to work. Without proper social support, such as childcare, the mothers have to perform multiple roles. The literature review confirms that stressful life events are significant risk factors for developing post natal depression, and that family and community support are very important in preventing postnatal depression (Ohara and Swain, 1996, Beck, 2001, Beck, 1996b, Beck, 2008, Leigh and Milgrom, 2008).

Literature also has shown that there is a relationship between postnatal depression, infant feeding practices and infant growth. Hence it is also important to document the prevalence of postnatal depression and identify the relationship between postnatal depression, infant feeding practices and infant growth in the Maldives. The prevalence of malnutrition is relatively high. The prevalence of underweight and stunted growth (Z-score < -2) is 1.4% and 6.2% below six months, 14.1% and 13.0% from six to eleven months, and 35.9% and 36.3% from 12 to 24 months, respectively (Ministry of Health and Family, 2009).

The Maldives, similar to other Muslim countries, has high rates of 'any breastfeeding': 85% at six months (Abdulraheem and Binns, 2007). A cross-sectional study involving 251 mothers in Malé, Hura, Himmafushi and Thulusdhoo in 2004 found that the full breastfeeding rate at four months was 41%. When mothers were asked about their opinions as to why mothers stop breastfeeding before six months, 75.3% of mothers said it was because there wasn't enough milk and 68.5% of the mothers said that it was because they had to work outside the home (Abdulraheem and Binns, 2007). The same study also showed that mothers introduced solid foods to their infants at a median age of four and a half months and infant formula was introduced as early as one month. The introduction of solid food or infant formula before six months is a health problem for developing countries because of the limited access to affordable and safe formula and complimentary feeding, and the lack of good health services (Stewart, 2007, Patel et al., 2003). Early introduction of complementary food causes diarrhoea and other sickness, and this in turn leads to malnutrition and death. Conversely, exclusive breastfeeding in the first half-year of life and continued breastfeeding, coupled with appropriate foods, reduces the number of children under five who die from malnutrition (UNICEF, 2004, Kramer et al., 2001b, Molbak et al., 1994b, Onnela, 1997, Betran et al., 2001, Kasla RR, 1995).

Hence it is important identify whether the poor feeding practices and poor growth is caused by postnatal depression. This study will also help to identify the rates of antenatal and postnatal depression and its effects on infant feeding outcomes and infant growth in the Maldives. The results of the study will help to develop better maternal and child health programs

In summary, the published data from the Maldives does not include any information on postnatal depression and its effects on infant feeding outcomes and infant growth. Hence to develop better maternal and child health programs it is important to document the prevalence of postnatal depression and identify any relationship between postnatal depression, infant feeding practices and infant growth in the Maldives.

1.5 Outline of thesis

This thesis is presented in six chapters. Chapter one contains the introduction, which gives a brief description of the maternal and child health services in the Maldives, the aims and objectives of this study, and the significance of the study.

Chapter two contains a review of literature on antenatal and postnatal depression, together with its prevalence, risk factors, implications and management. The chapter also reviews infant feeding methods, as well as the advantages and factors associated with breastfeeding. A review also was undertaken of World Health Organisation growth standards, factors affecting growth, the association between postnatal depression and infant feeding, and the association between postnatal depression and infant growth. Final review is of the association between postnatal depression, infant feeding and infant growth.

Chapter three contains the methodology, comprising of the study design and location, subjects, sample size calculations, tools used in the study, recruitment of the subjects, procedures for data collection and analysis, and ethical considerations.

Chapter four provides the detailed results from the analysis of the data of this study.

Chapter five discusses and compares the results of the study with the existing literature and gives a summary of the underlying limitations.

Chapter six concludes the thesis and gives recommendation for future applications.

Following chapter six is a list of references that were used in the study. The study tools are included in the appendix.

Chapter 2 Literature Review

This chapter describes the definitions used for perinatal depression, the prevalence of postnatal depression, infant feeding methods and infant growth faltering. The chapter also reviews the literature about contributing factors associated antenatal and postnatal depression, infant feeding methods and infant growth. In addition, a review has been included on the association between postnatal depression and infant feeding practices and postnatal depression and infant growth.

A literature search using the key words, ‘postnatal depression’, ‘perinatal depression’, ‘antenatal depression’, ‘definitions of postnatal depression’, ‘validation’, ‘risk factors for postnatal depression’, ‘prevalence of postnatal depression’, ‘postnatal depression and infant feeding’, ‘postnatal depression and infant growth’, ‘effects of postnatal depression’, ‘management of postnatal depression’ ‘infant feeding’, ‘prelacteal feeds’, ‘advantages of breastfeeding’, ‘factors associated with breastfeeding’, ‘infant growth’, ‘factors associated with infant growth’, ‘WHO guidelines for breastfeeding’, ‘NIHS and WHO growth charts’, and ‘WHO growth standards’, was carried out using the databases ‘Web of Knowledge’, ‘PubMed’ and ‘ProQuest’, and the World Health Organisation Website. From the records obtained, first the duplicates were removed and then the irrelevant records were excluded by title and abstract screening. The records also were excluded based on the year published, sample size and strength of the studies.

2.1 Postnatal depression

2.1.1 Definition

Postnatal depression is a serious health problem for many women in diverse cultures (Dennis, 2005). It is characterized by desolation, sadness, anxiety, fears, irrational thoughts, feelings of inadequacy, loss of libido, tiredness and dependency (Sichel, 2000). Many epidemiological studies define depression occurring within the first twelve weeks after delivery as postnatal or postpartum depression (Wisner et al., 2002, Hiltunen et al., 2004). Antenatal depression is depression which occurs during pregnancy and perinatal depression occurs from the time a woman first become pregnant to one year after the baby is born (Kheirabadi and Maracy, 2010). The onset of postnatal depression is within the first four weeks after delivery (American Psychiatric Association, c2000). In addition, a major depressive episode should be two weeks or longer, during which a woman has either depressed mood or feeling of inadequacy or pleasure in activities which are different from normal functioning (Horowitz and Goodman, 2005). Moreover, the presence, almost every day of four or more of the additional symptoms such as significant weight loss when not dieting, weight gain, change in appetite, insomnia, hypersomnia, psychomotor agitation and retardation is required for a diagnosis (Horowitz and Goodman, 2005).The prevalence rate is generally estimated to be in the range 10-15% although there is considerable variation reported between countries (Grote et al., 2010). Depression is associated with poor interpersonal relationships, less recreation, reduced functioning at work, early retirement, impaired overall life satisfaction, exposure to interpersonal violence, co-morbid disease and lower quality of health-care services received (Logsdon et al., 2011). Perinatal depression has adverse effects on both the mother and the infant. It affects physical, social, cognitive and emotional development of the infant (Murray and Cooper, 1996, Patel et al., 2003, Adewuya et al., 2008, Saleh el et al., 2013, Hamdan and Tamim, 2012). Perinatal depression also affects the mother-infant relationship and it can contribute to the child’s emotional, behavioural, cognitive and interpersonal problems later in life (Beck, 2006, Murray and Cooper, 1996, Pawlby et al., 2008).

2.1.2 Measurement of postnatal depression

There are several tools used by researchers to identify depression, anxiety, maternal concerns and maternal self-efficacy during the antenatal and postnatal periods. These include the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987), Diagnostic and statistical manual of mental disorders : DSM-IV-TR (American Psychiatric Association, 2000), Depression Anxiety and Stress Scale (DASS-21) (Lovibond and Lovibond, 1995), Maternity Social Support Scale (MSSS) (Webster et al., 2000), Cambridge Worry Scale (CWS) (Statham et al., 1997), Perceived Self-Efficacy Scale (PSES) (Reece, 1992), Perceived Knowledge Scale (PKS) (Smedley, 1999), Kessler 10-item scale, Self-Report Questionnaire (SRQ) (Harding et al., 1980) Aga Khan University Anxiety and Depression Scale (AKUADS) (Ali et al., 1998).

2.1.3 Edinburgh postnatal depression scale (EPDS)

The Edinburgh postnatal depression scale (Cox et al., 1987) is the tool most widely used by researchers to assess postnatal depression. It is a ten-item tool developed to screen for postnatal depression in communities. It was found that EPDS has sensitivity of 78% and specificity 86%, as well as being sensitive to change in the severity of depression over time (Cox et al., 1987). Response categories in each item are scored 0, 1, 2 or 3 according to increased severity of the symptom. Items marked with an asterisk are reverse scored (i.e. 3, 2, 1 and 0).The total score is calculated by adding together the scores for each of the ten items. According to (Cox et al., 1987), mothers who scored above a threshold of 12 were most likely to be suffering from a depressive illness of varying severity, and should therefore be further assessed by a health worker to ensure whether or not clinical depression was present. The EPDS is not a substitute for this clinical assessment, and a score just below the cut-off should not be taken to indicate the absence of depression, especially if the health professional has other reasons to consider this diagnosis (Cox et al., 1987). The data also suggested that a threshold of more than 9 might be appropriate if the scale was considered for routine use by primary care workers (Cox et al., 1987). The EPDS also has been used and validated in other countries. The tool has shown to have high sensitivity and specificity in studies in many countries including Malaysia (sensitivity 72.7% and specificity 95.1% at 11.5) (Abdul Kadir et al., 2004), Iran (sensitivity 95.3%, specificity 87.9% with a cut-off score of 12/13) (Mazhari and Nakhaee, 2007) Dubai, (sensitivity 73%, specificity 90% at 12) (Ghubash et al., 1997b), and India (94.1 and 90.2 at 8/9)(D, 2005).

2.1.4 Risk factors for antenatal and postnatal depression

There is an extensive body of literature documenting the factors associated with postpartum depression. A literature search indicated a number of significant risk factors for developing postnatal depression, as outlined in Table 2.1.

Table 2.1 Factors associated with postpartum depression

Genetic and biological risk factors	'polymorphic variations in the serotonin transporter', 'catechol-O-methyltransferase', 'brain derived neurotrophic factor gene polymorphisms,' levels of 'oestradiol, thyroxin and cortical', familial factors
Maternal physical and mental health	'previous history of depression', 'prenatal depression', anxiety, 'complicated-puerperium', 'positive history of premenstrual tension syndrome', gestational-diabetes, hypertension, miscarriages, caesarean-sections, insomnia
Poor interpersonal skills	'poor interpersonal-skills', 'low self-efficacy', 'perceived poor body image'
Poor relationships	'poor partner relationships', 'poor relationships with other family members/ in-laws'
Domestic violence	'attitude of acceptance toward violence', 'psychological violence during pregnancy', 'excessive alcohol use', emotional abuse, physical abuse
Baby variables	'low birth weight', 'gender of the infant', unwelcomed baby, 'negative attitude of parents toward the baby', 'low birth weight', underweight infant, artificial feeding, short duration of breastfeeding, breastfeeding difficulties, unhealthy baby, major malformation , neonatal death, stillbirth, necrotizing enterocolitis
Demographic factors	maternal age, marital status, residence, 'low maternal education level', 'stressful life events', ethnicity
Socioeconomic factors	unplanned pregnancy, primiparity, multiparity, 'lack of social support', 'low income', polygamy

Findings on molecular genetic studies have revealed that polymorphic variations in the serotonin transporter, catechol-O-methyltransferase, and the brain derived neurotrophic factor gene polymorphisms are associated with postnatal depression (Comasco et al., 2011a, Comasco et al., 2011b, Mehta et al., 2012a). In some studies, biological factors only cause depression when they interact with life stressors. In a non-psychiatric cohort of 419 Caucasians in Germany, serotonin transporter gene polymorphism did not directly cause perinatal depression but interacted with both lifetime and current stressors to influence depressive symptoms in the late postpartum period (Mehta et al., 2012a). A cohort study of 219 women, in Sweden also indicated that maternal stressors (β=2.29) and neurotrophic factor gene carrier status (β=3.44) were associated with higher mean EPDS scores at 6 weeks postpartum among mothers delivering during autumn/winter (darker months) compared to other seasons (Comasco et al., 2011a). In addition, in a case-control study of 275 women in Sweden, catechol-O-methyltransferase [odds ratio (OR) =4.2; 95% confidence interval (CI), 1.4–12.3], psychiatric contact (OR=3.5; 95% CI, 1.6–

7.6) and maternity stressors (OR=3.7; 95% CI, 0.9–8.0) were significantly associated with postpartum depression symptoms at 6 weeks (Comasco et al., 2011b).

In some studies the levels of hormones were associated with postpartum depression. In a study of 120 mothers in the city of Mansoura, Egypt, perinatal depression was associated with psychosocial stressors (t= 13.38), 'level of [estradiol (t= -6.07), thyroxin (t=-7.57), cortical(t= -11.16)]' and 'positive history of premenstrual tension syndrome' (χ^2= 10.76) at first week postpartum (Saleh el et al., 2013). Studies also have shown that familial factors make a mother more vulnerable to perinatal depression (Forty et al., 2006, Murphy-Eberenz et al., 2006).

Studies have reported multiparity, unplanned pregnancy, ethnicity, 'maternal mental and physical health', infants' health, delivery method and 'feeding method and duration' as risk factors for postnatal depression. The results from a prospective population-based, observational study of 17,648 women and infants in Texas showed that major malformation (adjusted OR=1.5; 95% CI, 1.1-2.3), neonatal death (adjusted OR=5.8; 95% CI, 2.9-11.4) stillbirth (adjusted OR=9.4; 95% CI, 6.0-14.8) and necrotizing enterocolitis (adjusted OR=21.7; 95% CI, 1.9–244.3) were associated with postnatal depression at two to six weeks (Nelson et al., 2013). A cohort study of 5,332 women in England found that, after adjusting for confounding factors, the risk factors for antenatal depression were multiparity (adjusted OR=1.40; 95% CI, 1.11-1.77), 'black and minority ethnic status' (adjusted OR=2.19; 95% CI, 1.65-2.90), 'physical or mental health problems' (adjusted OR=1.88; 95% CI, 1.08-3.28), and unplanned pregnancy (adjusted OR=1.66; 95% CI, 1.25-2.20) (Redshaw and Henderson, 2013). The same study showed that being left alone during labour (OR=4.41; 95% CI,1.47-13.25), and long term mental illness (OR=4.05 ; 95% CI, 1.41-11.66) increase the risk of postnatal depression at three months after birth (Redshaw and Henderson, 2013). In a cross-sectional study of 1,379 postpartum women in Qatar, after adjusting for confounding factors, unplanned pregnancy (adjusted OR=1.85; 95% CI,1.19–2.88), gestational-diabetes (adjusted OR=1.65; 95% CI,1.02–2.69), hypertension (adjusted OR=1.07; 95% CI,0.58–1.98), caesarean sections (adjusted OR=1.21; 95% CI, 0.75–1.96) miscarriages (adjusted OR=1.78; 95% CI, 0.83–3.83), 'low birth weight' (adjusted OR=4.1; 95% CI, 2.49–6.89), premature birth (adjusted OR=1.04; 95% CI, 0.57–1.92) and feeding method [‘breastfeeding with formula feeding’(adjusted OR=1.14; 95% CI, 0.69–1.89) and formula feeding (adjusted OR=4.07; 95% CI,2.19–7.58)] were found to be risk factors for postpartum depression at six months postpartum (Burgut et al., 2013b). A randomized controlled trial of 1,123 mothers in Hershey, Pennsylvania indicated that primiparous women were more likely to have a positive STAI (State Trait Anxiety Inventory) ≥ 40 (OR=1.57; 95% CI, 1.08–2.29), compared with multiparous women in the first week postpartum (Paul et al., 2013). The same study also demonstrated that ‘delivery by caesarean section’ (OR=1.46; 95% CI, 1.02–2.09), ‘reduced duration of breastfeeding’ (Kaplan-Meier plot of breastfeeding duration at six month by anxiety screen, P = 0.003), and ‘increased maternal, unplanned health care utilization within 2 weeks of delivery’ (P = 0.001) were associated with an STAI score ≥ 40 and an EPDS score ≥ 12 (Paul et al., 2013).

Studies also have shown that there is an association between postnatal depression and low birth weight. Results from a case control study of 35 mothers of ‘very low birth weight’ (VLBW) infants (<1,500 grams), 35 mothers of low birth weight (LBW) infants (1,500-2,500 grams) and 35 mothers of healthy term infants (>2,500 grams) showed that the number of mothers with high depressive scores (EPDS>12) at five months were significantly higher in ‘mothers of infants with VLBW’ than in ‘mothers of LBW’ and healthy term infants (42.9% vs. 4.3% and 5.7%) (Herguner et al., 2013). Multivariate logistic regression of the study showed that low birth weight (OR=1.01; 95% CI, 1.003–1.016) and long hospital stay (OR=1.074; 95% CI: 1.017-1.133) were predictors of postpartum depression at five months after delivery (Herguner et al., 2013). The case-control study conducted in Mansoura, Egypt also demonstrated that baby-variables [unwelcomed baby(χ^2=26.64), ‘negative attitude of parents toward the baby’ (χ^2=10.71), underweight (χ^2=25.01), ‘infant being a female’ (χ^2=26.64), artificial feeding (χ^2=32.63), unhealthy baby (χ^2=194.0)], parity(χ^2=80.93), ‘method of delivery’ (χ^2=41.25), complicated puerperium (χ^2=11.47), ‘negative attitude towards spouse’ (χ^2=7.45), social support (χ^2=8.46), marital status (χ^2=84.84) and residence (χ^2=48.63) were associated with postnatal depression in the first week (Saleh el et al., 2013).

Domestic violence has been shown to be a common risk factor for postpartum depression in many studies. In a cohort study of 846 pregnant women in China, the risk factors for depression at one month after delivery were ‘attitude of acceptance toward violence' (adjusted OR=4.6; 95% CI, 1.2-18.0), unexpected pregnancy (adjusted OR=4.3; 95% CI,1.3-9.0), 'psychological violence during pregnancy' (adjusted OR=4.0, 95% CI, 1.7-9.6), husband's occupation (adjusted OR=3.1; 95% CI, 1.4-6.9), 'excessive alcohol use' (adjusted OR=3.2; 95% CI, 1.6-6.8), and 'concern about the infant's health' (adjusted OR=2.5; 95% CI, 1.0-6.1) (Zhang et al., 2012b). A meta-analysis of six studies also has shown the effect of violence on postnatal depression. The study included 576 mothers in the violence group and 3,374 mothers in the non-violence group. The results showed that postpartum depression was associated with violence (pooled OR=3.47; 95% CI, 2.13-5.64) (Wu et al., 2012). In a prospective cohort study of 1,507 women in Australia, emotional abuse (adjusted OR=2.72; 95% CI, 1.72-4.13), physical abuse (adjusted OR=3.94; 95% CI, 2.44-6.36), 'depression in pregnancy' (adjusted OR=2.89; 95% CI, 1.75-4.77) and 'unemployment in early pregnancy' (adjusted OR=1.60; 95% CI, 1.03-2.48) were associated with an EPDS ≥13 at 12 months postpartum (Woolhouse et al., 2012).

Studies also have shown that poor relationships with partner and in-laws, 'poor interpersonal skills', 'low self-efficacy', 'maternal education level', 'gender of the infant' and stress, as well as demographic and socioeconomic factors, are associated with depression. A prospective cross-sectional study of 353 women in Jordan showed that stress, anxiety, financial problems, 'perceived lack of parenting knowledge', 'difficult relationship with mother-in-law', unplanned pregnancy, and 'low self-efficacy' were associated with antenatal depression (Mohammad et al., 2011). The study demonstrated that these seven factors accounted for 83% (r^2=0.834) of variance in the development of probable antenatal depression. The same study showed that, at six to eight weeks postpartum, antenatal depression, unplanned pregnancy, 'difficult relationship with mother-in-law', 'dissatisfaction with overall care', stress, 'lack of social support', 'giving birth to a female baby', 'feeling pressured to give birth quickly' and 'perceived low parenting knowledge' were associated, with an EPDS score ≥ 13 (Mohammad et al., 2011). These nine variables accounted for 82% (r^2=0.819) of variance in the development of probable postnatal depression (Mohammad et al., 2011). A cross-sectional study of 426 women at five to ten weeks postpartum, in Nepal, found that 'husband's alcoholism'(adjusted OR=9.4; 95% CI, 3.2–28.0), polygamy (adjusted OR=7.7; 95% CI, 2.3–25.9), previous depression (adjusted OR=5.1; 95% CI, 1.7–15.2), ‘stressful life events’ (adjusted OR=5.1; 95% CI, 1.7–15.2), multiparity (adjusted OR=7.1; 95% CI, 1.6–31.4), smoking (adjusted OR=5.6; 95% CI, 1.2–25.6) and ‘depression during pregnancy’(adjusted OR=3.3 ; 95% CI, 1.1–10.5) were associated with an EPDS ≥12 (Ho-Yen et al., 2007). A qualitative descriptive study of 167 mothers in India showed that; ‘being aged < 20 or > 30’ (adjusted OR=9.2; 95% CI, 2.93-28.61), ‘education less than five years of schooling’ (adjusted OR=3.8; 95% CI, 1.61-8.75), ‘multiparity’ (adjusted OR=6.9; 95% CI, 1.11-43.37), ‘thoughts about aborting pregnancy’ (adjusted OR=5.0; 95% CI, 1.70-14.67), ‘unhappy marriage’ (adjusted OR=9.4; 95% CI, 2.28-38.52), ‘physical abuse’(adjusted OR=3.3; 95% CI, 1.09-9.61), ‘family history of depression’ (adjusted OR=9.3; 95% CI, 1.17-51.2) and ‘use of alcohol’(adjusted OR=5.1; 95% CI, 1.98-13.52) were reported as risk factors for developing postnatal depression at two to ten weeks after delivery (Savarimuthu et al., 2010). In a quasi-experimental study of 420 women (first twelve months postpartum) in Pakistan, ‘domestic violence’(adjusted OR=2.8; 95% CI, 1.15-6.89), ‘difficulty in breastfeeding at birth’(adjusted OR=3.0; 95% CI, 1.20-7.43) and ‘unplanned current pregnancy’ (adjusted OR=2.1; 95% CI, 1.04-4.29) were significantly associated with depression [a score ≥19 on *Aga Khan University Anxiety and Depression Scale (AKUAD)*] (Ali et al., 2009). A prospective cohort study of 125 women in United Arab Emirates showed the risk factors for depression scores ≥13 at three months after birth included; ‘not breastfeeding’(χ^2=12.20), ‘giving birth to the first child’(r=-0.28), ‘poor body self-image’(χ^2=11.14), ‘poor relationship with mother-in-law’ (χ^2=5.40), and ‘an older age at marriage’(χ^2=7.73) (Green et al., 2006). A case-control study of 122 women with major postpartum depression (DSM-IV) and 115 healthy postpartum women, in Spain, showed that high perfectionism and, mainly, high concern over mistakes (OR=4.14; 95% CI, 1.24-13.81) is a personality dimension associated with major postpartum depression in the first six months postpartum (Gelabert et al., 2012).

A meta-analysis of 44 studies also found that ‘prenatal depression’, ‘child care stress’, ‘life stress’, ‘social support’, ‘prenatal anxiety’, ‘maternity blues’, ‘marital dissatisfaction’ and ‘history of previous depression’ are predictor variables of postnatal depression (Beck, 1996a). Several other meta-analyses have found that factors with moderate to strong association with postpartum depression include ‘depression and anxiety during pregnancy’, ‘postpartum blues’, ‘previous history of depression’, ‘stressful life events’, ‘a poor marital relationship’, and ‘poor social support’ (Ohara and Swain, 1996, Beck, 2001, Robertson et al., 2004, Jones et al., 2010). Other risk factors such as ‘low socioeconomic status’, ‘obstetric factors’, and ‘difficult infant temperament’ were found to be less strongly related to postpartum depression (Robertson et al., 2004, Beck, 2001).

A cross-sectional study of 257 pregnant or postpartum women in the United States also has shown that women with clinically significant Insomnia Severity Index (ISI) scores had significantly higher odds for reporting symptoms consistent with depression (OR=7.7; 95% CI, 3.76-15.78) and generalized anxiety (OR=2.55; 95% CI, 1.39-4.69) compared to women with lower ISI scores (Swanson et al., 2011).

2.1.5 Prevalence and Risk Factors of Perinatal depression around the world

Table 2.2 – 2.6 shows a summary of EPDS cut-off scores, prevalence and risk factors for postnatal depression. As shown in the tables Pakistan has the highest and Canada has the lowest percentage of mothers with depression.

Table 2.2 Summary of prevalence and predictors of postnatal depression in different countries

Country	Prevalence of Postnatal Depression	Tool and score at which depression was measured	Type of study and number of participants	Risk factors	Author
Dubai	18% 26%	EPDS score 12 EPDS score 10	Prospective study of 95 postpartum women	- -	(Ghubash et al., 1997a)
	24.5% 17.8% 15.8%	SQR≥6 EPDS≥12 PSE	Prospective study of 95 postpartum women	life events, marital problems, alcohol problem in a family member, presence of a housemaid	(Ghubash and Abou-Saleh, 1997)
Iran	21.5%	EPDS score 12/13	Cross-sectional study of 600 postpartum women	-	(Mazhari and Nakhaee, 2007)
	26.3%	EPDS score 12	Cohort study with a final sample of 1,898 postpartum women	history of depression, unplanned pregnancy, being housewife, having three or more children	(Kheirabadi and Maracy, 2010)
Jordan	22.1%	EPDS ≥13 DASS-21	A prospective cross-sectional study of 353 women at six to eight weeks and six months	Antenatal: stress, anxiety, financial problems, ‘perceived lack of parenting knowledge’, ‘difficult relationship with mother-in-law’, unplanned pregnancy, ‘low self-efficacy’ Postnatal: antenatal depression, unplanned pregnancy, ‘difficult relationship with mother-in-law’, ‘dissatisfaction with overall care’, stress, ‘lack of social support’, ‘giving birth to a female baby’, ‘feeling pressured to give birth quickly’, ‘perceived low parenting knowledge’	(Mohammad et al., 2011)
Egypt	17.9%	EPDS ≥13 DSM IV	First half of study- cross-sectional of 379 mothers at one week A case-control study of 120 mothers in Mansoura, Egypt	psychosocial stressors , levels of oestradiol, thyroxin and cortical, ‘positive history of premenstrual tension syndrome’, unwelcomed baby, ‘negative attitude of parents toward the baby’, underweight, ‘infant being a female’ artificial feeding, unhealthy baby, parity, ‘method of delivery’, complicated puerperium, ‘negative attitude towards spouse’, social support, marital status, residence	(Saleh el et al., 2013)

Table 2.3 Summary of prevalence and predictors of postnatal depression in different countries (cont.)

Country	Prevalence of Postnatal Depression	Tool and score at which depression was measured	Type of study and number of participants	Risk factors	Author
United Arab Emirates	16.8%	EPDS score 10 or above	Prospective study of 137 women	depression during pregnancy in both the second and third trimesters: number of children, religion, 'use of formula for feeding', educational level of mother, lack of breastfeeding, personal stressful life events, employment status following delivery	(Hamdan and Tamim, 2011)
	22% , 12.5%	EPDS $\geq$ 13	A prospective cohort study of 125 women at three months and six months postpartum	'not breastfeeding', 'giving birth to the first child', 'poor body self-image', 'poor relationship with mother-in-law', 'an older age at marriage'	(Green et al., 2006)
Qatar	17.6%	EPDS $\geq$ 12	A cross-sectional study of 1,379 postpartum women at six months	lower education, occupation (housewife), consanguinity, lack of access to transportation, history of unplanned pregnancy, infertility and other medical complications such as gestational diabetes, heart disease, threatened abortion and caesarean section	(Burgut et al., 2013a)
Turkey		EPDS>12	A case-control study of 105 mothers at five months	low birth weight and long hospital stay	(Herguner et al., 2013)
Bangladesh	22%	EPDS score 10 or above	A cohort study of 346 women	history of past mental illness, depression in current pregnancy, perinatal death, poor relationship with mother-in-law, husband or wife leaving home after a domestic quarrel	(Gausia et al., 2009)
Malaysia	21%	EPDS score 11.5	Cross-sectional study of 52 mothers	-	(Abdul Kadir et al., 2004)
	20.7%	EPDS score 12	Cross-sectional study of 421 women	-	(Azidah et al., 2006)
	6.8%	EPDS score 12	Cross-sectional study of 411 women	non-exclusive breastfeeding, previous history of depression	(Zainal et al., 2012)

Table 2.4 Summary of prevalence and predictors of postnatal depression in different countries (cont.)

Country	Prevalence of Postnatal Depression	Tool and score at which depression was measured	Type of study and number of participants	Risk factors	Author
Pakistan	25.8%	EPDS score 12 and above	A cohort study of 1,357 women.	psychological distress, disability, stressful life events	(Husain et al., 2011)
	28.8%	*Aga Khan University Anxiety and Depression Scale (AKUADS)*	A quasi-experimental study of 420 women	'domestic violence', 'difficulty in breastfeeding at birth', 'unplanned current pregnancy'	(Ali et al., 2009)
India	13.2%	EPDS score 8/9	A cross-sectional study of 129 women	-	(D, 2005)
	26.3	ICD-10 criteria%	A cross-sectional study of 137 women at two to ten weeks postpartum	age less than 20 or over 30 years, schooling less than five years, thoughts of aborting pregnancy, unhappy marriage, physical abuse during pregnancy and after childbirth, husband's use of alcohol, girl child delivered in the absence of living boys and a preference for a boy, low birth weight, family history of depression	(Savarimuthu et al., 2010)
	6.1%	EPDS score 10 and above	A cross-sectional study of 293 postpartum women	birth of female child, nuclear family structure, poor marital relationship	(Dubey et al., 2012)
	11.5%	K10 score>15	A cross-sectional study of 5,801 postpartum women	high maternal age, low asset ownership, health problems in the antepartum, delivery and/or postpartum periods, caesarean section, an unwanted pregnancy for the mother, small perceived infant size, stillbirth or neonatal death	(Prost et al., 2012)
Sri Lanka	19.4%	EPDS score 9	A cross-sectional study of 204 postnatal women	-	(Rowel et al., 2008)
	16.2%	EPDS score 9	A cross-sectional study of 376 postnatal women	Having heart burn	(Agampodi and Agampodi, 2013)
Nepal	12%	EPDS score 13 and above	A case-control of 100 postpartum women	-	(Regmi et al., 2002)
	4.9%	EPDS score>12	A cross-sectional study of 426 women five to ten weeks postpartum	husband's alcoholism, polygamy and previous depression, stressful life events, multiparity, smoking and depression during pregnancy	(Ho-Yen et al., 2007)

Table 2.5 Summary of prevalence and predictors of postnatal depression in different countries (cont.)

Country	Prevalence of Postnatal Depression	Tool and score at which depression was measured	Type of study and number of participants	Risk factors	Author
China	21.2%	EPDS score 12/13	Longitudinal correlation study of 170 women at six weeks and six months	learned resourcefulness and social support	(Ngai and Chan, 2012)
	11.8%	EPDS score ≥ 13	A cohort study of 846 pregnant women followed up at one month	‘attitude of acceptance toward violence’ unexpected pregnancy, ‘psychological violence during pregnancy’, husband's occupation, ‘excessive alcohol use’, ‘concern about the infant's health’	(Zhang et al., 2012b)
Singapore	18%	EPDS score 8/9	Prospective study of 200 antenatal women	high risk pregnancies	(Thiagayson et al., 2012)
Japan	12.3%	EPDS score ≥ 13	A cohort study of 99 women	anxiety during pregnancy	(Kokubu et al., 2012)
Australia	16.9% 7.7%	EPDS score >9 EPDS score >12	A cross-sectional study of 15,389 postpartum mothers	Infant temperament, unmet maternal expectations, social exclusion and social isolation	(Eastwood et al., 2012)
	12% 6.2%	EPDS score >9 EPDS score >12	A population-based cross-sectional study of 25, 455 mothers	maternal country of birth other than Australia, difficult financial situation, living in the suburb one year or less, ‘no regret leaving the suburb’, unplanned pregnancy, not breastfeeding, and poor rating of mother's own health stressful life events and social health issues	(Eastwood et al., 2011)
	17.4%	DASS-21	A population-based survey of 4,366	at first 12 months: emotional-abuse, physical- abuse, ‘depression in pregnancy’, ‘unemployment in early pregnancy’	(Yelland et al., 2010)
	16%	EPDS ≥13	A prospective cohort study of 1,507 women from pregnancy to 12 months postpartum	-	(Woolhouse et al., 2012)
Belgium, Germany, Italy, Poland and Spain	11.0%	EPDS ≥ 13	A cohort study of 1,678 postpartum women	no association with infant growth and depression	(Grote et al., 2010)
Spain		DSM-IV	A case-control study of (122 cases and 115 controls) women first six months postpartum	high perfectionism, high concern over mistakes, neuroticism, personal psychiatric history and 5-HTT low-expressing genotypes at one of the loci	(Gelabert et al., 2012)

Table 2.6 Summary of prevalence and predictors of postnatal depression in different countries (cont.)

Country	Prevalence of Postnatal Depression	Tool and score at which depression was measured	Type of study and number of participants	Risk factors	Author
United States	6.3%	EPDS ≥ 13	A prospective population-based, observational study between two and six weeks of 17,648 parturients	major malformation, neonatal death, stillbirth, necrotizing enterocolitis	(Nelson et al., 2013)
	17.1%	EPDS ≥ 13	Cross-sectional Data from 257 pregnant or postpartum women	insomnia	(Swanson et al., 2011)
	5.5%	STAI ≥ 40 EPDS ≥ 12	A randomized controlled trial of 1,123 mothers in Hershey, Pennsylvania (one week to six months)	primiparity, 'delivery by caesarean section', 'reduced duration of breastfeeding', 'increased maternal, unplanned health care utilization within two weeks of delivery'	(Paul et al., 2013)
Canada	4.5%	EPDS ≥ 12	A prospective longitudinal survey of 526 mothers	lack of confidence in breastfeeding	(Dunn et al., 2006)
England (Avon)	4.8%	EPDS score 12 /13	A prospective cohort study, Avon, longitudinal study of parents and children	maternal age, life events, smoking	(Deave et al., 2008)
	9.6%	A constructed tool to detect depression	A cohort study of 5,332 women at three months postpartum	multiparity, 'black and minority ethnic status', 'physical or mental health problems', living in deprived area, unplanned pregnancy, being left alone in labour	(Redshaw and Henderson, 2013)

2.1.6 Postnatal depression and infant feeding outcomes

A relationship between postnatal depression and infant feeding outcomes is found consistently in many studies (Gaffney et al., 2012, Saleh el et al., 2013, Hamdan and Tamim, 2012, Dennis and McQueen, 2009). A prospective study of 137 women in United Arab Emirates showed that women who were breastfeeding at two and four months had lower scores on EPDS and were less likely to be diagnosed with postpartum depression at four months (Hamdan and Tamim, 2012). The same study indicated that higher mean EPDS scores and diagnosis of postpartum depression at two months were predictive of lower rates of breastfeeding at four months (Hamdan and Tamim, 2012).

The Infant Feeding Practices Study II (N= 1447) in the United States showed that mothers with postnatal depression were 1.57 times more likely to breastfeed at low intensity (95% CI, 1.16-2.13) and 1.77 times (95% CI, 1.16-2.68) more likely to add cereal to infant formula (Gaffney et al., 2012). Similarly, in a secondary data analysis of 5,565 mothers in the US, mothers who were depressed were more likely to give cereal (OR=1.43; 95% CI, 1.22-1.67), water (OR=1.53; 95% CI, 1.320-1.67) or juice (OR=1.5; 95% CI, 1.22-1.83) and less likely to continue breastfeeding (OR=0.59; 95% CI, 0.5-0.7) between two to four months postpartum (McLearn et al., 2006).

In a cohort study of 2,586 women in the US, women who disliked breastfeeding in the first week were more likely to experience postpartum depression at two months (OR=1.42; 95% CI, 1.04-1.93), adjusting for maternal age, parity, education, ethnicity and participation in the postnatal Women Infants and Children (WIC) program (Watkins et al., 2011). In the same study, women with severe breastfeeding pain in the first day (adjusted OR=1.96; 95% CI, 1.17-3.29), the first week (adjusted OR=2.13; 95% CI, 0.74-6.15) and the second week (adjusted OR=2.24; 95% CI, 1.18-4.26) were more likely to be depressed compared with women with no pain (Watkins et al., 2011). Breastfeeding help was a protective factor among women with moderate (adjusted OR=0.22; 95% CI, 0.05- 0.94) or severe (adjusted OR=0.17; 95% CI, 0.04-0.75) pain with nursing (Watkins et al., 2011).

A United Kingdom longitudinal study (n= 1,272 antenatal women) found an association between depressive symptoms and lower rates of initiation and continuation of breastfeeding at six weeks postpartum (Green and Murray, 1994).

Likewise, in another longitudinal community-based study (n=434 pregnant women in Stockholm, Sweden), significantly fewer women with an EPDS ≥10 initiated breastfeeding, compared with women with EPDS<10 (82% vs. 94%, χ^2= 7.69) (Seimyr et al., 2004). The authors also found that, a significantly smaller number of women with EPDS ≥10 at two months breastfed (85% vs.93%, χ^2= 3.202) and that those who breastfed did so for a shorter duration (4.6 months, Standard Deviation (SD)2.4 vs. 5.3 months, SD 1.9) compared with women with an EPDS <10 at two months (Seimyr et al., 2004). The same study also showed that the women with EPDS ≥10 experienced breastfeeding more negatively than the women scoring low on EPDS (40% vs. 20%, χ^2= 9.07) and (51% vs. 16%, χ^2 = 31.48).

A population-based study of 594 participants in Vancouver, British Columbia, Canada found that mothers who had an EPDS score more than 12 at one week postpartum were significantly more likely to discontinue breastfeeding at eight weeks (F = 2.84) than those with an EPDS score of less than 12 (Dennis and McQueen, 2007). The same study also showed that mothers with an EPDS score >12 at one week were significantly more likely to perceive breastfeeding not to be progressing well , be less satisfied with the feeding method and have a lower breastfeeding self-efficacy score than mothers who had an EPDS score <12 (Dennis and McQueen, 2007).

In a prospective longitudinal study of 226 mother-infant pairs in Barbados, mothers who reported feelings of despair and depression at seven weeks, when compared with women reporting fewer depressive symptoms at this time, were less likely to believe that breastfeeding was better for their infants at seven weeks (r =−0.34) (Galler et al., 2006). They also were more likely to be superstitious about breastfeeding and have no confidence that breastfeeding leads to improved mother-infant bonding (Galler et al., 2006). Mothers with symptoms of depression and anxiety also were more likely to report that breastfeeding was restrictive and to believe that breastfeeding made them look unfashionable and restricted their freedom (r =−0.17) at six months (Galler et al., 2006). The same study also showed that mothers who had negative attitudes towards breastfeeding were more likely to stop breastfeeding and their babies had less intense suckling responses at three months (Galler et al., 2006).

A longitudinal cohort study of 1,745 women in Australia found that postnatal depression was significantly associated with breastfeeding duration and that women who experience postnatal depression at any time have a greater risk (Risk Ratio (RR)=1.25; 95% CI, 1.03‑1.52) of stopping breastfeeding than women who do not experience postnatal depression (Henderson et al., 2003). The same association was seen in: a descriptive study of 438 mothers in the UK (Cooper et al., 1993); another descriptive study of 906 women in the UK (Bick et al., 1998); a secondary analysis survey of 526 women in Canada (Dunn et al., 2006); and another longitudinal study of 159 women in Australia (Papinczak and Turner, 2000).

In the descriptive study of 438 women in the UK, women who had given up breastfeeding at eight weeks were significantly more prevalent in the depressed group compared to the non-depressed group in Oxford (56% vs. 22.9% $\chi 2 = 10.57$, df = 1) and in Cambridge (55.5% vs. 20.8% $\chi 2 = 11.4$, df = 1) (Cooper et al., 1993). The study by Beck and colleagues (1998) indicated that an EPDS ≥12 was positively associated with cessation of breastfeeding at 12 weeks (OR=1.93; 99% CI, 1.11-3.35). The secondary analysis in Vancouver, Canada showed that women who had EPDS ≥12 were more likely to wean from breastfeeding (OR=2.8; 95% CI, 1.17-6.62) at eight weeks (Dunn et al., 2006). The Australian study by Papinczak and Turner, in 2000, demonstrated that postnatal depression was positively associated with shorter duration of breastfeeding (F ratio 2.92; 95% Cl, 14.81-24.82) at three months postpartum.

A qualitative systematic review of 75 articles showed that women with depressive symptomatology in the early postpartum period were at increased risk for negative infant feeding outcomes, including decreased breastfeeding duration, increased breastfeeding difficulties, low breastfeeding self-efficacy, less likely initiation of breastfeeding and less exclusive breastfeeding (Dennis and McQueen, 2009). There was no association between depressive symptoms and infant feeding outcomes in seven studies in the same review (Dennis and McQueen, 2009).

The results from a longitudinal cohort study of 52 women in the US showed that, in the third trimester, oxytocin was inversely correlated with EPDS and STAI scores. The results of the study illustrated that, among the 39 women who breastfed at eight weeks postpartum, oxytocin level during breastfeeding was inversely correlated with maternal EPDS (R=-0.48) as well as STAI-State (R= -0.53) and STAI-Trait anxiety (R=-0.44) scores (Stuebe et al., 2013).

Findings from a prospective study of 197 mothers in Turkey, who were grouped according to exclusive breastfeeding and mixed feeding, indicated that there was no association between postpartum depression and feeding methods but that feeding method was significantly associated with delayed onset of lactation within the first 48 hours and the subsequent problems related to breastfeeding (Annagur et al., 2013).

A cohort study of 360 mothers in Brazil, using a multivariate Cox regression model, revealed that factors associated with breastfeeding cessation were symptoms of maternal depression (low levels: RR=1.59; 95% CI, 1.02-2.47; moderate to severe: RR=2.03; 95% CI, 1.35-3.01), bottle feeding (RR=2.07; 95% CI, 1.31-3.28) and pacifier use (RR=3.12, 95% CI, 2.13-4.57) in the first month of life after adjusting for confounders (Feldens et al., 2012).

In a longitudinal study of 5,089 two-parent families in the United States, mothers with postnatal depression were less likely to put their infants to sleep on their backs (OR=0.8; 95% CI, 0.6–1.06), less likely to have ever breastfed their infants (OR=0.98; 95% CI, 0.68–1.45), and more likely to put their infant to bed with a bottle (OR=1.53; 95% CI, 1.16–2.02) at nine months postpartum (Paulson et al., 2006).

These published studies and reviews show an association between symptoms of perinatal depression in the early postpartum period and increased risk of negative infant feeding outcomes.

Table 2.7 Summary of the studies on the association of breastfeeding and postpartum depression

Findings	Measuring tool	Study
Mothers with postnatal depression were more likely to breastfeed at low intensity at two months. Mothers with postnatal depression were more likely to add cereal to infant formula at two months.	EPDS≥10 at two months	A longitudinal study of 1,447 women in the US (Gaffney et al., 2012)
Women who disliked breastfeeding in the first week were more likely to experience postpartum depression at two months. Women who had severe breastfeeding pain in the first day, first week, and second week were more likely to be depressed at two months compared with women with no pain. Breastfeeding help on the first day was a protective factor of postnatal depression among women with moderate or severe pain with nursing.	EPDS≥13 at two months	A cohort study of 2,586 women in the US (Watkins et al., 2011)
Antenatal depressive symptoms were associated with lower rates of initiation or higher rates of discontinuation of breastfeeding.	EPDS during pregnancy and six weeks postpartum	A United Kingdom longitudinal study of (n= 1,272) women (Green and Murray, 1994)
Antenatal depressive symptoms were associated with lower rates of initiation of breastfeeding, postnatal depression was associated with discontinuation of breastfeeding, mothers with depression experienced breastfeeding more negatively	EPDS ≥10 30+weeks of gestation two months postpartum	A longitudinal community-based study of (n=434) pregnant women in Stockholm, Sweden (Seimyr et al., 2004)
Postnatal depression was associated with discontinuation of breastfeeding, perception of breastfeeding not to be progressing well, being less satisfied with the feeding method and having a lower breastfeeding self-efficacy score.	EPDS score >12 at one week	A population-based study of 594 participants in Vancouver, British Columbia, Canada (Dennis and McQueen, 2007)
Mothers who had depression were less likely to believe that breastfeeding was better for their infants at seven weeks and more likely to be superstitious about breastfeeding and to have no confidence that breastfeeding leads to improved mother-infant bonding. Mothers with symptoms of depression and anxiety were also more likely to report that breastfeeding was restrictive and believe that breastfeeding made them look unfashionable and restricted their freedom at six months. Mothers who had negative attitudes towards breastfeeding were more likely to stop breastfeeding and their babies had less intense suckling responses at three months.	The Zung Depression Scale and Zung Anxiety Scale and feeding attitudes questionnaire at seven weeks, three months and six months	A prospective longitudinal study of 226 mother-infant dyads in Barbados (Galler et al., 2006)

Table 2.8 Summary of the studies on the association of breastfeeding and postpartum depression (cont.)

Findings	Measuring tool	Study
Postnatal depression was significantly associated with breastfeeding duration.	EPDS>12 at two, six and twelve months postpartum	A longitudinal cohort study of 1,745 women in Australia (Henderson et al., 2003)
Women who had given up breastfeeding were significantly higher in the depressed group compared to the non-depressed group.	Present State Examination or (PSE)at eight weeks postpartum	A descriptive study of 438 mothers in the UK (Oxford, Cambridge) (Cooper et al., 1993)
Postnatal depression was significantly associated with early cessation of breastfeeding.	EPDS ≥12 at 12 weeks postpartum	A descriptive study of 906 women in the UK (Bick et al., 1998)
Depression was associated with early weaning.	EPDS ≥12 at six weeks	A secondary analysis survey of 526 women in Canada (Dunn et al., 2006)
Depressed mothers were more likely to give cereal, water, and juice between two to four months and less likely to continue breastfeeding.	Epidemiologic Studies Depression Scale (CES-D) at two to four months	A secondary data analysis of 5,565 mothers in the US (McLearn et al., 2006)
Postnatal depression was significantly associated with shorter duration of breastfeeding.	Modified scale similar to Kessler 10-item scale at three months	A longitudinal study of 159 women in Australia (Papinczak and Turner, 2000)
Decreased breastfeeding duration, increased breastfeeding difficulties and low breastfeeding self-efficacy resulted in being less likely to initiate breastfeeding and less exclusive breastfeeding.	EPDS PES	A qualitative systematic review of 75 articles (Dennis et al., 2009)
Oxytocin level during breastfeeding was inversely correlated with maternal EPDS and both STAI-State and STAI-Trait anxiety scores.	EPDS≥10 STAI score 34 as median at eight weeks	The results from a longitudinal cohort study of 52 women in the US (Stuebe et al., 2013)
No association was found between postpartum depression and feeding methods. Feeding method was significantly associated with delayed onset of lactation within the first 48 hours and the problems related to breastfeeding.	EPDS>12 at six weeks postpartum	A prospective study of 197 mothers, Turkey (Annagur et al., 2013)
Breastfeeding cessation was associated with symptoms of maternal depression.	Beck Depression Inventory at one month	A cohort study of 360 mothers in Brazil, (Feldens et al., 2012)
Mothers with postnatal depression were less likely to put their infants to sleep on their backs, less likely to have ever breastfed their infants and more likely to put their infant to bed with a bottle.	Epidemiologic Studies Depression (CES-D) Scale ≥15 at nine months postpartum	A longitudinal study of 5,089 two-parent families in the US (Paulson et al., 2006)
Women who were breastfeeding at two and four months had lower scores on EPDS and were less likely to be diagnosed with PPD.	EPDS at two months and four months	A prospective study of 137 women in United Arab Emirates (Hamdan and Tamim, 2012)

2.1.7 Postnatal depression and infant growth

Several studies have shown that postnatal depression can influence infant growth. A longitudinal birth cohort study of 1,035 mothers in Johannesburg, South Africa has shown that maternal postnatal depression at six months is associated with the child being stunted at two years of age (OR=1.61;95% CI, 1.02-2.56), after adjusting for socioeconomic status, maternal age, child gender and preterm delivery (Avan et al., 2010). The study also demonstrated that stunted children had a significantly higher mean score on the Richman child behaviour scale, indicating that stunted growth is significantly associated with child behaviour problems (Avan et al., 2010). In a case-control study (n= 242) in Nigeria, there was a significantly higher percentage of infants who were below the fifth percentile (weight for age) in the group of mothers who were depressed than in the non-depressed group at three months (OR=3.28; 95% CI,1.03-10.47) and six months (OR=3.34; 95% CI, 1.18-9.55) (Adewuya et al., 2008). Similarly in a cohort study of 171 mothers and infants in Goa, India, a higher proportion of babies in the group of mothers with postnatal depression were underweight (24% vs. 9%) and short for age (15% vs. 7%,) compared with non-depressed mothers group (Patel, DeSouza et al. 2003). Multivariate analysis of this study also showed that, after adjustment for confounding factors, postnatal depression was strongly associated with being underweight (RR=2.3;95% CI, 1.1-4.7),) and being short for age (RR 2.9;95% CI,1.3-6.8) at six months (Patel et al., 2003). A prospective study of 632 mother-infant dyads in Rawalpindi, Pakistan, found similar deficits in the growth of infants of depressed mothers (Rahman et al., 2004). The findings indicated that maternal depression was significantly associated with infants being underweight (OR=3.5; 95% CI, 1.5-8.6) and (OR=3.0; 95% CI, 1.5-6.0) at six and twelve months of age, respectively, and being stunted (OR=3.2; 95% CI, 1.1-9.9) and (OR=2.8; 95% CI, 1.3-6.1) at six months and twelve months of age, respectively (Rahman et al., 2004). In a further cross-sectional study of 595 mothers and their infants of 6-24 months of age in Brazil, depressive symptoms (a score ≥16 on the Centre for Epidemiological Studies Depression Scale (CES-D)) among mothers were associated with short stature among their children (adjusted OR=1.8; 95% CI, 1.1-2.9) (Surkan et al., 2008b).

By contrast, a cross-sectional study undertaken to evaluate the association between maternal postpartum depression and childhood overweight in low-income urban communities in Teresina, Piaui, northeast Brazil (n=589) found that infants of mothers with depression have a higher risk of being above the 85th percentile (adjusted OR=1.7; 95% CI, 1.4- 2.2) and the 95th percentile (adjusted OR=2.3; 95% CI, 1.6- 3.3) on the weight for height figures of the World Health Organisation (Surkan et al., 2008a). Similarly, the Infant Feeding Practices Study II (N= 1447) has shown that there was significantly greater average weight gain at six months among infants of mothers with postpartum depression (10.15 lb, SD = 2.32 vs. 9.85 lb, SD = 2.32) (Gaffney et al., 2012). The authors concluded that screening for PPD at well-child clinics may lead to improved maternal health outcomes and the prevention of early-modifiable risk factors for childhood obesity (Gaffney et al., 2012).

Studies with larger sample sizes have shown that there is no association between postnatal depression and infant growth. A cohort study of 4,287 mother-infant dyads in Pelotas, Brazil, has shown that at 12, 24 and 48 months (follow up checks) there was no association with long lasting postnatal depression (EPDS score ≥13) and infant growth (World Health Organization growth curves) when adjusted for confounding factors (Santos et al., 2010). However, the unadjusted results indicate that the prevalence of underweight (3.6% vs. 1.2%) and stunting (5.9% vs. 3.1%) is higher among depressed mothers compared with mothers who are not depressed (Santos et al., 2010).

A critical review of 11 studies from the UK (The United Kingdom of Great Britain and Northern Ireland), India, Pakistan, South Africa, Ethiopia, Jamaica, Brazil, Peru and Vietnam, by Stewart, discussed four reasons why postnatal depression is associated with growth faltering in developing countries but not in developed countries (Stewart, 2007).

Firstly, confounding factors may not have been adequately accounted for (Stewart, 2007). He argued that in some studies the association between postnatal depression and under-nutrition was not significant, after adjusting for confounding factors including poverty, socioeconomic status, parental education levels and birth weight. However, the association remained significant after adjustment in the studies completed in Goa, India and Rawalpindi, Pakistan (Patel, DeSouza et al. 2003; Rahman, Iqbal et al. 2004).

Secondly, the effects of depression, such as tiredness, worthlessness and psychomotor slowing, can affect the mother’s ability to provide proper nutritional care, proper hygiene and appropriate health care-seeking behaviours, so that the children’s growth is affected (Stewart, 2007). In the longitudinal study of 632 women and children in Rawalpindi, Pakistan, after adjustment for confounding factors including poverty, parental education and low birth weight, postnatal depression was associated with stunted growth and five or more diarrheal episodes (Rahman et al., 2004).

Thirdly, the association between stunted growth and postnatal depression may be due to the stress caused by both internal and external factors in bringing up a child who is slow to develop and grow (O'Brien et al., 2004, Stewart, 2007).

Fourthly, the environment in developing countries is more hostile and less favourable for child health, so that postnatal depression affects infant nutrition and growth more severely (Patel et al., 2003, Stewart, 2007). Hence more prospective studies, including adjustment for potential confounders, are needed to understand the questions raised by the past researchers (Stewart, 2007).

Some recent studies also have shown that there is no association between postnatal depression and infant growth among South Asian Communities living in developed countries. A prospective cohort study of 704 mothers in the north-west of England, areas with a high population density of Pakistani-origin were recruited from Central Manchester Hospital in the City of Manchester and East Lancashire Hospital in Lancashire. All infants were weighed and measured at birth and six months, and their development was assessed using the Bayley Scales of Infant Development-Third Edition. There was no difference in the birth weight or weight and height at six months of infants of depressed mothers versus infants of psychologically well mothers in this sample of British Pakistani women (Husain et al., 2012).

Table 2.9 Summary of the association between postnatal depression and infant growth

Findings	Tools	Study
Postnatal depression at six months was associated with child being stunted at two years, and stunted growth was significantly associated with child behaviour problem at two years.	Pitt inventory≥19 at six months WHO growth standards and Richman child behaviour scale at two years postpartum	A longitudinal birth cohort study of 1,035 mothers in Johannesburg, South Africa (Avan et al., 2010)
Infants of depressed mothers were more likely to be below the fifth percentile (weight for age) than those of non-depressed mothers at three and six months.	DSM-III-R and anthropometry at six weeks, three, six and nine months postpartum	A case-control study (n= 242) in Nigeria (Adewuya et al., 2008)
Postnatal depression was strongly associated with being underweight and short for age at six months	EPDS 11/12 and WHO growth standards at six months postpartum	A cohort study of 171 mothers and infants in Goa, India (Patel et al., 2003)
Maternal depression was associated with being underweight and stunted at six months and twelve months.	ICD-10 and anthropometry at two, six and twelve months postpartum	A prospective study of 632 mother-infant dyads in Rawalpindi, Pakistan (Rahman et al., 2004)
Depressive symptoms among mothers were associated with short stature among children.	CES-D ≥16 from six to twenty-four months postpartum	A cross-sectional study of 595 mothers and their infants in Brazil (Surkan et al., 2008b)
Maternal depression was associated with the infant being above the 85th and 95th percentiles on the weight for height WHO growth curve.	CES-D ≥16 from six to twenty-four months postpartum	A cross-sectional study of 589 infants and mothers in Teresina, Piaui, north-east Brazil (Surkan et al., 2008a)
Greater average weight gain at six months was found among infants of mothers with PPD.	EPDS≥10 and anthropometry at six months	Longitudinal study of 1,447 in US (Gaffney et al., 2012)
No association was found between depression and infant growth when other factors were adjusted. Unadjusted results indicate that the prevalence of underweight and stunted children is higher among depressed mothers compared with mothers who are not depressed.	EPDS ≥13 at 12, 24 and 48 months	A cohort study of 4,287 mother-infant dyads in Pelotas, Brazil with 48 month follow up (n=3,792) (Santos et al., 2010)
No association was found between postnatal depression and infant growth in most developed countries. Postnatal depression was associated with depression and infant feeding in developing countries.	EPDS 13/13 ICD-10 CES-D ≥16 at six weeks, three, six and nine months	A critical review of 11 studies from the UK, India, Pakistan, South Africa, Ethiopia, Jamaica, Brazil, Peru and Vietnam (Stewart, 2007)
No association was found between postnatal depression and infant growth.	EPDS≥12 and anthropometric measures at six months	A prospective cohort study of 704 mothers in the north-west of England, areas with high density of Pakistani-origin (Husain et al., 2012)

2.1.8 Other effects of postnatal depression

The Canadian National Longitudinal Survey of Children and Youth revealed that children of depressed mothers were at an increased risk of having low receptive vocabulary (adjusted OR=1.93) and displaying inattention (adjusted OR=2.42) or physical aggression (adjusted OR=4.06) at ages four to five years after adjusting for family, demographic factors, family functioning and parenting qualities (Letourneau et al., 2013). The findings also illustrated that, for mothers who experienced depression continuously and when their child was two to three years or older, there was a high risk factor for anxiety (OR=3.93 and OR=1.43, respectively) and for the child to perform poorly in mathematics (OR=1.23and OR=1.25, respectively) when the child was ten and eleven years old (Letourneau et al., 2013). Other studies have confirmed that postnatal depression results in low levels of mother-infant bonding, and less healthy eating and sleeping habits in their infants (George et al., 2005, Paulson et al., 2006, Edhborg et al., 2005b, Edhborg et al., 2005a). A longitudinal study of infants born preterm (<35 weeks) or at low birth weight (<2500 g) (n = 137) demonstrated that maternal depressive symptoms at four months was associated with preterm children's cognitive function at sixteen months (McManus and Poehlmann, 2012). The results of this study showed that postnatal depression at four months was associated with lower cognitive function on the Bailey Scales of Infant Development, 2nd edition (OR=-5.22; 95% CI, -10.19 to 0.25) at sixteen months, controlling for a host of socioeconomic characteristics (McManus and Poehlmann, 2012). In the longitudinal birth cohort study of 1,035 mothers in Johannesburg, maternal postnatal depression was significantly associated with child behaviour problems at age two years (β=0.363) and this association held when controlling for child characteristics and socioeconomic status (Avan et al., 2010). Similar results were seen in the study which was conducted in the north-west of England, in areas with a high population density of Pakistani-origin. Findings showed significantly lower adaptive behaviour scores in infants of depressed mothers than those of psychologically well mothers (mean difference 4.6, t=2.81, df 195) (Husain et al., 2012).

Studies also have shown an association between depression and insomnia (Swanson et al., 2011). Data from 257 pregnant or postpartum women who sought outpatient psychiatric treatment at a university hospital-affiliated clinic in the United States indicated that, after controlling for Penn State Worry Questionnaire (PSWQ), the partial correlation between EPDS score and Insomnia Severity Index (ISI) was 0.15 and 0.37 for pregnant and postpartum women, respectively, and, after controlling for EPDS, the partial correlation between PSWQ and ISI was 0.20 and 0.12 for pregnant and postpartum women, respectively (Swanson et al., 2011).

2.2 Infant Feeding

2.2.1 Introduction

The World Health Organisation recommends exclusive breastfeeding until six months of age, followed by the introduction of appropriate complementary foods while breastfeeding continues, for optimal health and development of the infant (Daelmans et al., 2009). Good early nutrition is an important factor influencing one's overall lifetime health. Early nutrition also affects the human microbiome, which is an important factor in determining the development of obesity and chronic disease (Thompson, 2012)**.**

2.2.2 Breastmilk and its advantages to the infant

Breastfeeding has a lot of nutritional benefits and is coupled with reduced short-term morbidity and mortality from gastrointestinal and respiratory infections, sudden infant death syndrome and (in preterm infants) necrotizing enterocolitis (Kramer, 2010). The protective effect of breastmilk against infections continues into the second and even third years of life in developing countries, thus bringing significant reductions in mortality (Molbak et al., 1994a). Breastmilk also has protective effects against obesity (Yang and Huffman, 2013), hypertension (Stuebe et al., 2011), insulin-resistance type 2 diabetes (Owen et al., 2006) and atopic disease (Gdalevich et al., 2001a). Breastfeeding also creates a healthy intestinal microbiota profile in early life which, in turn, reduces the risks of obesity and diabetes, as well as allergic diseases, including asthma and enteric inflammatory conditions, sometimes manifesting at seven years of age(Isolauri, 2012). Breastfeeding has also been associated with improved cognitive ability (Kramer, 2010).

2.2.2.1 Nutritional benefits

Human breastmilk contains all the necessary nutrients required for growth and development of the newborn infant at a time of rapid growth of the infant's vital systems (NHMRC 2012). Breastmilk is also known as the gold standard for protective nutrients fed to newborn infants (Walker, 2010). The nutrients in human breastmilk are in forms that can be easily absorbed and are bio-available (Lawrence, 2011). Breastmilk components, including, glutamate, certain polyunsaturated long-chain fatty acids, oligosaccharides, lysozyme, immunoglobulin, bile salt–stimulated lipase, growth factors and numerous other bioactive factors, facilitate optimal function of the infant's immature systems and confer both active and passive immunity (Labbok et al., 2004). Breastmilk also contains living cells which have functional importance (Schack-Nielsen and Michaelsen, 2007). A secondary data analysis from the Western Australian Pregnancy Cohort (Raine) Study, demonstrated that the flavours transferred in breastmilk provide repeated early exposure to different tastes and positively shape children to prefer a variety of foods (Scott et al., 2012).

2.2.2.2 Prevention of infant mortality

Breastfeeding has been shown to prevent infant mortality and morbidity from infectious diseases. The leading causes of death among children under five years of age are acute respiratory infections and diarrhoeal diseases, which are also the leading overall causes of loss of healthy life years (World Health Organization, 2009). Suboptimal breastfeeding is the second leading individual risk factor out of the six main risk factors for children's deaths (World Health Organization, 2009). Deaths attributed to suboptimal breastfeeding formed 2.1% of total children's deaths in the world and 3.7% of the deaths in low income countries in 2004 (World Health Organization, 2009). In 2004, being underweight, in conjunction with micronutrient deficiencies and suboptimal breastfeeding, accounted for 35% of child deaths and 32% of loss of healthy life years worldwide (World Health Organization, 2009). Worldwide in 2009, approximately 8.1 million children under five years of age died, with neonatal deaths accounting for 41% and infectious diseases for 68% (You et al., 2010, Black et al., 2010). Studies have shown that early initiation of breastfeeding, 'exclusive breastfeeding' for six months and prolonged duration of breastfeeding to two years of age could prevent many of these deaths. Likewise, a pooled analysis from Brazil, the Gambia, Ghana, Pakistan, the Philippines and Senegal indicated that the protection provided by breastmilk against infant mortality from infectious diseases was highest in the youngest ages of infancy [pooled odds ratios: (OR=5.8; 95% CI, 3.4-9.8) for infants less than two months of age, (OR=4.1; 95% CI, 2.7-6.4) for two to three month-olds, (OR=2.6; 95% CI, 1.6-3.9) for four to five month-olds (OR=1.8; 95% CI, 1.2-2.8) for six to eight month-olds, and (OR=1.4; 95% CI, 0.8-2.6) for nine to eleven month-olds] (Victora et al., 2000). The same study showed that in the first six months of life, protection against diarrhoea was significantly greater (OR= 6.1; 95% CI, 4.1-9.0) than against deaths due to acute respiratory infections (OR=2.4 ; 95% CI, 1.6-3.5) (Victora et al., 2000). A prospective observational cohort study of 10,942 breastfed singleton neonates born in Ghana showed that the risk of death as a result of infection increased with increasing delay in the initiation of breastfeeding from one hour to seven days; overall late initiation (after day 1) was associated with a 2.6-fold risk (OR=2.61; 95% CI, 1.68-4.04) and partial breastfeeding was associated with a 5.7-fold adjusted risk of death as a result of infectious disease (adjusted OR=5.73; 95% CI, 2.75-11.91) (Edmond et al., 2007). Findings from a cohort study of 10,464 newborns conducted in South India indicated that, after adjusting for birth weight, gestational age and other covariates, late initiation (>24 hours) was associated with approximately 78% higher risk of death (adjusted RR=1.78; 95% CI, 1.03-3.10) (Garcia et al., 2011). A systematic review of all literature published from 1980 to 2009 assessing 'levels of suboptimal breastfeeding as a risk factor for selected diarrheal morbidity and mortality outcomes' highlighted the importance of breastfeeding to protect against diarrhoea-specific morbidity and mortality throughout the first two years of life (Lamberti et al., 2011). The results of the random effects meta-analysis of these studies indicated varying degrees of protection across levels of breastfeeding exposure, with the greatest protection conferred by 'exclusive breastfeeding' among infants from birth to five months of age and by 'partial breastfeeding' among infants and young children of six to twenty-three months of age. Not breastfeeding resulted in an excess risk of diarrhoeal mortality in comparison with 'exclusive breastfeeding' among infants from birth to five months of age (RR=10.5; 95% CI, 2.79-39.6) and in comparison with 'partial breastfeeding' among children aged six to twenty-three months (RR=2.18; 95% CI, 1.14-4.16)] (Lamberti et al., 2011). The results from the multi-centre randomized, controlled trial in developing countries, which investigated 9,424 mother-infant pairs (2,919 in Ghana, 4,000 in India and 2,505 in Peru) showed that, after adjusting for confounding factors, infants who were not breastfed had a higher risk of death than infants who were predominantly breastfed (Hazards Ratio (HR)=10.5; 95% CI, 5.0-22.0) and partially breastfed (HR=2.46; 95%CI, 1.44-4.18) in the first six months of life (Bahl et al., 2005). A cohort study of 690 mother-infant pairs in Tanzania reported that a one-month increase in ‘exclusive breastfeeding’ was associated with a 49% reduction in early infant mortality in the first six months of life (RR=0.51; 95% CI, 0.28-0.93) and a non-significant 15% reduction in risk of HIV infection or death (RR=0.85; 95% CI, 0.71-1.01) over the first five years of life (Natchu et al., 2012). A meta-analysis of twenty-four original case-control studies showed, for infants who received any amount of breastmilk for any duration, (adjusted OR=0.55; 95% CI: 0.44-0.69) and for exclusive breastfeeding for any duration (OR=0.27; 95% CI, 0.24-0.31) there is a lower risk of Sudden Infant Death Syndrome (Hauck et al., 2011a).

2.2.2.3 Prevention of infant morbidity

Acute respiratory and gastrointestinal tract infections were reported to be the leading causes of morbidity in children (World Health Organization, 2004). Breastfeeding has been a modifiable factor which has been suggested to reduce infectious diseases (Bahl et al., 2005).

Protection from gastroenteritis

There is clinical evidence of the strong protective effect of breastfeeding against age-related infectious gastroenteritis. An important function of early breastfeeding is its anti-inflammatory effect on the immature, excessive inflammatory response in newborns (Walker, 2010). Components in breastmilk, including growth factor (TGF)-beta, interleukin (IL)-10, erythropoietin, and lactoferrin, can act individually or in concert to contain the neonatal immature anti-inflammatory response (Walker, 2010). A case-control study of 304 infants (167 cases and 137 controls) in England has shown that, after adjustment for confounders, infants who were never breastfed or never exclusively breastfed were more likely to have diarrhoeal disease compared with infants who were breastfed or exclusively breastfed (OR=2.74; 95%CI, 1.35-5.57 and OR=3.62; 95%CI, 1.45-9.03, respectively) (Quigley et al., 2006). A major cluster randomised, controlled trial of 16,000 infants indicated that longer duration and exclusivity of breastfeeding reduced the risk of gastrointestinal tract infections during the first twelve months after birth (Kramer et al., 2001a). Results from a prospective birth cohort study of 1,901 infants in Germany reported that ‘exclusive breastfeeding’ for six months or longer significantly reduced the risk for gastrointestinal tract infection compared with non-breastfeeding or breastfeeding for less than four months (adjusted OR=0.60; 95% CI, 0.44-0.82) (Rebhan et al., 2009). A cross-sectional study of 1,278 children under five years old in Qatar showed that ‘formula feeding’ and short breastfeeding duration were associated with higher incidence of diarrhoea (RR=2.68; 95% CI, 1.52-4.38 and RR=2.18; 95% CI, 1.51-3.08, respectively) (Ehlayel et al., 2009). An epidemiological ecological study of 1,329,618 children under one year of age, between 1999 and 2008, showed that ‘exclusive breastfeeding’ among children under four months old had a negative correlation with hospitalization rates due to diarrhoea (Rho= -0.483) (Boccolini et al., 2012). A systemic review of several studies also found that a history of breastfeeding was associated with a reduction in the risk of necrotizing enterocolitis (Ip et al., 2007).

2.2.2.3.1 Protection from respiratory tract infections

Breastfeeding provides protection for infants against respiratory disease, including upper and lower respiratory tract infections. A prospective birth cohort study of 2,602 live born children, ascertained through antenatal clinics at the major tertiary obstetric hospital in Perth, Western Australia, showed that ‘predominant breastfeeding’ for at least six months and ‘partial breastfeeding’ for up to one year may reduce the prevalence and subsequent morbidity of respiratory illness and infection in infancy (Oddy et al., 2003). A systematic review and meta-analysis of 36 studies showed that infants who were never ‘exclusively breastfed’ have higher risk of having acute lower respiratory tract infections (adjusted OR=2.34; 95%CI, 1.42-3.88) (Jackson et al., 2013). The National Health and Nutrition Examination Survey III, a nationally representative cross-sectional home survey of 2,277 children aged from six to twenty-four months conducted from 1988 to 1994 in America, revealed that there was a statistically significant increased risk for pneumonia (adjusted OR=4.27; 95% CI, 1.27-14.35) in those who were ‘fully breastfed’ for four to six months compared with infants who were ‘fully breastfed’ for six months or more (Chantry et al., 2006). The Multiple Indicator Cluster Survey (MICS) 2003 data from Bangladesh, which included 1,633 infants aged from birth to three months, showed that ‘exclusively breastfed’ infants were less likely to have acute respiratory infections (adjusted OR=0.69; 95% CI, 0.54-0.88) (Mihrshahi et al., 2007). The results from a cohort study of 351 infants in Bangladesh, showed that infants who were not ‘exclusively breastfed’ had significantly higher seven-day prevalence of ARI (adjusted OR=2.31; 95% CI, 1.33- 4.00) than infants who were 'exclusively breastfed' (Mihrshahi et al., 2008). A population-based prospective cohort study of 4,164 infants in the Netherlands found that, compared with 'never-breastfed' infants, infants who were 'exclusively breastfed' for four months and continued 'any breastfeeding' afterwards had a lower risk of upper respiratory infections and lower respiratory infections in six months postpartum (adjusted OR=0.50; 95%CI, 0.32-0.79 and adjusted OR=0.41; 95%CI, 0.26-0.64, respectively) and a reduced risk of lower respiratory tract infections between seven to twelve months (adjusted OR=0.46; 95% CI, 0.31-0.69) (Duijts et al., 2010).

2.2.2.3.2 Other infectious diseases

A cross-sectional study of 372 preschool children in China showed, after multivariate-adjusted analysis, that prolonged 'exclusive breastfeeding' was a protective factor for the incidence of fever in children with hand, foot and mouth disease (OR=0.401; 95% CI, 0.229-0.704) at three to four years of age (Zhu et al., 2012b). Several studies have indicated that breastfeeding protects against acute otitis media because immunoglobulins contained in breastmilk protect against infections (Ip et al., 2007). A meta-analysis of five cohort studies suggested that, compared with 'never breastfeeding', 'ever breastfeeding' was associated with a lower risk of acute otitis media (pooled adjusted OR=0.77; 95% CI, 0.64-0.91) (Ip et al., 2007). Results from four prospective cohort studies showed that infants had a higher risk of otitis media if any formula was introduced in the first three to six months (pooled OR=2.00, 95% CI, 1.40-2.78) (McNiel et al., 2010). A case-control study of 200 cases and 336 controls aged zero to six years, in Sweden, found that children who were 'not breastfed' significantly had a higher risk of urinary tract infection compared with 'exclusively breastfed' children (HR=2.30; 95%CI, 1.56-3.39) (Marild et al., 2004). A retrospective case-control study of 56 cases and 102 controls, conducted in a NICU (Neonatal Intensive Care Unit) in Israel, showed that breastfeeding was associated with a lower risk of urinary tract infection (OR=0.314; 95%CI, 0.140-0.707) (Levy et al., 2009).

2.2.2.3.3 Prevention of asthma and allergies

Many studies suggest a protective effect of prolonged and exclusive breastfeeding on reducing the risk of atopic dermatitis, including asthma, allergic rhinitis, positive allergen skin tests and food allergies in infancy (Gdalevich et al., 2001b, Gdalevich et al., 2001a, Kramer et al., 2001a, Ip et al., 2007). A study embedded in a population-based prospective cohort study of 5,368 children in the Netherlands showed that, compared with children who were breastfed for six months, those who were 'never breastfed' had overall increased risks of wheezing, shortness of breath, dry cough and persistent phlegm during the first four years [(OR=1.44; 95% CI, 1.24-1.66), (OR=1.26; 95% CI, 1.07-1.48), (OR=1.25; 95% CI, 1.08-1.44) and (OR 1.57; 95% CI,1.29-1.91), respectively] (Sonnenschein-van der Voort et al., 2012). In a cross-sectional study of 3,781 children, conducted in Finland, total 'breastfeeding' duration of nine and a half months or less was associated with an increased risk of non-atopic asthma (OR=3.60; 95% CI,1.67-7.76) (Nwaru et al., 2013). In this study, the time of introduction of solid food and risk of allergic disease produced different outcomes. Introduction of wheat, rye, oats, or barley at five to five and a half months of age was inversely associated with asthma (OR=0.59; 95% CI, 0.41-0.86) and allergic rhinitis (OR=0.66; 95% CI, 0.50-0.87), whereas introduction of other cereals at less than four and a half months increased the risk of atopic eczema (OR=1.47; 95% CI, 1.10-1.97) (Nwaru et al., 2013). Results from a case-control study of 252 children with eczema (cases) and 305 children without eczema (controls), in Belgium, also indicated that early introduction of solid food before four months was associated with a reduced risk of eczema up to four years of age (adjusted OR=0.49; 95%CI, 0.32-0.74), predominantly in children whose parents had allergic disease (adjusted OR=0.35; 95%CI, 0.20-0.63) (Sariachvili et al., 2010). However, in these studies, the results from the high-risk population make it difficult to generalise the results to the whole population, and exposure in these studies were determined retrospectively. There is still a lack of convincing evidence as to whether introducing solid food between four and six months provides any protection against the development of allergic diseases. A case-control study of 271 asthma cases and 271 non-asthmatic controls in the Pingjiang district of the city of Suzhou, in China, showed that breastfeeding provided a protective factor against asthma (OR=0.51; 95% CI, 0.418-0.914) from birth to fourteen years of age (Zhu et al., 2012a). In a prospective birth cohort study of 1,105 infants in New Zealand, after adjustment for confounders, each month of 'exclusive breastfeeding' was associated with significant reductions in current asthma in children from two to six years of age (from adjusted OR=0.83; 95% CI, 0.76-0.92 to adjusted OR=0.91; 95% CI, 0.83-0.99) (Silvers et al., 2012). The same study also indicated that current asthma at the age of two

(OR=0.94; 95% CI, 0.90-0.97), three (adjusted OR=0.94; 95% CI, 0.91-0.97), and four (adjusted OR=0.96; 95% CI, 0.93-0.99) years of age was also reduced by each month of 'any breastfeeding' (Silvers et al., 2012).

2.2.2.3.4 Prevention of risk of chronic diseases

Many studies suggest that breastfeeding reduces the risk of chronic diseases. A review and summary of some recent meta-analyses of studies in Australia since 1927, linking premature weaning from breastmilk with later-life chronic disease risk, suggests that, after adjustment for major confounding variables, the risks of chronic disease are 30-200% higher in those who were not breastfed compared with those who were breastfed in infancy (Smith and Harvey, 2011). Overall, the attributable proportion of chronic disease in the population is estimated at 6-24% for a 30% exposure to premature weaning (Smith and Harvey, 2011). Cross-sectional data from the baseline survey of the longitudinal cohort study (IDEFICS) of 14,726 children aged two to nine years in eight European countries (Italy, Estonia, Cyprus, Belgium, Sweden, Hungary, Germany and Spain) indicated that, after controlling for education, income and other potential confounders, 'exclusive breastfeeding' for four to six months was a protective factor against being overweight (including obesity) when compared with children 'never exclusively breastfed' (OR=0.73; 95% CI, 0.63-0.85) (Hunsberger et al., 2013). A community-based prospective study of 930 healthy neonates in China indicated that high BMI status at three months is significantly and inversely associated with breastfeeding as any proportion of feeding occasions (adjusted OR=0.74; 95%CI, 0.56-0.98) and that high weight gain in the first three months also is significantly inversely associated with breastfeeding (OR=0.76; 95% CI, 0.59-0.96) (Zhang et al., 2012a). Data from a prospective birth cohort study on 568 Indian children, showed that breastfeeding duration was strongly negatively associated with weight gain at two years of age (adjusted OR=0.12 ; 95% CI, 0.19-0.05) and weight gain at two years of age was strongly associated with high BMI at five years (adjusted OR=3.8; 95% CI, 2.53-5.56) (Caleyachetty et al., 2013). The Growing Up in Ireland (retrospective) study of 7,798 children at nine years indicated that being breastfed for between thirteen and twenty-five weeks was associated with a 38% reduction in the risk of obesity at nine years of age, while being breastfed for twenty-six weeks or more was associated with a 51% reduction in the risk of obesity at nine years of age (McCrory and Layte, 2012). The results also pointed towards a dose response patterning in the data for those breastfed in excess of four weeks (McCrory and Layte, 2012).

Elevated blood pressure and blood cholesterol levels are major risk factors for cardiovascular disease, which is the major cause of death in the world. Several studies indicated that breastfeeding may have a protective effect on blood pressure and blood cholesterol levels in adulthood. A prospective birth cohort study in Japan, the Tohoku Study of Child Development of 377 mother-offspring pairs at the child's age of seven years found that the duration of breastfeeding (greater than eight months) was more strongly associated with lower home blood pressure (92.9 mm Hg systolic/55.1 mm Hg diastolic) than in the short-term breastfeeding group (94.7mm Hg systolic/56.4 mm Hg diastolic) (Hosaka et al., 2013). A comparative cross-sectional study of 60 men and 72 women were grouped into 'exclusive breastfeeding', 'mixed feeding', and formula feeding, with 20 men and 24 women per group. The results showed that systolic, diastolic and mean blood pressure levels, as well as respiratory and heart rates, were higher in the groups of 'exclusively formula feeding' and 'mixed-feeding' than in those with 'exclusively breastfeeding' (Hernandez-Gonzalez et al., 2012). A meta-analysis of 30 studies on the association of breastfeeding and blood pressure later in life suggested that infants who were breastfed had lower systolic pressure (mean difference -1.21 mmHg; 95%CI, -1.72 to -0.70) and diastolic blood pressures (mean difference -0.49 mmHg; 95%CI, -0.87 to -0.11)(Horta et al., 2007). In another meta-analysis 'ever breastfeeding' had an influence on a small reduction of less than 1.5 mmHg in systolic blood pressures and less than 0.5 mmHg in diastolic blood pressures, compared with 'never breastfeeding' (Ip et al., 2007). In the PROBIT study of 13,889 there was no association with breastfeeding and childhood blood pressure at six and a half years of age (Kramer et al., 2007).

Studies have shown that there is an association between high blood cholesterol in adulthood and breastfeeding in infancy (Horta et al., 2007, Ip et al., 2007, Owen et al., 2002). A meta-analysis has shown that adults who were breastfed, compared with 'non-breastfed' adults, had a lower mean cholesterol level of 0.18 mmol/L (6.9 mg/dl) (Horta et al., 2007). A review of 17 studies of a total of 17,498 subjects found that the mean total blood cholesterol level was lower among adults who were 'ever breastfed' compared with those who were 'formula fed' (mean difference -0.04 mmol/L; 95% CI, -0.08 to 0.00 mmol/L) (Owen et al., 2008). The study also indicated that the reduced risk was more common with exclusivity of breastfeeding (mean difference -0.15 mmol/L; 95% CI, -0.23 to -0.06 mmol/L) (Owen et al., 2008). There was no association between early breastfeeding and cardio-vascular risk factors later in life, in a pooled analysis of five studies from developing countries (Brazil, Guatemala, India, the Philippines and South Africa) (Fall et al., 2011).

The results from a case-control study of 245 multiple sclerosis patients and 296 population-based controls indicated that there was an independent significant association between breastfeeding and multiple sclerosis (adjusted OR=0.58; 95% CI, 0.35–0.94) (Conradi et al., 2013). When 'no breastfeeding' was used as a reference in the analysis, the protective effect only emerged after four months of breastfeeding (adjusted OR=0.51; 95% CI, 0.29–0.88) (Conradi et al., 2013).

2.2.2.4 Cognitive development

There is increasing evidence that breastfeeding is associated with improved cognitive development (Kramer, 2010, Bernard et al., 2013, Herba et al., 2013). A Cohort Study of 1,387 children, two years of age, and 1,199 children, three years of age, in France has shown that 'ever-breastfed' children scored 3.7 +/-1.8 ($P = 0.038$) points higher than 'never-breastfed' children in language ability on the Communicative Development Inventory (CDI) and 6.2 +/-1.9 ($P = 0.001$) points higher on the Ages and Stages Questionnaire (ASQ) (Bernard et al., 2013). The same study also indicated that, among breastfed children, 'exclusive and any-breastfeeding' durations were positively associated with both CDI and ASQ scores (Bernard et al., 2013). In a cohort study of 37 to 42 weeks (term, n = 11,101), and 28 to 36 weeks (preterm, n = 778) infants in the United Kingdom, after adjusting for confounders, there was a significant difference in mean scores between children who were breastfed and children who were 'never breastfed': in term children, a two-point increase in score for picture similarities (when breastfed ≥4 months) and naming vocabulary (when breastfed ≥6 months); in preterm children, a four-point increase for naming vocabulary (when breastfed ≥4 months) and picture similarities (when breastfed ≥2 months) and a six-point increase for pattern construction (when breastfed ≥2 months) (Quigley et al., 2012).

A cluster-randomized trial of 13,889 healthy breastfeeding infants in Belarus indicated that ‘exclusive breastfeeding’ and longer duration of breastfeeding is associated with higher means on all of the Wechsler Abbreviated Scales of Intelligence measures, with cluster-adjusted mean differences (95% confidence intervals) of +7.5 (+0.8 to +14.3) for verbal IQ, +2.9 (-3.3 to +9.1) for performance IQ, and +5.9 (-1.0 to +12.8) for full-scale IQ. (Kramer et al., 2008). A meta-analysis of eight studies has shown that children who had been breastfed for at least one month scored higher on the intelligence test (mean difference 4.9; 95% CI, 2.97-6.92) compared with the children who had never been breastfeed or were breastfed for less than one month (Horta et al., 2007). The results from the Western Australian pregnancy cohort of 2,868 children suggested that longer breastfeeding duration was associated with better developmental scores from one to three years of age (Oddy et al., 2011). The long-term effect on cognitive development from the same cohort study showed that the children who were breastfed for less than six months were more likely to have mental health problems from two to fourteen years of age when compared with children who were breastfed for longer durations (Oddy et al., 2010). Results from a population-based birth cohort study of 657 women in the city of Sabadell (Catalonia, Spain) showed that greater levels of accumulated breastfeeding during the first year of life were related to higher mental development (0.37 points per month of full breastfeeding ; 95% confidence interval, 0.06-0.67) and children with a longer duration of breastfeeding exposed to higher ratios of between n-3 and n-6 PUFAs in colostrum had significantly higher mental scores than children with low breastfeeding duration exposed to low levels (Guxens et al., 2011). In preterm infants, the advantageous effect of breastmilk on neural and cognitive development is more outstanding. A study of 300 preterm infants from the United Kingdom showed that giving breastmilk in the early weeks after birth resulted in higher developmental test scores at eighteen months and higher IQ scores at seven to eight years of age, compared with infant formula-fed preterm infants (Lucas et al., 1990, Lucas et al., 1992). The results from a cohort study conducted on 1,035 extremely low birth weight infants in the United States indicated that receiving breastmilk was associated with improvements in neuro-developmental outcomes and behaviour in comparison with not receiving breastmilk (Vohr et al., 2006). Studies have suggested that cognitive development may be related to the higher level of long-chain polyunsaturated fatty acids found in breastmilk, of which the major lipid components are docosahexaenoic and arachidonic acids (Koletzko et al., 2008, Fleith and Clandinin, 2005). Recent studies also have indicated that breastfeeding in the neonatal period might increase docosahexaenoic acid (DHA) levels and influence brain development (Tanaka et al., 2009, Herba et al., 2013).

2.2.2.5 Infant growth pattern

Many studies have shown that a rapid growth in early infancy is associated with health status and the development of chronic diseases in later life (Barker, 2004, Barker et al., 2009, Zhang et al., 2013). Formula-fed infants have been shown to gain weight and length more rapidly (Nommsen-Rivers and Dewey, 2009, Dewey, 2009). The results from a prospective cohort study of 2,217 newborns babies indicated that, compared with 'formula feeding', 'exclusive breastfeeding' in the first month is associated with a lower risk of being obese (adjusted OR=0.53; 95% CI, 0.31-0.90) at two years of age (Zhang et al., 2013). An observational cohort study nested within a large randomized trial (PROBIT study) of 2,862 infants in Belarus has shown that weight gain (difference 28g/month; 95% CI, 12-44 g/month) and length gain (difference 1.1 mm; 95% CI, 0.5-1.6 mm), from three to six months was higher in the group of infants who had received 'complementary feeds' at three months compared with the group of infants who received only breastmilk (Kramer et al., 2003). A cohort study of 647 mothers and newborn infants in Japan indicated that breastfed infants were significantly shorter and lighter throughout the first twenty-four months when compared with the national references and WHO growth standards for both length and body weight (Tanaka et al., 2013). Conversely, a German cohort study of 1,901 infants reported that infants who were 'not breastfed' or 'any breastfed' for less than four months had lower weight-for-length z-scores in the first few days and highest scores from six to seven months of life compared with infants who were 'exclusively breastfed' for four months and longer (Rebhan et al., 2009).

2.2.3 Advantages to the mother

2.2.3.1 Prevention of breast cancer and ovarian cancer

Previous studies have indicated that breastfeeding reduces the risk of breast cancer through two mechanisms: the differentiation of breast tissue and reduction in the lifetime number of ovulatory cycles (Franca-Botelho Ado et al., 2012). One of the primary components of human milk that is hypothesized to reduce cancer risk is alpha-lactalbumin, and tumour cell death can be induced by HAMLET (a human milk complex of alpha-lactalbumin and oleic acid). Therefore, HAMLET may provide safe and effective protection against the development of breast cancer, and mothers should be encouraged to breastfeed their babies as clinical evidence has shown that there is a lower risk of breast cancer in women who do so (Franca-Botelho Ado et al., 2012). A population-based study conducted in Galicia, Spain, consisting of 510 women diagnosed with operable invasive breast cancer, found that a lifetime breastfeeding period of seven months or longer was less frequent in case patients with 'triple negative breast cancer' (TNBC) (OR=0.25; 95% CI, 0.08-0.68) compared to 'luminal A breast cancers' (Redondo et al., 2012). The study also showed that the number of pregnancies combined with a long breastfeeding period were associated with reduced odds of triple negative breast cancer compared with 'luminal A breast cancer', although the association seemed to be slightly more pronounced among women with a low number of pregnancies (OR=0.09, 95% CI, 0.005-0.54) (Redondo et al., 2012). A review of epidemiological studies on breastfeeding and breast cancer among Japanese women indicated that the three cohort studies failed to find a significant inverse association between breastfeeding and the risk of breast cancer. Some case-control studies observed a statistically significant association and some studies found a non-significant risk reduction for women who ever had breastfed or for women with a longer duration of breastfeeding (Nagata et al., 2012). Experimental studies have supported the biological plausibility of a protective effect of breastfeeding on breast cancer risk (Nagata et al., 2012). A case-control study of 1,665 pairs of women with a deleterious mutation in either BRCA1 (n = 1,243 pairs) or BRCA2 (n = 422 pairs) who were matched according to year of birth, mutation status and country of residence, showed that, among BRCA1 mutation carriers, breastfeeding for at least one year was associated with a 32% reduction in risk (OR=0.68; 95% CI, 0.52-0.91) and breastfeeding for two or more years conferred an even greater reduction in risk (OR=0.51; 95% CI, 0.35-0.74) (Kotsopoulos et al., 2012). The study also demonstrated that, among BRCA2 mutation carriers, there was no significant association between breastfeeding for at least one year and breast cancer risk (Kotsopoulos et al., 2012). The results from a hospital-based case-control study comprising 521 women (with an histologically confirmed incidence of breast cancer) and 521 controls (frequency-matched by age and province of residence) in Iran indicated that breastfeeding for less than 37 months was related to a higher risk of breast cancer in young women (OR=37 0.61; 95% CI, 0.44-0.84) compared with women who breastfed for 37 months or more (Ghiasvand et al., 2011). In a case-control study of 100 recent cases of breast cancer (histologically confirmed) and 203 controls (age and parity matched) in the Western Province in Sri Lanka, women who breastfed for 24 months or more during their lifetime had significantly lower risk of breast cancer than those who breastfed for less than 24 months (OR=0.40; 95%CI, 0.22-0.73) (De Silva et al., 2010). This study also found that, compared with 0-11 months of lifetime breastfeeding, there was a 66.3% reduction in breast cancer risk in women who breastfed for 12-23 months, 87.4% reduction in 24-35 months and 94% reduction in 36-47 months of breastfeeding (De Silva et al., 2010).

A case-control study of 493 incident ovarian cancer patients and 472 hospital-based controls (mean age: 59 years) conducted in Guangzhou, Guangdong Province, China showed that women who breastfed for a total duration for 31 months or more compared with women who breastfed for 10 months or less (adjusted OR=0.09; 95% CI, 0.04-0.19), and women who have breastfed three or more children compared with women who breastfed only one child (adjusted OR=0.38; 95% CI, 0.27-0.55) have a reduced risk of ovarian cancer (Su et al., 2013). Similarly, data from participants in a population-based study of ovarian cancer in western Washington State, USA (United States of America) (2002-2007) who had had at least one birth (881 cases and 1,345 controls) were used to assess relations between patterns of breastfeeding and ovarian cancer (Jordan et al., 2012). The results indicated that women who 'ever breastfed' had a 22% reduction in their risk of ovarian cancer compared with those who 'never breastfed' (OR=0.78; 95% CI, 0.64-0.96) and the risk reduction appeared to become greater with longer durations of feeding per child breastfed (OR=0.56; 95% CI, 0.32-0.98) (Jordan et al., 2012).

2.2.3.2 Prevention of postpartum haemorrhage

Loss of more than 500 mL of blood following childbirth is usually caused by failure of the uterus to contract fully after delivery of the placenta, and occurs in over 10% of deliveries, with a 1% mortality rate worldwide (Chelmow, 2008). A systematic review of 40 RCTs, or observational studies, which were searched on Medline, Embase, The Cochrane Library, and other important databases, showed that interventions were effective in reducing postpartum haemorrhage. They were: active management of the third stage of labour; carboprost injection; controlled cord traction; ergot compounds (ergometrine/ methylergotamine); immediate breastfeeding; misoprostol (oral, rectal, sublingual or vaginal); oxytocin, or oxytocin plus ergometrine combinations; prostaglandin E2 compounds; and uterine massage (Chelmow, 2011, Chelmow, 2008).

2.2.3.3 Early return to pre-pregnant weight

Data from Active Mothers Postpartum (AMP), a study of overweight and obese postpartum women (n = 450), to determine the effect of baseline characteristics, breastfeeding, diet, physical activity and contraception on weight change from six weeks to 12, 18, and 24 months postpartum, demonstrated that weight loss was associated with breastfeeding, hormonal contraception, lower junk food plus greater healthy food intake, and greater physical activity (Ostbye et al., 2012). A matched cohort of 322 women practicing exclusive breastfeeding and 205 women using other methods of infant feeding in the first six months after delivery showed that weight loss was significantly higher among the 'exclusively breastfeeding' group than in the group with other feeding methods during the first six months of exclusive breastfeeding (4.13 vs. 1.06kg) (Okechukwu et al., 2009). A positive correlation also was seen between the frequency of breastfeeding and maternal weight changes in the 'exclusively breastfeeding group' (r = 0.56)(Okechukwu et al., 2009). In a Danish National Birth Cohort consisting of 36,030 mothers who 'ever breastfed' at six months postpartum and 26,846 mothers who breastfeed at 18 months postpartum, it was shown that breastfeeding was negatively associated with postpartum weight retention in all women except the heaviest category of pre-pregnancy BMI. The analysis indicated that for every one-point increase in breastfeeding, weight retention was reduced by 0.06–0.09 kg at six months and 0.01–0.04 kg at 18 months postpartum. These results suggest that, when combined with gestational weight gain values of approximately 12 kg, breastfeeding as recommended could eliminate weight retention by six months postpartum in many women (Baker et al., 2008). A longitudinal study of 24 mothers aged between 19-42 years of age in Athens-Clarke County and surrounding counties of the State of Georgia between November 2005 and December 2006 showed that at 12 weeks postpartum, 'exclusively breastfeeding' mothers had lost more total body weight than mixed feeding mothers (4.41 +/- 4.10 kg versus 2.79 +/- 3.09 kg) but there was no significant difference in fat weight change between the two groups. (Hatsu et al., 2008). A study consisting of 431 women which was conducted by in-person interviews during pregnancy and at days 0, 3, and 7 also showed that delayed onset of lactogenesis is associated with maternal obesity (OR=2.21; 95% CI, 1.24-3.94)and factors associated with ineffective breastfeeding (Nommsen-Rivers et al., 2010).

2.2.3.4 Prevention of depression

Several studies have shown that breastfeeding reduces the risk of postnatal depression (Dennis and McQueen, 2009) (Hamdan and Tamim, 2012). A summary is shown in Table 2.7.

2.2.3.5 Increased mother-infant bonding

Studies have shown that interaction and skin-to-skin contact during breastfeeding encourages mother-infant bonding and attachment (Moore et al., 2012). A review of 34 randomized controlled trials involving 2,177 participants (mother-infant dyads) found a statistically significant positive effect of early skin-to-skin contact on breastfeeding at one to four months postpartum (13 trials; 702 participants) (RR=1.27; 95% CI, 1.06- 1.53), and skin-to-skin contact increased breastfeeding duration (seven trials; 324 participants) (mean difference 42.55 days; 95% CI, -1.69 to 86.79) but the results did not reach statistical significance (P = 0.06) (Moore et al., 2012). The findings from another review study to clarify the role of breastfeeding in the mother-infant relationship concluded that the few empirical studies investigating this association have not found convincing support for a relation between breastfeeding and the quality of the mother-infant relationship, although theoretical models show that endocrine and sensory factors involved in breastfeeding may enhance the maternal bond (Jansen et al., 2008). A prospective cohort study of 21,842 mothers in San Bernardino and Riverside counties, California, showed that, compared with mothers with no early skin-to-skin contact, 'exclusive breastfeeding' was higher in mothers who experienced skin-to-skin contact for one to fifteen minutes (OR=1.4; 95% CI, 1.19-1.59), 16 to 30 minutes (OR=1.7; 95% CI, 1.47-1.88), 31 to 59 minutes (OR=2.4; 95% CI, 2.07-2.70), and more than one hour (OR=3.15; 95% CI, 2.91-3.41) (Bramson et al., 2010). The results demonstrate a dose-response relationship between early skin-to-skin contact and breastfeeding exclusivity (Bramson et al., 2010).

2.2.3.6 Birth controlling effect

Breastfeeding is associated with suppression of ovarian activity, with variable degrees of amenorrhea and infertility. In 1988, the contraceptive effect of breastfeeding was formalized into the lactational amenorrhea method of contraception (Shaaban, 2010). Literature shows that, although lactational amenorrhea is associated with infertility during the first six postpartum months provided the mother is exclusively or almost 'exclusively breastfeeding', breastfeeding will not always provide effective contraception and women should not be discouraged to start long-term effective contraception as soon as they wish (Shaaban, 2010).

2.2.3.7 Prevention of maternal infections

Recent studies also have shown that breastfeeding protects against maternal infections. A cross-sectional study of 1,871 women who gave birth at a regional hospital in Denmark indicated that infection was associated with higher rates of discontinuation of breastfeeding (Ahnfeldt-Mollerup et al., 2012). The results showed that, within four weeks after delivery, 24% of all women had experienced one or more self-reported episodes of infection including breast infection (12%), wound (3%), airway (3%), vaginal (3%) and urinary tract (3%) infections, endometritis (2%) and other infections (2%) (Ahnfeldt-Mollerup et al., 2012). Analysis showed that a significantly larger proportion of women with a postpartum infection stopped breastfeeding (21%) within the first four weeks after delivery compared with women without infection (12%) (Ahnfeldt-Mollerup et al., 2012)

2.2.4 Economic benefits

A study conducted in the US, to explore the economic assessment projection of the costs in a tertiary hospital, indicated that added costs to become a baby-friendly hospital would be approximately USD$148 per birth, but these costs would sharply decrease over time as breastfeeding rates increased in a baby-friendly environment

(DelliFraine et al., 2013). Breastfeeding also offers economic benefits to the family and society (Binns et al., 2013). A framework was developed, using Louisiana as a case study, for estimating the potential cost savings to individual states if families were able to meet current recommendations for breastfeeding (Ma et al., 2013). Using cost-analysis methods, cost savings, as well as case and death reductions in infant illnesses and deaths due to four selected infant diseases (respiratory tract infections, gastroenteritis, necrotizing enterocolitis and Sudden Infant Death Syndrome), were calculated utilizing the most recent data for breastfeeding and low/very low birth weight rates in Louisiana (Ma et al., 2013). The estimates showed that a total of $216,103,368 could be saved and 18 infant deaths by these four conditions prevented if 90% of newborns in Louisiana were exclusively breastfed for the first six months of life ($186,371,125 in savings and 16 infant deaths prevented with 80% compliance) (Ma et al., 2013).

2.2.5 Measurement of breastfeeding knowledge, attitudes and practices

There are several tools which measure breastfeeding knowledge, attitudes and practices. The most common ones are the IOWA infant feeding attitudinal scale and the breastfeeding and demographic questionnaire. Such questionnaires previously have been used in the Perth Infant Feeding Study (PIFS) and in many other countries, including China, Vietnam, Kenya and the Maldives (Scott and Binns, 1999, Scott et al., 2001, Lakati et al., 2002, Duong et al., 2004b, Abdulraheem and Binns, 2007, Xu et al., 2007). The Iowa Infant Feeding Attitudinal Scale (IIFAS) (De la Mora and Russell, 1999) is used to assess the knowledge and attitude of a mother towards infant feeding. "Negative attitude towards breastfeeding" is scored 17 to 48, "neutral" - 49 to 69, "positive attitude towards breastfeeding" - 70 to 85 (De la Mora and Russell, 1999). Demographic and breastfeeding information include the mother's breastfeeding practice knowledge, attitude, breastfeeding duration, time breastfeeding was initiated and factors associated with breastfeeding including prelacteal feeding.

Breastfeeding definitions in these studies were consistent with the World Health Organisation (Daelmans et al., 2009).

- Prelacteal feeds: any liquid or solid received before breastmilk, from the mother, a wet nurse or expressed breastmilk, with the exceptions of drops or syrups consisting of vitamins, mineral supplements and medicines.

- Exclusive breastfeeding: the infant has received only breastmilk, from its mother, a wet nurse or expressed breastmilk, and no other liquids or solids, with the exceptions of drops or syrups consisting of vitamins, mineral supplements and medicines.

- Predominant breastfeeding: the infant's predominant nourishment has been breastmilk. However, the infant may also have received: water or water-based drinks (sweetened and flavoured water, teas, infusions, etc.); fruit juice or Oral Rehydration Salts (ORS) solution; drops and syrup forms of vitamins, minerals and medicines; or ritual fluids (in limited quantities). With the exception of fruit juice and sugar-water, no food-based fluid is allowed under this definition.

- Full breastfeeding: 'Exclusive breastfeeding' and 'predominant breastfeeding' together.

- 'Any breastfeeding': the child has received some breastmilk (direct from breast or expressed). The infant may have received other solids or liquids.

2.2.6 Factors associated with infant feeding practices

Factors which affect breastfeeding patterns and duration include demographic factors (maternal age, education, socioeconomic status, employment or early return to work), biomedical factors (maternal smoking, delivery method, prelacteal feeds/supplementary feeding, breastfeeding problem, maternal obesity), health service-related factors (breastfeeding education, professional support), and psychological and cultural factors (support from family, friends and society; maternal confidence; traditional perception and culture; infant formula advertising) (McCarter-Spaulding and Horowitz, 2007, Thome et al., 2006, Clifford et al., 2006, Binns and Scott, 2002).

2.2.6.1 Demographic Factors

2.2.5.1.1 Age, education and socioeconomic status

Maternal age is determined to be positively associated with breastfeeding initiation and duration in western countries (Scott et al., 2001, Meedya et al., 2010, Dubois and Girard, 2003, Blyth et al., 2004). Data from the Year 2000 Korea National Fertility study, consisting of 1,066 mothers aged 35 years or older, showed a longer breastfeeding duration than the younger age groups, whereas the maternal age was not a significant factor in affecting whether or not a mother would breastfeed (Hwang et al., 2006). The Perth Infant Feeding Study (PIFS II), a prospective cohort study of 587 women, indicated that women who were younger had a higher risk of discontinuing 'any breastfeeding' before 12 months (HR1.55; 95% CI, 1.21-1.98) compared with women aged 30 years or older (Scott et al., 2006). Findings from another Australian cohort study of 764 mothers showed that there was a significant positive association with older maternal age and 'any breastfeeding' at six months (adjusted OR per five year increase in age=1.58; 95% CI,1.35-1.86) (Forster et al., 2006). Many other studies have shown there are a number of demographic factors that are significant for infant-feeding. A Pennsylvania population-based cohort of late preterm mother-infant dyads for the year 2009 (n = 7,012) suggested that being married (OR=0.33; 95% CI, 0.30–0.37), older age (OR=0.06; 95% CI, 0.04–0.10), and having a high school diploma (OR=0.72 ; 95% CI, 0.62–0.83), were inversely associated with 'breastfeeding non-initiation' and that 'race/ethnicity, being black' (OR=1.51; 95% CI, 1.33–1.70), multiparity (OR=1.59 ; 95% CI, 1.44–1.76), receiving 'Women, Infants and Children Program benefits'(OR=2.15; 95% CI, 1.95–2.37), and smoking (adjusted OR=3.10 ; 95% CI, 2.75–3.48) were positively associated with 'breastfeeding non-initiation' (Demirci et al., 2013). A prospective cohort study of 681 mothers in London found that maternal age was strongly associated with 'area-based breastfeeding', with a 4-6% increase in odds of breastfeeding associated with a unit increase in the percentage of older mothers (Oakley et al., 2013). The same study showed that, outside London, 'a black and minority ethnic background', compared with those from a 'white British background', was associated with higher breastfeeding (1-3% increase in odds per unit increase in the proportion from a black minority background) (Oakley et al., 2013). Similarly, a prospective cohort study of 3,561 mothers and infants which was embedded in The Generation R Study, in

Rotterdam, the Netherlands, showed that maternal age (adjusted OR=0.98; 95% CI, 0.96-1.00), no infant family history of asthma or atopy (adjusted OR=0.80; 95% CI, 0.69-0.93) and no infant history of allergy to cow's milk (adjusted OR=0.63; 95% CI, 0.46-0.85), were negatively associated with early introduction of food, and that multiple parity (adjusted OR=1.23; 95% CI, 1.05-1.43), was positively associated with early introduction of complementary food (Tromp et al., 2013). A stratified two-stage cluster sample of 3,112 children aged from birth to 23 months, in Tanzania, revealed that the risk of delayed initiation of breastfeeding within one hour after birth was significantly higher among 'young mothers aged less than 24 years', 'uneducated' and 'employed mothers from rural areas who delivered by caesarean section', and 'those who delivered at home and were assisted by traditional birth attendants or relatives' (Victor et al., 2013). In the same study, the risk factors associated with 'non-exclusive breastfeeding' during the first six months were 'lack of professional assistance at birth' and 'residence in urban areas' (Victor et al., 2013). The results from a longitudinal study of 562 mother-infant pairs in Turin indicated that the main factors that had a negative impact on the 'duration of breastfeeding' included 'negative maternal infant-feeding attitude' (OR=2.9; 95% CI, 1.7-5.2), and 'early pacifier introduction'(OR=2.4, 95% CI, 1.3-4.3) at one month (Bertino et al., 2012). A longitudinal study of 201 first-time mothers in Australia who participated in the Healthy Beginnings Trial, as a control group, indicated that mothers who knew the recommendation for breastfeeding were 26% more likely to initiate breastfeeding (adjusted RR=1.26; 95% CI, 1.14 - 1.37) and 34% less likely to have stopped breastfeeding at 12 months (adjusted HR 0.66; 95% CI, 0.46 -0.95) than those who did not (Wen et al., 2012). Having an intention to meet the recommendation was weakly positively associated with the 'initiation of breastfeeding' only (Adjusted Risk Ratio (ARR)=1.09; 95% CI, 1.03 - 1.20) (Wen et al., 2012). A cross-sectional household study of 805 child-mother pairs in Andhra Pradesh, India, showed that 'timely initiation of breastfeeding' and 'exclusive breastfeeding' for six months was significantly less likely among mothers belonging to scheduled castes and scheduled tribes (OR=0.27; 95% CI, 0.10-0.76 and OR=0.24; 95% CI, 0.08-0.76, respectively) (Meshram et al., 2012). Also, timely initiation of 'complementary feeding' was less likely among 'non-scheduled castes' and 'scheduled tribe communities' (OR=0.24; 95% CI, 0.11-0.54) (Meshram et al., 2012). The Sri Lanka Demographic and Health Survey (SLDHS) (n = 2735) showed that 'delayed initiation of breastfeeding' is less likely in mothers from the estate sector (OR=0.61; 95% CI, 0.39-0.95) or richer wealth quintile (OR=0.60; 95% CI, 0.39-0.90) (Senarath et al., 2012). The same study also showed that 'non-exclusive breastfeeding' was associated with children from urban areas (OR=1.72; 95% CI, 1.02-2.89), or the estate sector (OR=4.48; 95% CI, 2.24-8.99); and a child was at risk for not currently breastfeeding if born in a private hospital (OR=3.73; 95% CI, 1.95-7.13), delivered by caesarean section (OR=1.46; 95% CI, 1.03-2.08), living in urban areas (OR=2.80; 95% CI, 1.90-4.12) or the estate sector (OR=3.23; 95% CI, 3.51 37.12), or estates (OR=11.4; 95% CI, 3.51-7.12) and not receiving postnatal home visits (OR=2.62; 95% CI, 1.21 5.65), and they were more likely to discontinue breastfeeding by one year of age (Senarath et al., 2012).

2.2.6.1.2 Employment

A cross-sectional study of 1,178 infants and young children aged 6-24 months who were selected by stratified cluster random sampling in Chengdu, China, showed that the provision of maternity leave was positively correlated with breastfeeding duration (Huang et al., 2012). The results from a longitudinal study in Beirut, nested within a randomized controlled trial (RCT), showed that non-working mothers were more likely to breastfeed (OR=3.92; 95% CI, 1.93-7.94) compared with working mothers (Hamade et al., 2013). An intervention study of 200 formal women workers who returned to work before the child had reached six months of life, in the city of Piracicaba (Southeastern Brazil), showed that mothers who did not have a 30-minute break during their working hours had higher odds ratio of stopping breastfeeding (OR=4.10; 95% CI, 1.81-9.26) (Brasileiro et al., 2012). A cross-sectional study in the city of Porto Alegre, with a sample of 1,099 infants under one year of age, indicated that the prevalence of exclusive breastfeeding was higher in children whose mothers were on maternity leave (OR=3.81; 95% CI, 2.0-7.27) or not employed (OR=2.05; 95% CI, 1.2-3.48) (Campagnolo et al., 2012). Similarly, the results from a national cross-sectional study conducted in Canada, consisting of 5,615 women whose infants were aged six months or more, indicated that women who were unemployed were more likely to 'exclusively breastfeed' their infants for six months compared with women who were employed (adjusted OR=1.55, 95% CI, 1.12-2.03) (Al-Sahab et al., 2010). The United Kingdom Millennium Cohort Study, which consisted of 6,917 mothers, reported that there was a positive association between continued breastfeeding for at least four months and longer durations (more than 6 months) of leave from work (adjusted OR=1.25; 95% CI, 1.07-1.47) (Hawkins et al., 2007).

2.2.6.2 Biomedical factors

2.2.5.2.1 Smoking

Many studies have indicated that smoking is associated with lower rates of breastfeeding initiation and duration. A study which examined feeding practices and factors associated with breastfeeding initiation in 281 women with severe pre-eclampsia and their 200 late-preterm and 81full-term infants indicated that breastfeeding initiation is less likely in smoking mothers (OR=0.19; 95% CI, 0.09-0.40) (Cordero et al., 2012). The results from a cohort study of 6,747 Chinese infants in Hong Kong showed that women who ever-smoked were more positively associated with non-initiation of breastfeeding than ‘non-smoking’ women (adjusted OR=2.51; 95%CI, 1.63-3.86) and that women who smoked during pregnancy had a positive association with breastfeeding discontinuation before four months (adjusted OR=3.02; 95%CI, 1.17-7.80) (Leung et al., 2002). A cohort study which included 1,256 mothers and their partners in north-western China showed that the paternal smoking rate was 64.8% and maternal smoking rate was 1.7%, and that paternal smoking was associated with early cessation of ‘any breastfeeding’ (HR=1.84; 95% CI, 1.11-3.04) and ‘exclusive breastfeeding’ (HR=1.33; 95% CI, 1.09-1.64) (Xu et al., 2010). The results from a longitudinal cohort study of 587 mothers which was conducted in Perth indicated that ‘women who smoked during pregnancy’ breastfed their infants for shorter durations compared with non-smoking women (adjusted HR=1.6; 95% CI, 1.2-2.1) (Giglia et al., 2006). In a prospective mother-child cohort study of 1,181 conducted in Crete, Greece, among women breastfeeding who were ex-smokers or smokers during pregnancy, a statistically significant shorter duration of breastfeeding (OR=-1.82; 95% CI, -2.49 to -1.16) was found (Vassilaki et al., 2012).

2.2.6.2.2 Delivery method and prelacteal feeds/supplemental feeding

In many countries, the first food an infant receives is not breastmilk. This is due to the late initiation of breastfeeding or introduction of prelacteal feeds based on religious, cultural and medical factors (Qiu et al., 2007, Sallam et al., 2013, Zanardo et al., 2013). The introduction of prelacteal feeds has been shown in some studies to reduce the duration of breastfeeding (Declercq et al., 2009). The United Nations

International Children's Emergency Fund (UNICEF) has initiated a program to promote colostrums-feeding and maternal-infant contact soon after birth given the adverse consequences of prelacteal feeding and such practices (UNICEF, 2011).

A prospective cohort study of 695 mothers and infants which was undertaken in 2010 and 2011 in Jiangyou, China, two years after the earthquake, found that giving birth at a health centre was associated with delayed breastfeeding initiation (OR=0.11; 95% CI, 0.04-0.32), whereas attending antenatal classes (OR=2.57; 95% CI, 1.36 4.87) and receiving encouragement from hospital staff to initiate breastfeeding (OR=5.60; 95% CI, 2.31-13.55) were correlated with putting the baby to the breast soon after delivery (Tang et al., 2013). In many Muslim communities, a sweet food (Tahneek) is given to infants soon after birth as a ritual feed (Shaikh and Ahmed, 2006). A sample of 373 women, recruited soon after giving birth in hospitals in Kuwait, found that 76.4% of their babies received infant formula and 4.6% received glucose water as prelacteal feeds. Even though prelacteal feeds were given to the majority of infants, 92.5% of the mothers were able to initiate breastfeeding (Dashti et al., 2010). The practice of giving prelacteal feeds is also common in Asian countries. A community-based study of prelacteal feeds among the Hindu and Muslim infants in rural Nepal showed that 39% of the mothers introduced prelacteal feeds and the most common prelacteal foods were sugar water, sugarcane juice or honey (Khanal and Sauer, 2013). Birth preparedness and the time of initiation of breastfeeding were associated with the introduction of prelacteal feeds in this study (Khanal and Sauer, 2013). A review of prelacteal feeds in China found that the practice was common, with the highest reported rate in the Shandong Province in Eastern China, where 72% of the infants received prelacteal feeds before breastfeeding was initiated, and five out of the seven studies found that prelacteal feeding was associated with reduced breastfeeding duration(Tang et al., 2012). A study of prelacateal feeds in Hangzhou, China, found that, upon hospital discharge, mothers who gave prelacteal feeds were less likely to ‘any breastfeed’ their infants (OR=0.12; 95% CI, 0.06-0.24) (Qiu et al., 2007).

Having a birth by caesarean section also is associated with infants being given prelacteal feeds. A cohort study of 9,446 mother-infant pairs across four Italian hospitals (Padua, Brescia, L’Aquila and Udine) showed that the mothers who had caesarean sections were significantly more likely than the mothers who had vaginal delivery to give infant formula as a first feed and to continue doing so upon hospital discharge (adjusted OR=3.74; 95% CI, 3.03-4.60) (Zanardo et al., 2013). A study in Minia University Hospital, Egypt, showed that the infants of 83.3% of women who delivered by caesarean section and 40% of women who delivered by spontaneous vaginal delivery were given prelacteal feeds (Sallam et al., 2013).

A prospective cohort study involving 463 mothers in Vietnam has shown that maternal grandmother's preference for breastfeeding was associated with exclusive breastfeeding (not giving any prelacteal feeds) on hospital discharge (adjusted OR=3.52; 95% CI, 1.21-10.28) (Duong et al., 2004a).

Studies also have shown that birth complications and late initiation of breastfeeding were associated with early introduction of complementary food and shorter duration of breastfeeding. An exploratory cross-sectional survey of 284 mothers attending community groups in Swansea, Wales, found that all the mothers initiated breastfeeding but introduced complementary feeds and discontinued breastfeeding before six months postpartum (Brown and Jordan, 2013). The reasons given in this study for discontinuing breastfeeding were pain and difficulty in breastfeeding due to complications including caesarean deliveries [$F(1,255) = 19{\cdot}17$, $P < 0{\cdot}01$, $d = 0{\cdot}9$], foetal distress [$F(1,255) = 11{\cdot}373$, $d = 0{\cdot}9$)], failure to progress [$F(1, 255) = 4{\cdot}616$, $d = 0{\cdot}6$], and postpartum haemorrhage [$F(1,255) = 4{\cdot}239$, $d = 0{\cdot}7$]) (Brown and Jordan, 2013). Data from the Pregnancy Risk Assessment and Monitoring System (PRAMS) in 11 states and New York City showed that breastfeeding initiated within the first hour after birth (adjusted OR=1.29; 95% CI, 1.16-1.45) was positively associated with breastfeeding duration (Ahluwalia et al., 2012). A quantitative sequential mixed-methods design, including 2,560 women aged 16 years or older, showed that an unexpected delivery method (i.e., unplanned caesarean or instrument-assisted vaginal delivery) was associated with an increased likelihood of initiating breastfeeding (OR=1.48; 95% CI, 1.10-1.99) when compared with planned caesarean deliveries (Watt et al., 2012).

2.2.6.2.3 Breastfeeding problems

One of the main reasons mothers stop breastfeeding is due to breastfeeding problems such nipple problems, mastitis, maternal and infant illness or lower milk production. A case-control study of mothers with persistent nipple pain (n = 21) compared them with those mothers without nipple pain (n = 21) (McClellan et al., 2012). The results showed that lower milk productions were associated with longer feed durations for mothers with pain. The same study showed that, although there were no significant differences in the average 24-hour milk production or any feeding characteristics between the groups, four women with persistent nipple pain had milk production levels below 500 mL/day (McClellan et al., 2012). A convenient sample of 593 mothers in United Arab Emirates, who had infants up to two years of age, indicated that the most common reasons perceived by mothers for terminating breastfeeding were: new pregnancy (32.5%), insufficient milk supply (24.4%) and infant weaning (24.4%) (Radwan, 2013). The same study showed that a mother's feeding on demand (OR=2.92; 95% CI, 1.39-6.14) and feeding more frequently at night (OR=3.37; 95% CI, 1.27-8.96) were significant factors associated with practices of exclusively or predominantly breastfeeding before six months (Radwan, 2013). A cohort study of 1,177 mothers in the US aged 18 years or more, who responded to monthly surveys from pregnancy until their child was one year, found that the major reasons why mothers stop breastfeeding before they desire include concerns about maternal or child health (infant nutrition, maternal illness or the need for medicine, and infant illness) and the difficult process associated with breastfeeding (lactation and milk-pumping problems) (Odom et al., 2013). The results from a prospective study of 946 women conducted in the United States indicated that mastitis was associated with cessation of breastfeeding in the first weeks after birth (HR=5.7; 95%CI, 1.3-25.9) and was the second most common reason for discontinuing breastfeeding (Schwartz et al., 2002).

2.2.6.2.4 Maternal obesity

Several studies have shown that maternal obesity increases the risk of late initiation and early cessation of breastfeeding. Findings from a randomized trial of 1,597 Danish mothers of singleton infants indicated that mothers with 'high post-partum body mass index (BMI)' compared with mothers with 'normal body mass index' had a significantly higher rate of cessation of 'exclusive breastfeeding' before six months (Kronborg et al., 2013). The study showed that, after adjustment analysis, (n = 1226) among primiparae, high BMI was associated with nearly double the risk of early cessation of 'exclusive breastfeeding' (HR = 1.74; 95% CI, 1.21-2.50) (Kronborg et al., 2013). In the Pregnancy, Infection and Nutrition Postpartum Study (mothers=550) in the United States, being overweight or obese before pregnancy (35.7% of 550) was inversely associated with the durations of any and exclusive breastfeeding (Mehta et al., 2012b). After adjustments for confounding factors, women who entered pregnancy overweight or obese were more likely to not initiate breastfeeding (relative risk ratio (RRR)=5.39; 95% CI, 2.41-12.04) and to breastfeed for less than four months (RRR=2.38; 95% CI, 1.33-4.27) compared with women of normal weight status (Mehta et al., 2012b). The results from a study of 22,131 mothers conducted in Ontario, Canada, indicated that mothers being overweight (BMI of 25.0-29.9) and obese (BMI of 30 or more) were negatively associated with 'exclusively breastfeeding' in hospital (adjusted OR=0.67; 95% CI, 0.60-0.75) and upon discharge (adjusted OR=0.68; 95% CI, 0.61-0.76) compared with non-overweight mothers (Visram et al., 2012). A prospective cohort study of 688 women in North Carolina, USA, indicated that women who began pregnancy overweight or obese (BMI more than 26 kg/m^2) had almost four times the risk of not initiating breastfeeding compared with underweight or normal weight women (BMI 26 kg/m^2 or less) (RR=3.94; 95% CI, 2.17-7.18) after adjusting for race, poverty level, education level and marital status (Mehta et al., 2011).

2.2.6.3 Health service related factors

2.2.5.3.1 Breastfeeding education and professional support

Several studies have reported that attendance at antenatal breastfeeding education programs is associated with increased initiation and duration of breastfeeding. A meta-analysis of five studies (n=582) on sample populations with low incomes in the USA showed that breastfeeding education had a significantly positive effect on increasing initiation rates when compared with standard care (RR=1.57; 95% CI, 1.15-2.15) (Dyson et al., 2005). A cross-sectional survey of 80 physician mothers in the University of Florida College of Medicine has shown that physician mothers who reported actively promoting breastfeeding among their female patients and house staff had significantly longer personal breastfeeding duration when compared with physician mothers who denied actively promoting breastfeeding (Sattari et al., 2013). An intervention study of 206 pregnant, overweight or obese, low-income women randomly assigned them to receive either intervention (including three prenatal visits, daily in-hospital support and up to 11 postpartum home visits promoting EBF) or standard care (controls) at a baby-friendly hospital (Chapman et al., 2013). The adjusted post-hoc analyses of this study indicated that, at two weeks postpartum, the intervention group had significantly greater odds of continuing any breastfeeding (adjusted OR=3.76; 95% CI, 1.07-13.22), and giving at least 50% of feedings as breastmilk (adjusted OR=4.47; 95% CI, 1.38-14.5), when compared with the mothers in the control group (Chapman et al., 2013). The findings from a mixed-method interview study of 908 callers of UK-based breastfeeding help-lines suggested that breastfeeding help-lines were beneficial in building confidence and making callers feel reassured and motivated to continue breastfeeding (Thomson et al., 2012). A cohort study of 4,725 participants in Los Angeles County, California, indicated ‘in-hospital initiation of breastfeeding and exclusive breastfeeding’ is significantly associated with breastfeeding outcomes, after controlling for known confounders (Langellier et al., 2012). The results showed that mothers who exclusively breastfed in the hospital were eight times more likely to reach the recommendation of breastfeeding for 12 months or longer than mothers who did not breastfeed in the hospital (Langellier et al., 2012). The Pregnancy Risk Assessment and Monitoring System (PRAMS) study also showed that receiving telephone support on breastfeeding was positively associated with breastfeeding duration (adjusted OR=1.20; 95% CI, 1.03-1.39) (Ahluwalia et al., 2012). The results from the prospective cohort study of 1,798 mothers in Alberta, Canada, reported that the odds of predominantly breastfeeding were two times greater if mothers' perceptions of talking about breastfeeding with a healthcare provider were positive, compared to negative (McNeil et al., 2013). A cross-sectional study of 2,669 women in Australia indicated that cessation of breastfeeding before ten weeks was associated with hospital midwives and child health nurses being unhelpful (adjusted OR=2.09; 95% CI, 1.31-3.36) and (adjusted OR=2.67; 95% CI, 1.94-3.66), respectively (Hauck et al., 2011b).

2.2.6.4 Psychological and cultural factors

2.2.5.4.1 Support from family, friends and society

Influences of family, friends and relatives are very important in determining breastfeeding practices. A prospective cohort study involving 463 mothers in Vietnam has shown that a maternal grandmother’s preference for breastfeeding is associated with exclusive breastfeeding upon hospital discharge (adjusted OR=3.52, 95% CI,1.21-10.28) (Duong et al., 2004a). A cohort study of 587 infants undertaken in Western Australia indicated that there was a positive association between at least one infant being breastfed and 'exclusive breastfeeding' rate at discharge (adjusted OR=1.87; 95% CI, 1.14-3.07) and that mothers with 'maternal grandmother preferred breastfeeding' were less likely to discontinue 'any breastfeeding' before 12 months (HR=0.71; 95% CI, 0.55-0.92) (Scott et al., 2006). A convenience sample of 108 pregnant women in Glasgow, Scotland, showed that paternal infant-feeding attitude was a significant predictor of the choice of feeding method (OR=1.16; 95% CI, 1.09-1.24) (Scott et al., 2004). Data from the Infant Feeding Practices Survey II (n = 2,586), a national longitudinal consumer-based study, found that there was a positive association between longer breastfeeding duration and receiving breastfeeding education from classes/support groups (OR=1.85; 95% CI, 1.24-2.76) and receiving breast pump education from friends/relatives (OR=1.70; 95% CI, 1.13-2.55) (Chen et al., 2012).

2.2.6.4.2 Maternal confidence

The Breastfeeding Self Efficacy Scale (BSES) is a tool used to determine a mother's view of her ability to breastfeed (Chambers et al., 2007, Dennis and Faux, 1999). Many studies have shown that higher breastfeeding self-efficacy scores are associated with longer duration of breastfeeding. A cross-sectional study of 89 mothers in Portugal showed that the 'breastfeeding self-efficacy scores' were higher in mothers who 'exclusively breastfed' (t (87) = 7.6) (Zubaran and Foresti, 2013). A cross-sectional study of 82 participants in Hong Kong also demonstrated that there was a positive association with breastfeeding self-efficacy and continued 'exclusive breastfeeding' at six weeks postpartum (adjusted OR=1.10; 95% CI, 1.06-1.15) (Ku and Chow, 2010). A Danish cohort study of 471 women found that those with low to medium breastfeeding self-efficacy scores were more likely to discontinue breastfeeding at any time before four months compared with women with high breastfeeding self-efficacy scores (HR=1.90; 95% CI, 1.33-2.73) (Kronborg and Vaeth, 2004).

2.2.6.4.3 Infant formula advertising

Research has shown that infant formula exposure is associated with early breastfeeding cessation. A cross-sectional study of 3,895 women conducted in the United States showed that mothers who received commercial hospital packs were more likely to discontinue 'exclusive breastfeeding' before 10 weeks (adjusted

OR=1.39; 95% CI, 1.05-1.84) (Rosenberg et al., 2008). The results of another study in the United States, consisting of 547 women, which investigated the relationship between ‘free commercial formula distribution’ and ‘breastfeeding initiation and duration’, indicated that women who received infant formula samples were more likely to discontinue breastfeeding at two weeks postpartum (adjusted OR=1.91; 95% CI, 1.02-3.55) (Howard et al., 2000). The cohort study of 4,725 participants in Los Angeles County showed that mothers who received a discharge pack were half as likely to ‘exclusively breastfeed’ up to six months than those who did not receive one (Langellier et al., 2012).

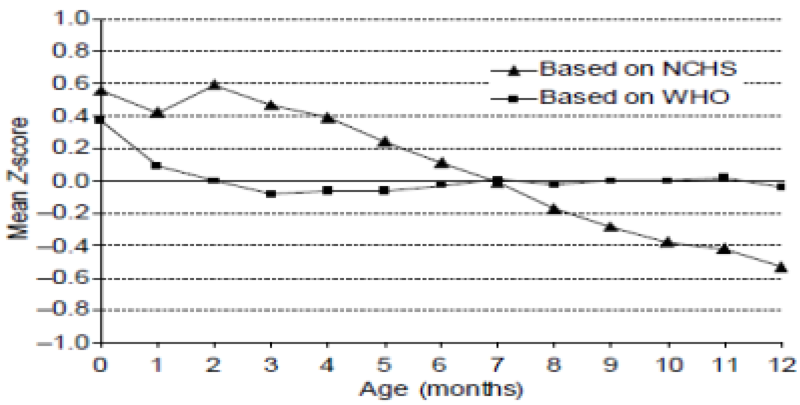
2.3 Infant Growth

2.3.1 WHO growth standards

The WHO Child Growth Standards were developed based on the data collected in the WHO Multicentre Growth Reference Study (MGRS) (World Health Organization and UNICEF, 2009). The published World Health Organisation new child growth standards for ‘attained weight and height’ to 2006 replace the previously recommended 1977 NCHS/WHO child growth reference (World Health Organization and UNICEF, 2009). According to the working group of the MGRS, they utilized four salient features in developing study protocols and the operational framework: a) consideration of infant feeding choices including breastfed infants, b) use of an international sampling frame, c) heavy reliance on current information technology, and d) a proposed link between anthropometric measurements and specific functional outcomes of predictive relevance to the well-being of children (Garza and de Onis, 2004). The study was carried out between 1997 and 2003 and collected primary growth data and relevant information from approximately 8,500 children of widely different ethnic backgrounds and cultural settings (Brazil, Ghana, India, Norway, Oman and the USA) (World Health Organization, 2013). The World Health Organisation states that new growth curves are believed to provide an international standard for the best representation of physiological growth for all children from birth to five years of age, and to ascertain that breastfed infants are the normative models for growth and development (World Health Organization, 2013). However some studies have shown contradicting results. A cohort study of 647 mothers and infants in Japan indicated that breastfed infants were significantly shorter and lighter almost throughout the first 24 months when compared with the national references and WHO growth standards for both length and body weight (Tanaka et al., 2013). The effect of ethnic differences on the growth of infants and young children in populations is small compared with the effects of the environment, using the new WHO growth standards (World Health Organization and UNICEF, 2009). The World Health Organisation argues that, although there can be some variations due to ethnic differences among groups, for practical purposes they are not considered large enough to invalidate the general use of the WHO growth standards as a standard for all populations (World Health Organization, 2013). Breastfed infants being classified as small have adverse consequences. Growth patterns of exclusively breastfed infants, when compared with the new WHO growth standards, have shown that they were classified as having poor growth, which leads to the introduction of additional feeds before six months (Binns and Lee, 2012). Literature also has indicated that WHO growth standards can be a bigger issue for Japanese and Eastern Asian groups who have migrated to Western countries (Agostoni, 2013). The results from the Millenium Cohort Study showed that infants from immigrant Asiatic parents seem more prone to develop overweight and obesity as they age (Rudolf, 2011).

Growth patterns and estimates of malnutrition based on the World Health Organization (WHO) Child Growth Standards ('the WHO standards') and the National Centre for Health Statistics (NCHS)/WHO international growth reference ('the NCHS reference') were compared using a secondary analysis of longitudinal data consisting of 4,787 infants from Bangladesh and 10, 381 infants from Dominican Republic and a pooled sample of infants from North America and Northern Europe (de Onis et al., 2006).

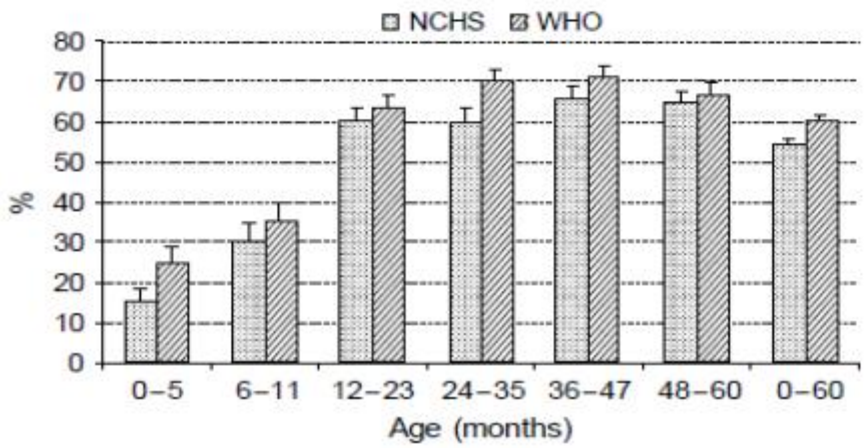
Figure 2.1Mean weight-for-age Z-score on NCHS and WHO growth references



Source: (de Onis et al., 2006)

Underweight rates increased during the first six months and, thereafter, decreased when based on the WHO standards. In the Bangladesh data set, the prevalence of underweight seems to be even higher in the first six months when WHO growth standards were used (de Onis et al., 2006)

Figure 2.2 Median length/height-for-age Z-score using NCHS and WHO growth references



Source: (de Onis et al., 2006)

The study also showed that, for all age groups, prevalence of stunting was higher and both wasting and severe wasting were substantially higher during the first half of infancy, according to the WHO 2006 standards. According to the author, use of the WHO standards (2006) is an improved tool to monitor the rapid and changing rate of growth in early infancy (de Onis et al., 2006). The WHO standards have been adopted by 125 countries (by April 2011) and another 25 were considering their adoption (de Onis et al., 2012). Thirty had not adopted them due to preference for local references (de Onis et al., 2012).

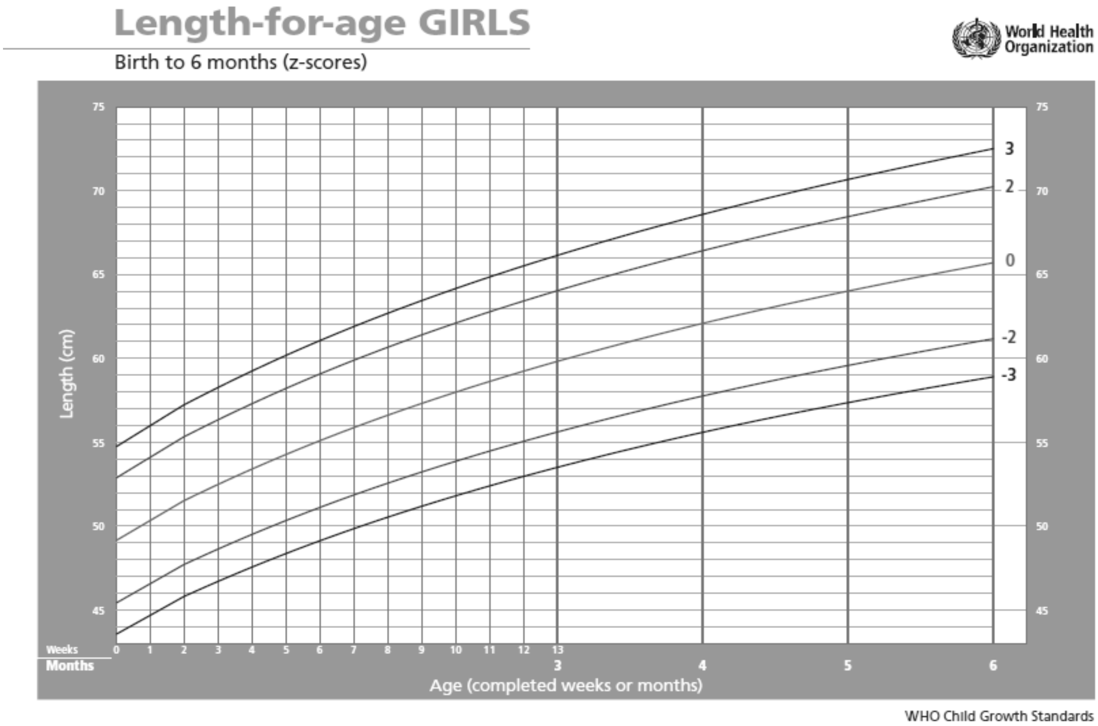
2.3.2 Measurement of infant growth

There are various indicators used for measuring infant growth. These include: length/height-for-age, weight-for-age, weight-for-length, weight-for-height, Body mass index-for-age (BMI-for-age), head circumference-for-age, arm circumference-for-age, subscapular skinfold-for-age, triceps skinfold-for-age, motor development milestones, weight velocity, length velocity and head circumference velocity (World Health Organization, 2013). The most widely used measurements around the world are length/height-for-age, and weight-for-age, along with the relevant standard charts.

2.3.3 World Health Organization growth charts (2006)

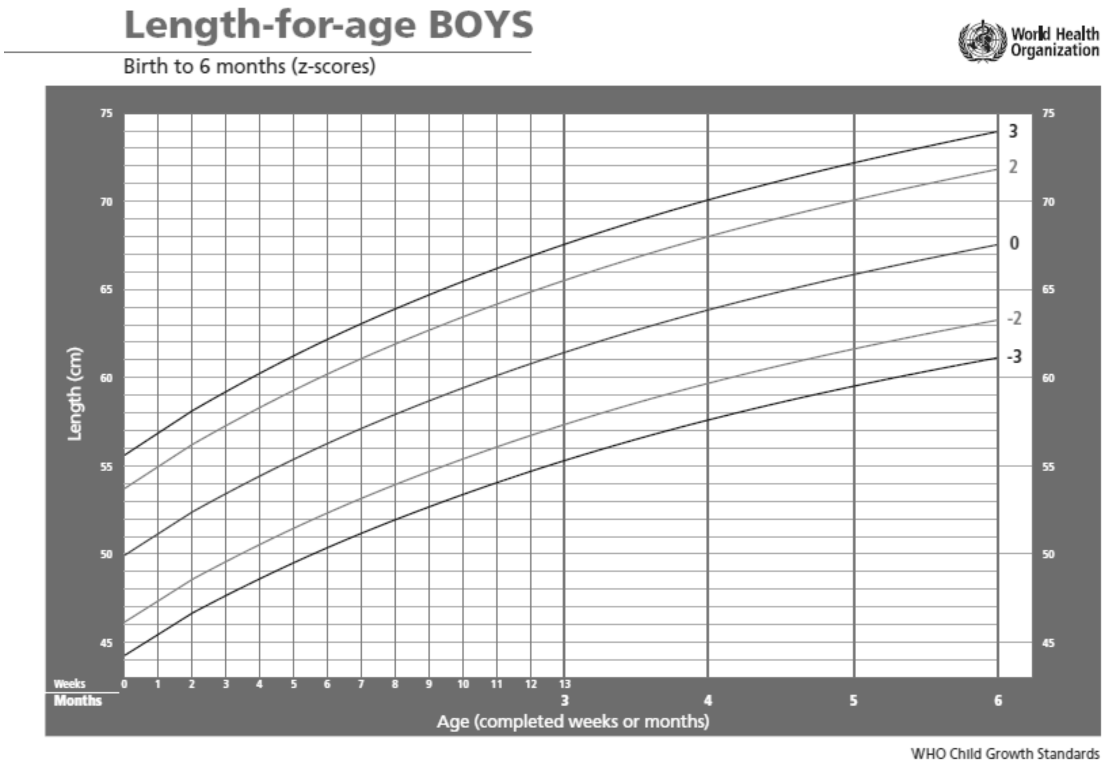
WHO length/height-for-age and weight-for-age reference charts (2006) are available as Z-scores and percentiles (World Health Organization, 2013).

Figure 2.3 Length-for-age for girls 0-6 months reference chart as Z-scores (WHO 2006)



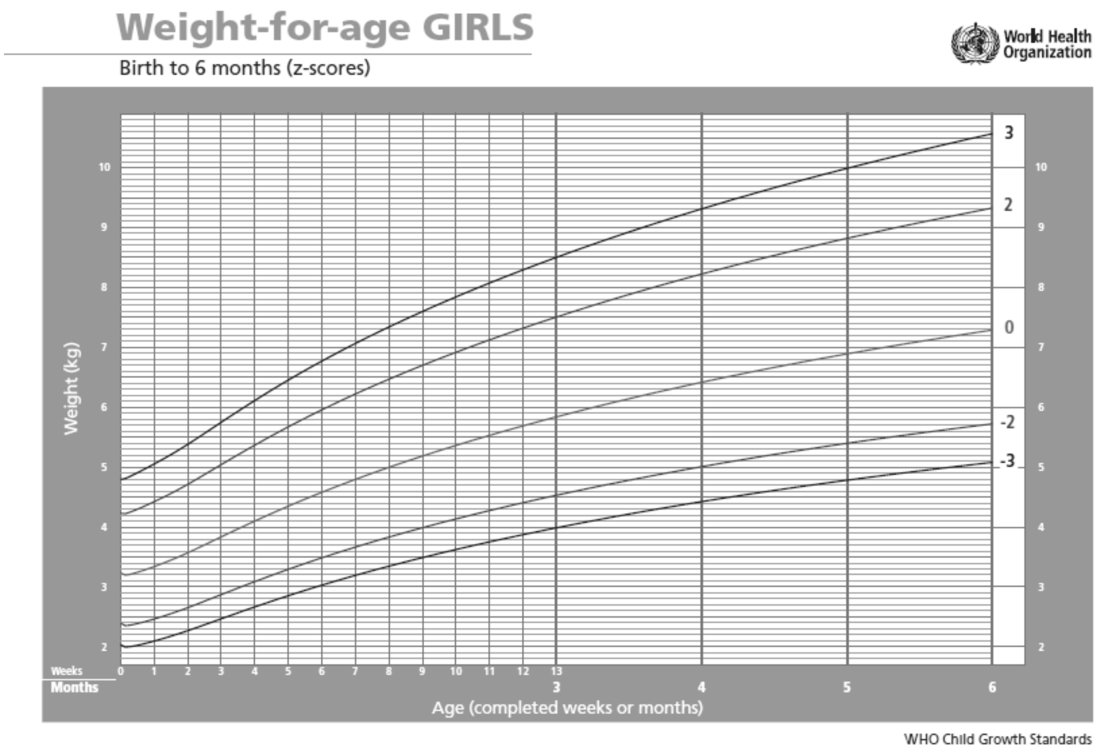
Source: (World Health Organization, 2013).

Figure 2.4 Length-for-age for boys 0-6 months reference chart as Z-scores (WHO 2006)



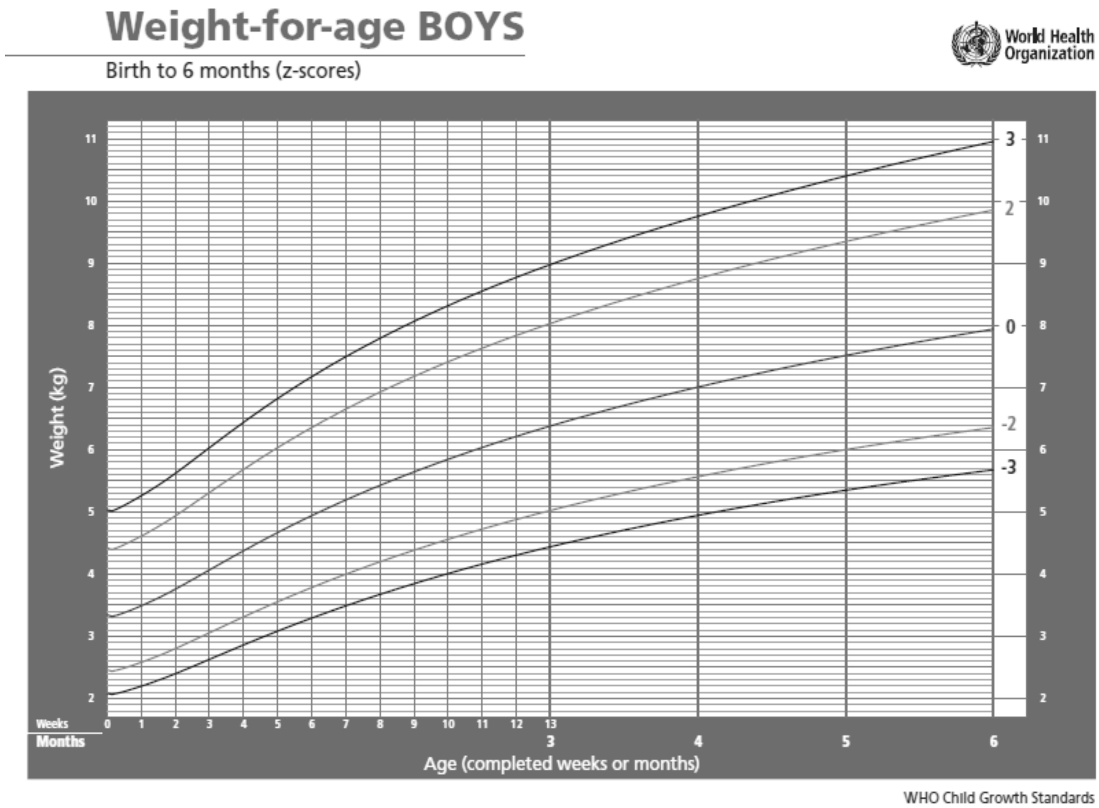
Source: (World Health Organization, 2013).

Figure 2.5 Weight-for-age for girls 0-6 months reference chart as Z-scores (WHO 2006)



Source: (World Health Organization, 2013)

Figure 2.6 Weight-for-age for boys 0-6 months reference chart as Z-scores (WHO 2006)



Source: (World Health Organization, 2013)

2.3.4 Prevalence of stunting, wasting and being overweight: secular trends

Table 2.10 UNICEF-WHO-WB estimated prevalence (%) of stunted preschool children 1990-2025 with 95% confidence intervals by UN regions and sub-regions

UN regions and subregions	1990	1995	2000	2005	2010	2011	2015	2020	2025
Africa	41.6 38.5-44.6	40.3 37.7-42.8	38.9 36.7-41.1	37.4 35.3-39.5	35.9 33.6-38.2	35.6 33.3-38.0	34.5 31.8-37.3	33.2 30.0-36.5	32 28.2-35.8
Eastern Africa	50.6 44.2-57.0	48.6 43.2-54.0	46.6 42.1-51.0	44.5 40.8-48.3	42.5 39.3-45.9	42.1 38.9-45.4	40.5 37.3-43.9	38.6 34.9-42.3	36.7 32.4-41.1
Middle Africa	47.2 36.4-58.2	44.2 36.8-51.8	41.2 36.6-46.0	38.4 34.5-42.3	35.6 30.1-41.4	35 29.1-41.4	32.8 25.1-41.6	30.2 20.5-42.1	27.8 16.5-42.8
Northern Africa	28.6 22.3-35.8	26.6 20.6-33.6	24.8 18.8-31.9	23 16.9-30.6	21.3 14.9-29.6	21 14.6-29.4	19.8 13.1-28.7	18.3 11.4-28.0	16.9 9.9-27.4
Southern Africa	36.2 32.9-39.7	34.9 31.0-39.1	33.6 29.1-38.4	32.3 27.3-37.8	31.1 25.6-37.1	30.8 25.2-37.0	29.8 23.9-36.5	28.6 22.3-35.9	27.5 20.8-35.3
Western Africa	39.1 35.4-42.9	38.4 35.3-41.6	37.1 34.7-40.9	37.8 33.5-40.8	36.5 32.1-41.1	36.4 31.7-41.2	35.8 30.4-41.6	35.2 28.8-42.2	34.6 27.1-42.9
Asia[1]	48.4 45.6-51.1	42.5 39.9-45.1	37 34.3-39.8	32.3 29.1-35.4	27.7 24.2-31.3	26.8 23.2-30.5	23.7 19.7-27.6	20.2 15.9-24.5	17.1 12.6-21.6
Eastern Asia	36.8 34.9-38.6	27.3 25.8-29.0	19.6 18.3-20.9	13.6 12.7-14.6	9.2 8.6-10.0	8.5 7.9-9.2	6.2 5.7-6.7	4.1 3.8-4.4	2.7 2.5-2.9
South-central Asia	59.3 54.4-64.0	53.9 49.2-58.5	48.3 43.4-53.3	42.8 37.3-48.5	37.5 31.3-44.1	36.4 30.1-43.2	32.4 25.7-39.9	27.8 20.8-36.1	23.5 16.5-32.4
South-eastern Asia	47.3 38.1-56.6	42.2 34.7-50.1	37.2 30.9-44.0	32.6 26.9-38.8	28.2 22.7-34.5	27.4 21.8-33.7	24.2 18.6-30.9	20.6 14.9-27.9	17.5 11.7-25.3
Western Asia	29.2 22.7-36.6	26.2 19.5-34.2	23.4 16.3-32.4	20.8 13.4-31.0	18.5 10.8-29.7	18 10.4-29.5	16.3 8.7-28.6	14.4 6.9-27.6	12.6 5.4-26.7
Latin America and Caribbean	24.6 19.3-29.9	21.5 16.5-26.5	18.5 13.7-23.3	16 11.4-20.6	13.8 9.4-18.2	13.4 9.0-17.7	11.8 7.6-16.0	10 6.0-14.0	8.5 4.8-12.2
Caribbean	16.5 9.4-27.2	13.4 7.3-23.4	10.9 5.7-19.9	8.7 4.3-16.8	7 3.3-14.2	6.7 3.1-13.7	5.6 2.5-11.9	4.4 1.9-9.9	3.5 1.5-8.3
Central America	34 23.9-45.8	29.8 20.4-41.4	25.9 17.2-37.1	22.4 14.5-33.0	19.2 12.1-29.2	18.6 11.6-28.5	16.4 10.0-25.7	13.9 8.3-22.5	11.8 6.8-19.5
South America	21.4 15.5-28.8	18.6 13.1-25.7	16.1 10.9-23.1	13.9 8.9-20.9	11.9 7.2-19.0	11.5 6.9-18.6	10.2 5.8-17.3	8.7 4.6-15.9	7.4 3.6-14.5
Oceania[2]	40.4 26.8-55.7	39.3 26.8-53.3	38.1 24.5-53.9	36.9 20.8-56.7	35.8 16.8-60.6	35.5 16.0-61.4	34.6 13.2-64.9	33.5 10.2-69.2	32.4 7.7-73.4
All developing countries	44.6 42.6-46.7	39.9 37.9-41.8	35.6 33.6-37.5	32 29.8-34.1	28.7 26.3-31.0	28 25.6-30.4	25.8 23.2-28.4	23.4 20.6-26.2	21.3 18.4-24.2
Developed countries	6.1 3.3-11.0	6.3 3.5-11.3	6.6 3.6-11.6	6.9 3.8-12.0	7.2 4.0-12.5	7.2 4.1-12.6	7.5 4.2-13.0	7.8 4.4-13.6	8.1 4.5-14.2
Global	39.9 38.1-41.8	36.1 34.3-37.9	32.5 30.7-34.3	29.3 27.3-31.2	26.3 24.1-28.4	25.7 23.5-27.9	23.8 21.4-26.1	21.7 19.2-24.2	19.9 17.2-22.5

[1]Excluding Japan [2]Excluding Australia and New Zealand

Note: These estimates were derived using the WHO and UNICEF Joint Global Nutrition Database, 2011 revision (completed July 2012), the United Nations, Department of Economic and Social Affairs, Population Division, 2011 (World Population Prospects: The 2010 Revision, CD-ROM Edition) and the method described in de Onis et al. 2004. These data supersede relevant historical analyses previously published by WHO and UNICEF

Source: World Health Organisation

Table 2.11UNICEF-WHO-WB estimated prevalence (%) of underweight preschool children 1990-2015 with 95% confidence intervals by UN regions and sub-regions

UN regions and sub-regions	1990	1995	2000	2005	2010	2015
Africa	22.7 20.0-25.4	21.5 19.2-23.8	20.3 18.3-22.4	19.1 17.1-21.1	17.9 15.9-19.9	16.8 14.7-19.0
Eastern Africa	27.2 22.1-32.9	25.1 20.8-30.1	23.2 19.3-27.6	21.4 17.7-25.5	19.6 16.1-23.8	18 14.4-22.4
Middle Africa	26.5 18.9-35.7	24.1 18.0-31.4	21.8 16.8-27.9	19.7 15.1-25.4	17.8 13.1-23.7	16 11.1-22.6
Northern Africa	11.3 6.8-18.2	9.9 5.6-16.8	8.7 4.7-15.6	7.6 3.8-14.6	6.7 3.1-13.6	5.8 2.6-12.7
Southern Africa	12.1 8.0-18.0	12.1 8.4-17.0	12 8.8-16.3	12 9.0-15.8	11.9 9.0-15.6	11.9 8.8-15.8
Western Africa	25.9 21.5-30.9	24.9 21.3-28.9	23.9 20.9-27.3	23 20.0-26.2	22 18.9-25.5	21.1 17.5-25.2
Asia[1]	32.9 29.2-36.7	29.4 25.5-33.3	25.9 21.8-30.1	23 18.5-27.4	20 15.2-24.7	17.2 12.3-22.2
Eastern Asia	15 13.9-16.2	10.5 9.7-11.4	7.3 6.7-7.9	5 4.6-5.4	3.4 3.1-3.7	2.3 2.1-2.5
South-central Asia	48.6 40.8-56.4	43.8 36.2-51.8	39.2 31.4-47.5 .8	34.7 26.8-43.7	30.6 22.4-40.1	26.7 18.5-36
South-eastern Asia	31.2 27.2-35.5	27.2 23.6-31.0	23.5 20.3-27.0	20.1 17.2-23.5	17.2 14.4-20.3	14.5 11.9-17.6
Western Asia	14.4 10.2-19.9	11.2 7.5-16.4	8.6 4.9-14.8	6.6 3.0-13.9	5.1 1.8-13.2	3.8 1.1-12.7
Latin America & Caribbean	7.7 5.5-9.9	6.4 4.5-8.2	5.2 3.6-6.8	4.3 2.9-5.6	3.5 2.4-4.7	2.9 1.9-3.9
Caribbean	8.5 4.9-14.3	6.9 3.8-12.3	5.6 2.9-10.5	4.6 2.3-9.0	3.7 1.7-7.7	3 1.3-6.6
Central America	11.1 6.7-17.9	8.7 5.2-14.2	6.8 4.0-11.4	5.3 3.1-9.1	4.2 2.3-7.3	3.2 1.7-5.9
South America	6.1 4.1-9.1	5.2 3.4-7.8	4.4 2.9-6.7	3.7 2.4-5.7	3.2 2.0-4.9	2.7 1.7-4.3
Oceania[2]	19.4 14.3-25.8	18 13.5-23.5	16.6 12.0-22.6	15.4 10.2-22.6	14.2 8.3-23.1	13.1 6.7-23.9
All developing countries	28.4 25.7-31.0	25.4 22.6-28.1	22.5 19.7-25.3	20.1 17.2-22.	17.8 9 14.8-20.8	15.8 12.7-18.9
Developed countries	1.5 0.9-2.8	1.7 1.0-2.8	1.9 1.2-3.0	2.1 1.4-3.1	2.3 1.6-3.4	2.6 1.8-3.7
Global	25.1 22.7-27.5	22.7 20.3-25.1	20.3 17.8-22.8	18.1 15.6-20.7	16.1 13.4-18.8	14.3 11.6-17.1

[1]Excluding Japan [2]Excluding Australia and New Zealand

Note: These estimates were derived using the WHO and UNICEF Joint Global Nutrition Database, 2011 revision (completed July 2012), the United Nations, Department of Economic and Social Affairs, Population Division, 2011 (World Population Prospects: The 2010 Revision, CD-ROM Edition) and the method described in de Onis et al. 2004. These data supersede relevant historical analyses previously published by WHO and UNICEF

Source: World Health Organisation

2.3.5 Factors associated with stunting, wasting and being overweight

A literature search using PubMed and Web of Knowledge indicated that risk factors associated with being stunted and underweight include age of children, birth interval, mothers' educational level, maternal nutrition, household wealth status, child feeding status, incidence of infectious diseases, maternal low body-mass-index, and low birth weight. The risk factors for children being overweight include maternal obesity, formula feeding, maternal smoking, birth weight and, in some studies, sex of the infant. Many studies indicated that prevalent cases of child obesity might be prevented by exclusive breastfeeding, smoking cessation during pregnancy, adequate sleep during childhood and avoiding high birth weight (Das and Rahman, 2011, Sanghvi et al., 2001, Weng et al., 2012, Shi et al., 2013).

The Bangladesh Demographic and Health Survey 2004, consisting of 6,005 children, showed that the significant risk factors for being undernourished were 'age of child', in comparison with 0-11 months [(12-23 months OR=6.97; 95% CI, 5.69-8.55)(24 months OR=5.381; 95% CI, 4.47-6.48)], 'birth interval', in comparison with age 48 months or more[(24-47 months OR=1.542; 95% CI, 1.33-1.79), (less than 24 months OR=67; 95% CI, 1.41-1.99)], mothers' education level, in comparison with higher education [(secondary education OR=2.286; 95% CI, 1.68-3.12), (primary education OR=2.17; 95% CI, 1.55-3.04), (no education OR=2.596; 95% CI,1.86-3.62)], maternal nutrition, compared with normal BMI of 18.5 or more (BMI< 18.5 OR=1.7; 95% CI, 1.57-2.04) 'household wealth status', compared with the richest (poorest OR=2.0; 95% CI, 1.58-2.57), 'child feeding index', compared with high feeding status (low feeding status OR=1.271; 95% CI, 1.04-1.55), and 'incidence of infectious disease', compared with no disease (incidence of fever OR=1.2; 95% CI, 1.08-1.42) (ARI OR=1.27; 95% CI, 1.08-1.50) and (diarrhoea OR=1.31; 95% CI, 1.04-1.65) (Das and Rahman, 2011). A case-control study which assessed the risk factors for underweight status in children under three years of age showed that current maternal weight (OR=8.25; 95% CI, 2.38-33.3), 'current maternal body-mass-index' (OR=4.55; 95% CI, 1.15-16.7), 'infant birth weight' (OR=4.87; 95% CI, 1.52-25) and 'excessive maternal vomiting in pregnancy' (OR=4.48; 95% CI, 1.1-18.25) were significant risk factors for 'current child underweight status' (Sanghvi et al., 2001). A household survey in Peru, consisting of 252 children less than 5 years of age, showed that the prevalence of wasting, underweight and stunting were 26.6%, 28.6% and 32.1 %, respectively, based on the new WHO Child Growth Standards (Casapia et al., 2007). Multivariate logistic regression showed that risk factors for wasting were ‘moderate-high intensity Trichuris infection’ (OR=2.50; 95% CI, 1.06-5.93), ‘hookworm infection’ (OR=6.67; 95% CI, 1.08-41.05), age (6-month OR=1.27; 95% CI, 1.11-1.46), maternal education (secondary incomplete OR=5.77; 95% CI, 2.38-13.99), and ‘decreasing maternal BMI’ (1 kg/m2 OR=1.12; 95% CI, 1.02-1.23) (Casapia et al., 2007). The study also showed that risk factors for underweight were ‘moderate-high intensity Trichuris infection’ (OR=4.74; 95% CI, 1.99,-11.32), ‘age of the child’ (6-month OR=1.22; 95% CI, 1.07-1.38) maternal education (secondary incomplete OR=2.92; 95% CI, 1.40-6.12) and ‘decreasing maternal BMI’ (1 kg/m2 OR=1.11; 95% CI, 1.02-1.21) (Casapia et al., 2007). Risk factors for stunting in this study were ‘age of the children’ (6-month OR=1.14; 95% CI, 1.02-1.27) and ‘short maternal height’ (1 cm OR=1.12; 95% CI, 1.06-1.20) (Casapia et al., 2007).

A review of thirty prospective studies suggested that childhood overweight was associated with ‘maternal pre-pregnancy overweight’, ‘high infant birth weight’ and ‘rapid weight gain during the first year of life’ (Weng et al., 2012). Meta-analysis comparing breastfed with non-breastfed infants found a 15% decrease (95% CI, 0.74-0.99; I-2 = 73.3%; n = 10) in the odds of childhood overweight. For children of mothers who smoked during pregnancy there was a 47% increase (95% CI, 1.26- .73; I-2 = 47.5%; n = 7) in the odds of childhood overweight (Weng et al., 2012). The review also showed that the earlier solid foods were introduced to the children the more likely they were to be overweight (Weng et al., 2012). However, there was conflicting evidence for ‘duration of breastfeeding’, ‘socioeconomic status at birth’, parity and ‘maternal marital status at birth’, and there were no associations with childhood-overweight for maternal age, ‘maternal education at birth’, maternal depression or infant ethnicity (Weng et al., 2012). The results from the review were inconclusive for delivery type, ‘gestational weight gain’, ‘maternal postpartum weight loss’ and 'fussy' infant temperament, due to the limited number of studies (Weng et al., 2012). Data for the Women and Children National Demography and Health Survey (PNDS 2006) in Brazil, consisting of 1,735 children aged 0-24 months, showed that factors associated with overweight were ‘birth weight of 3kg or more' (adjusted OR=5.2; 95% CI, 2.56-10.56), 'per capita income - one minimum wage or more' (adjusted OR=2.50; 95% CI, 1.20-5.21), and 'residence in Midwestern region' (adjusted OR=2.40; 95% CI, 1.01-5.72) (Cocetti et al., 2012). Analysis of data from a nationally representative sample of 968 term-born children aged six to eleven years, in the Canadian Health Measures Survey, showed that 21% were overweight and another 13% were obese (Shi et al., 2013). The risk factors which were positively associated with obesity were 'birth weight per 100 gram' (OR=1.05; 95% CI, 1.005-1.09), and 'maternal smoking during pregnancy' (OR=2.26; 95% CI, 1.23-4.15). The study also showed that 'exclusive breastfeeding' for six months (OR=0.44; 95% CI, 0.31-0.61), 'adequate sleep hours' (OR=0.39; 95% CI, 0.16-0.94) and 'being physically active' (OR=0.50; 95% CI, 0.26-0.93) were found to be protective factors (Shi et al., 2013). A longitudinal study of 374 children aged 12-24 months, in Texas, showed that healthy weight mothers were less likely to have 'overweight or obese children' than 'overweight or obese mothers' (OR=0.46; 95% CI, 0.27–0.78) (Barroso et al., 2012). The results from a community-based, prospective study of 930 healthy neonates (489 boys and 441 girls) in China, reported that 'high BMI status' at three months is significantly and inversely associated with breastfeeding, as a proportion of feeding occasions (OR=0.74; 95% CI, 0.56-0.98) and is positively associated with lower birth weight (OR=2.07; 95% CI, 1.23-3.49) (Zhang et al., 2012a). The study also indicated that 'high weight gain' (=85th percentile, re WHO velocity standards) in the first three months is significantly associated with breastfeeding (OR=0.76; 95% CI, 0.59-0.96) and 'sex of the child', with boys at a higher risk than girls (OR=1.44; 95% CI, 1.07-1.97) (Zhang et al., 2012a). A cross-sectional study of 963 children showed that overweight in children is directly associated with 'central obesity in the mother' (OR=1.46; 95% CI, 1.07-1.98) and duration of non-exclusive breastfeeding for a period of less than six months (OR=1.82; 95% CI, 1.31-2.51) (Moreira et al., 2012). A retrospective study of 204 healthy schoolchildren (aged six to nine years) showed that birth weight, (β = 0.278), 'mother's pre-pregnancy weight' (β = 0.234), and 'infant feeding choice' (formula feeding) (β = 0.297,) were significant factors associated with weight-Standard Deviation Scores at 18 and 36 months (Nagahara et al., 2013). Feeding-choice (formula-feeding) was the only factor associated with 'BMI-Standard Deviation Scores' at 18 months (β = 0.277) (Nagahara et al., 2013). A sample of 3,121 participants from German birth studies indicated that birth weight, 'standardized BMI at five years' (60-64 months) (OR=0.77; 95% CI, 0.73-0.81) and maternal smoking during pregnancy were positively associated with standardized BMI at 10 years of age (Pei et al., 2013).

A summary of the studies of factors associated with infant growth faltering is shown in Table 2.12.

Table 2.12 Factors associated with infant growth faltering

Findings	Study
Significant risk factors for being undernourished are 'age of child' (12-23 months), birth-interval ('24-47months' and 'less than 24 months') mothers' education level (secondary, primary or no education), maternal nutrition, 'household wealth status' (poor) 'child feeding index' and 'incidence of infectious disease' including fever, ARI and diarrhoea.	The Bangladesh Demographic and Health Survey 2004 consisting of 6,005 children (Das and Rahman, 2011) <5 years of age
The risk factors for children being overweight include maternal obesity, formula-feeding, maternal smoking, 'high infant birth weight' and 'rapid weight gain' during the first year of life and, in some studies, sex of the infant.	A review of thirty prospective studies (Weng et al., 2012)
Overweight incidence was 21% and another 13% of children were obese. The risk factors which were positively associated with obesity were 'birth weight per 100g' and maternal smoking during pregnancy. 'Exclusive breastfeeding' for six months, 'adequate sleep hours' and 'being physically active' were found to be protective factors.	Analysis of data from a nationally representative sample of 968 term-born children aged 6-11 years in the Canadian Health Measures Survey (Shi et al., 2013)
'Current maternal weight', 'current maternal body mass index', 'infant birth weight' and 'excessive maternal vomiting' in pregnancy were significant risk factors for current child-underweight status.	A case-control study of children under 3 years of age (Sanghvi et al., 2001)
Prevalence of wasting, underweight and stunting were 26.6%, 28.6% and 32.1%, respectively, based on the new WHO Child Growth Standards. Risk factors for wasting were: moderate-high intensity Trichuris infection, hookworm infection, age, maternal education (secondary incomplete) and decreasing maternal BMI.	A household survey in Peru consisting of 252 children <5 years old, (Casapia et al., 2007)
Factors associated with overweight were 'birth weight ≥3 kg', 'per capita income ≥ one minimum wage', and 'residence in Midwestern region' (of Brazil).	Data for the Women and Children National Demography and Health Survey 2006 in Brazil, consisting of 1,735 children aged 0-24 months (Cocetti et al., 2012)

Table 2.13 Factors associated with infant growth faltering (cont.)

Findings	Study
'Healthy weight mothers' were less likely to have overweight or obese children than overweight or obese mothers.	A longitudinal study of 374 children aged 12-24 months, in Texas (Barroso et al., 2012)
'High BMI status' at three months is significantly and inversely associated with 'breastfeeding, as a proportion of feeding occasions' and positively associated with 'lower birth weight'. 'High weight gain' (=85th percentile, re WHO velocity standards) in the first three months is significantly associated with breastfeeding and 'sex of the infant', with boys at a higher risk than girls.	The results from a community-based, prospective study of 930 healthy neonates (489 boys and 441 girls) in China, at three months (Zhang et al., 2012a)
Overweight in children is directly associated with 'central obesity' in the mother and duration of non-exclusive breastfeeding for a period of less than 6 months.	A cross-sectional study of 963 children (Moreira et al., 2012)
Birth weight, 'mother's pre-pregnancy weight', and 'infant feeding choice' (formula-feeding) were significant factors associated with weight-Standard Deviation Scores at 18 and 36 months. 'Feeding choice' (formula-feeding) was associated with BMI-Standard Deviation Scores at 18 months.	A retrospective study of 204 healthy schoolchildren (aged 6-9 years) (Nagahara et al., 2013)
'Birth weight', 'standardized BMI' at 5 years (60-64 months) and 'maternal smoking' during pregnancy were positively associated with standardized BMI at 10 years of age.	A sample of 3,121 participants in Germany at 5-10 years of age

The contributing factors for antenatal and postnatal depression include 'genetic and biological factors', 'maternal mental and physical health', 'poor interpersonal health' 'poor relationships with other family members/ in-laws', 'domestic violence', 'baby variables', 'demographic and 'socio-economic factors' unplanned pregnancy, primiparity, multiparity, 'lack of social support', 'low income', and polygamy. Factors which affect breastfeeding patterns and duration include demographic factors biomedical factors health service-related factors and psychological and cultural factors. Growth faltering is associated with 'age of children', birth-interval, 'mothers' educational level', maternal-nutrition, 'socioeconomic-status', 'child feeding status', 'incidence of infectious diseases', 'maternal low body-mass-index', and 'low birth weight' Infant being overweight is associated with maternal obesity, formula feeding, maternal smoking, birth weight and, sex of the infant. Antenatal depression and postnatal depression has shown to be associated with lower initiation and shorter duration of breastfeeding. Antenatal and postnatal depression is also associated with infant growth faltering although some studies showed no association. Since there has not been any study on antenatal and postnatal depression in the Maldives, the prevalence rate and the above factors identified by the literature which are associated with antenatal and postnatal depression will be evaluated. The factors associated with infant feeding and infant growth faltering will also be identified. Finally an assessment will be done on the association be done on the association of antenatal and postnatal depression with infant feeding and growth faltering.

Chapter 3 Methodology

This chapter discusses the study design, study setting, sample selection, sample size calculation, research tools, data analysis, ethical consideration and information on storage of data.

3.1 Study Design study setting and sample selection.

3.1.1 Study design

A prospective cohort design was used to follow up 458 mothers selected from the antenatal clinics of the Reproductive Health Centre in the Indira Gandhi Memorial Hospital (IGMH) and ADK Hospital in Malé. A prospective cohort study was used because the status of depression, infant feeding practices, and infant growth at the time of enrolment and how it varies during the study period can be more accurately established than if other designs are used. The exposure status also can be accurately assessed at the beginning of the study. Using a longitudinal design allows for the documentation of associations between depression, infant feeding problems and infant growth faltering. This design allows for time sequence between exposures (eg depression) and outcomes including feeding problems, growth faltering and postnatal depression.

3.1.2 Study setting

Malé is the capital city of the Republic of Maldives. There were 6,946 live births in the whole of the Maldives in 2008 and more than one third were in Malé in the two major hospitals, the Indira Gandhi Memorial Hospital (IGMH) and ADK Hospital. There were, on average, six live births per day in Malé and all the deliveries took place in these two hospitals. Pregnant mothers attend the hospitals for their antenatal examinations monthly until 35 weeks of gestation, and then weekly from 36 weeks gestation until delivery in these two hospitals.

3.1.3 Recruitment of the sample

3.1.3.1 Inclusion criteria

Mothers who are of reproductive age at their 36 weeks of pregnancy were included in this study.

3.1.3.2 Exclusion criteria

Mothers who were under 18 years of age or critically ill or who were unable to give informed consent. After birth the exclusion criteria were widened to include mothers and babies who were seriously ill, or where the infant died or spent more than seven days in neonatal intensive care.

For this study the mothers were contacted at their 36 week antenatal examinations at the antenatal clinics of the Indira Gandhi Memorial Hospital (IGMH) and ADK Hospital. Mothers were given the information sheet about the research. The mothers who wanted to participate in the research participated in a face-to-face interview based on EPDS, IOWA infant feeding attitudinal scale, demographic and breastfeeding survey at 36 weeks of pregnancy. The PhD student (Lecture in health promotion, research and nutrition with 9 years of experience) conducted all the interviews to minimise bias. The antenatal clinic at IGMH had set timings (9am to 12 pm) and sometimes from (2pm-3pm) for antenatal check-up. Every mother who attended the antenatal clinic at IGMH was invited to participate in the study. Any mother who was missed at ADK hospital during this time was called from ADK hospital and invited to participate. Interviews were also conducted at ADK from 8am to am and 12 pm to 2 pm. Due to the small population and low birth rate in Maldives, every mother was invited until the sample size was reached for this cohort study. On average 5 mothers were interviewed each day. The date of each interview was noted and a phone call was given after one month to confirm the birth date and exact day of one month follow-up.

After delivery, the mothers were followed up at one month, three months and six months, postnatal, when they attended for their child's immunisation at vaccination clinics at IGMH, ADK hospital and Malé Health Centre. Mothers attend ADK hospital and Malé Health Centre, for their infants' routine immunisations, at monthly intervals up to four months of age, and then at six months postpartum. The date of the next interview was noted on the questionnaire and on the computer. Mothers were sent a text message and the time of the postnatal check-up noted. As Malé Health Centre is next to ADK hospital, mothers were interviewed in a comfortable place at ADK hospital. Any mother who was not interviewed at the clinic due to PhD student recruiting mothers at IGMH was followed up by phone or by visiting them at home. Malé is only 5.8 km^2 and any home can be visited within 5 minutes. A convenient time was set up by calling the mother and the interview was carried out. Mothers who travelled to other islands and countries were followed up on phone. The variation in age of the infants of the mothers included at each time point was one to seven days.

3.1.4 Sample Size calculation

Sample size calculations were undertaken using Statcalc V6 from Epi Info 2000. Based on studies in similar cultures and in the Maldives, it was assumed that the incidence of postnatal depression would be 15% and the breastfeeding rate at six months would be 85%. With a probability of 95% and power of 80%, a sample of 366 mothers would allow the detection of a 15% difference in breastfeeding rates at six months. Allowing for a 20% dropout rate this means that a sample of 458 mothers was needed to be recruited. In the mothers without postnatal depression, assuming the breastfeeding rate at six months was 85%, this sample size would give a 95% confidence interval of 88.82 for a sample of 458. If the sample size was reduced by 20% dropping out, the confidence interval would be 89.81. This would allow detection of a difference of 15% in breastfeeding rates between mothers with postnatal depression and other mothers.

3.1.5 Research tools (Appendix D: Questionnaires used in the study)

The Edinburgh Postnatal Depression Scale EPDS (Cox 1987) is a reliable, valid, ten-item tool which can be administered easily and has been developed to specifically screen for postpartum depression. The questions are based on the mother's mood and feelings in the previous seven days. This tool has been used and validated by researchers in many countries and cultures, including countries with similar Islamic cultures to the Maldives such as Malaysia, Iran, Saudi Arabia and India (Ghubash et al., 1997b, Abdul Kadir et al., 2004, Mazhari and Nakhaee, 2007, Savarimuthu et al., 2010). A score of 10 or more on the EPDS scale indicated possible depression and a score of more than 12 was regarded as a major episode of postnatal depression (Cox, 1987). Mothers were interviewed based on EPDS at 36 weeks of pregnancy, one month, three months and six months after birth.

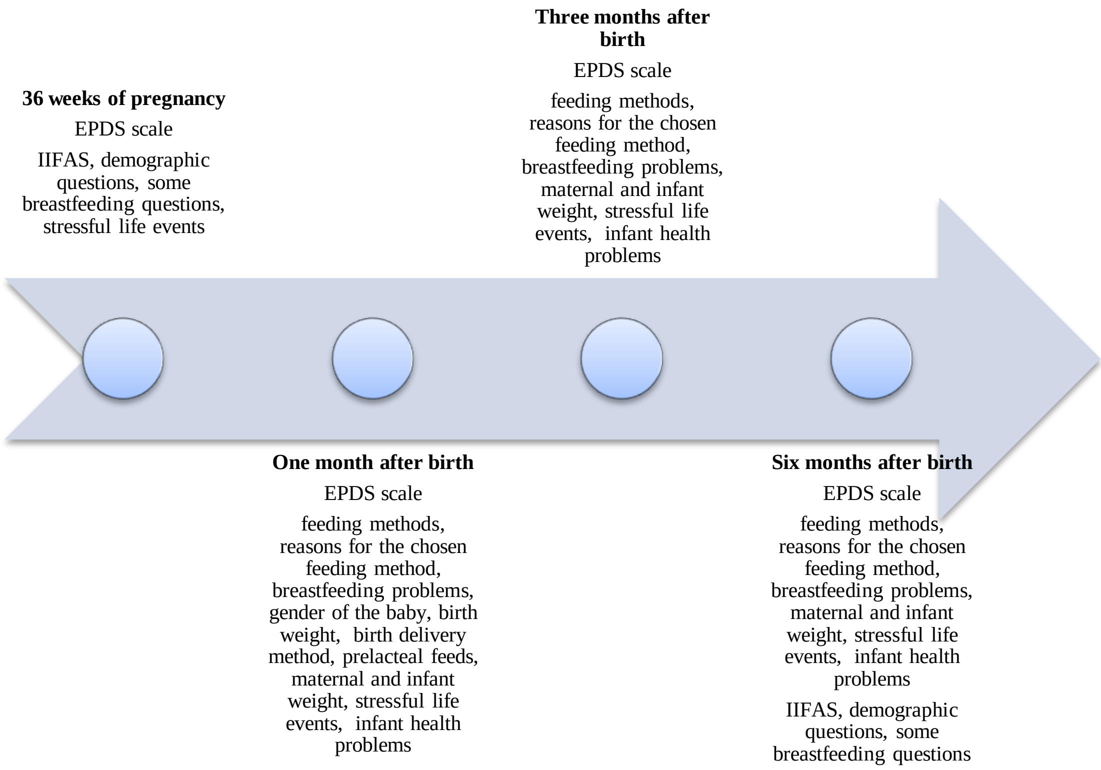
In addition, mothers completed the Iowa Infant Feeding Attitudinal Scale (IIFAS) (De la Mora and Russell, 1999) to assess their knowledge, attitudes and practices regarding infant feeding. The IIFAS is a validated reliable tool that consists of a scale of 17 items based on mothers' knowledge and attitudes towards infant feeding practices. Half of the questions are worded favourably towards breastfeeding and the other half are worded in a way that is favourable to formula feeding. Each item has a scale ranging from 1 to 5: 1=strongly disagree and 5=strongly agree. The lowest possible score in a completed questionnaire is 17 and the highest possible score is 85. Scores between 49 and 69 indicate a neutral attitude towards breastfeeding (De la Mora and Russell, 1999). IIFAS was given at 36 weeks of pregnancy and six month after birth.

Mothers also were asked to complete the demographic and some breastfeeding information survey at 36 weeks of pregnancy, and again at six months after delivery, to assess the demographic and socioeconomic factors (maternal education, occupation of the mother and her husband, annual income, living conditions, social support and smoking status) and ask some breastfeeding questions (maternal mother's breastfeeding status and some questions about breastfeeding knowledge). This questionnaire was used and validated in breastfeeding studies in China, Australia, Vietnam, Kenya and the Maldives (Scott and Binns, 1999, Scott et al., 2001, Lakati et al., 2002, Duong et al., 2004b, Abdulraheem and Binns, 2007, Xu et al., 2007). It is also very important to use standard definitions to measure breastfeeding. A study undertaken by (Binns et al., 2009) showed that only half of the studies that claimed to measure exclusive breastfeeding used a definition consistent with the World Health Organisation (Refer to Appendix for the WHO definitions of breastfeeding).

The weight and length of the baby at birth, one month, three months and six months were recorded. An infant was regarded as underweight or stunted if he or she was two-standard deviations below the levels on the weight-for-age and lengtht-for-age charts, respectively, on the World Health Organisation standard growth chart 2006 (World Health Organisation, 2006). An infant‘s length/ weight which lies within the area of plus or minus two standard deviations on the World Health Organisation weight-for-age and length-for-age standard growth chart (World Health

Organisation, 2006) is regarded as normal length/ weight. The weighing equipment was provided by the Malé Health Centre and the well-baby clinics in the hospitals and health centres. Primary health workers and nurses who were trained at the faculty of Health Sciences at Maldives National University measured length of infants and weight of mothers and infants. In addition, feeding method and duration, reasons for choosing a feeding method, infant's health (number of diarrhoeal episodes and the number of times the infant was admitted with acute respiratory infections) and maternal weight were recorded at one month, three months and six months prospectively by the PhD student. Fig 3.1 shows a summary of the study design.

Fig 3.1: Summary of the study designs



All the questionnaires were translated into Dhivehi and then back-translated by a different translator. The translation of the EPDS was assessed for language and cultural appropriateness using a focus group of mothers. The IIFAS and the demographic and breastfeeding questionnaire have been translated and used in previous studies in the Maldives. All the questionnaires were checked for validity and reliability and cultural appropriateness by a small pilot group of mothers and experts in the National Research Committee of the Maldives.

3.2 Data Analysis

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 19 for Windows software (IBM, Chicago, IL, USA). Frequency distributions of the data were generated and the data was checked for outliers and errors, and then cleaned. Growth data was transformed into Z-scores based on the WHO growth reference for analysis. Descriptive statistics was used to describe continuous variables. Univariate analyses (including chi-square and independent sample t-tests) were used to make comparisons between subgroups of interest. Multivariate logistic regression models were then developed to identify important variables affecting infant feeding, growth faltering and postnatal depression outcomes. Confounding factors identified from the literature were allowed for in making adjustments in the analysis, including maternal education, socioeconomic status, social support, type of birth, breastfeeding problems, marital status, prenatal and postnatal depression, parity, unplanned pregnancy, infant feeding outcomes, multiple births, cultural factors, poverty, mother's attitude and knowledge regarding infant feeding (IOWA Scale) and breastfeeding problems. Survival analysis was used to explore the association between Edinburgh depression scores and 'exclusive', 'full', 'any' breastfeeding and infant growth faltering. Kaplan Mier curves were drawn to see the effects of depression on feeding methods over six months. All the data was entered and checked by the PhD student and double checked by two expert supervisors on SPSS.

The following variables in Table 3.1 were analysed at each time point of the study.

Table 3.1 Variables that were analysed at each point of the study

36 weeks of pregnancy	One month after birth	Three months after birth	Six months after birth
Depression at 36 weeks and association with IIFAS, demographic factors, some breastfeeding questions, stressful life events, birth weight and gender of the baby.	**Depression at 1month** and association with demographic factors, breastfeeding duration. feeding methods and reasons for the chosen feeding method, at 1, 3 and 6 months, breastfeeding problems, gender of the baby, birth weight, birth delivery method, prelacteal feeds, maternal and infant weight at 1, 3and 6 months, stressful life events, infant health problems at 1, 3 and 6 months	**Depression** at 3 months and association with demographic factors, breastfeeding duration. Feeding methods, reasons for the chosen feeding method, breastfeeding problems , at 1, 3 and 6 months, maternal and infant weight, stressful life events, infant health problems at 1, 3 and 6 months.	**Depression** at 6 months and association with demographic factors breastfeeding duration. Feeding methods, reasons for the chosen feeding method and breastfeeding problems at 1, 3 and 6 months, maternal and infant weight, stressful life events, infant health problems at 1, 3 and 6 months
	Feeding methods at 1 month and association with depression, IIFAS at 36 weeks, demographic factors, reasons for the chosen feeding method, breastfeeding problems, gender of the baby, birth weight, birth delivery method, prelacteal feeds, maternal and infant weight, stressful life events, infant health problems	**Feeding methods** at 3 months and association with depression, IIFAS at 36 weeks, demographic factors, reasons for the chosen feeding method, breastfeeding problems, maternal and infant weight, stressful life events, infant health problems at 1, 3 and 6 months.	**Feeding methods** at 6 months and association with depression IIFAS at 6 months, demographic factors, reasons for the chosen feeding method, breastfeeding problems, maternal and infant weight, stressful life events, infant health problems at 1, 3 and 6 months.
	Infant's weight at one month and association with depression at one month at 1, 3 and 6 months, IIFAS 36 weeks demographic factors, feeding methods, reasons for the chosen feeding method, breastfeeding problems , at 1, 3 and 6 months, gender of the baby, birth weight, birth delivery method, prelacteal feeds, maternal weight, stressful life events, infant health problems at 1, 3 and 6 months	**Infant's weight** at 3 months and association with depression at 1, 3 and 6 months, demographic factors, feeding methods, reasons for the chosen feeding method, breastfeeding problems , at 1, 3 and 6 months, maternal weight, stressful life events, infant health problems at 1, 3 and 6 months	**Infant's weight** at 6 months and association with depression, demographic factors, feeding methods, reasons for the chosen feeding method, breastfeeding problems , at 1, 3 and 6 months, maternal weight, stressful life events, infant health problems at 1, 3 and 6 months

3.3 Ethical Considerations

The study was approved by the Curtin University Human Research Ethics Committee and also by the National Research Committee of Maldives (**Appendix A: The letters of ethics approval**). Approval also was obtained from the IGMH and ADK Hospital. Informed consent was obtained from each participant. At recruitment, mothers were given an explanatory paper and were informed as to the aim of the study and that confidentiality and anonymity was ensured. Participants were advised that it was voluntary to participate in the survey and that non-participation or withdrawal would not prejudice future treatment in any way. The postnatal clinic at the IGMH Reproductive Health Centre was notified if any one of the participants had an Edinburgh Postnatal Depression Scale EPDS greater than 12, so that they could receive appropriate treatment and support.

3.4 Storage of Data

All questionnaires were stored securely for five years at Curtin University and, during the time of data collection, at Maldives National University. The data files and other electronic work were also stored for five years with secure password protection.

3.5 Limitations

The limitations of this study include the data being collected from the capital city of Malé, where the facilities, including health and education, are better compared with those on the islands. This means that some of the results cannot necessarily be generalised to the whole Maldives. Although many factors affecting depression, feeding methods and infant growth faltering were explored, data for all the factors identified by the literature were not collected due to the time constraints of a PhD study. This might have caused some bias in the data. The IIFAS also was given at 36 weeks of pregnancy and six months after delivery to minimise Hawthorne effect. However, this might have caused some bias in the analysis when comparing attitude towards breastfeeding and breastfeeding practices at one month and three months. The initial idea for measuring weight of the mother at each stage was to see the difference in weight change in breastfeeding and non-breastfeeding mothers. As the analysis showed no significant difference a weight range was used for the analysis. However, measuring height as well would have enabled BMI calculation thus giving a better indication of the mothers' weight status.

In conclusion, it took one and a half years to reach a sample size of 458 because of the small population in the Maldives and because the birth rate was so low. The translation of the questionnaires to Dhivehi took some time because of the limited vocabulary in some areas. However the participation rate was very high in the Maldives which will be discussed in the results section.

Chapter 4 Results

This chapter discusses the results of the study using descriptive statistics, cross tabulations, multivariate logistic regressions and survival analysis.

4.1 Descriptive statistics

In total, 461 mothers were invited for the study and 458 mothers participated. The three mothers who chose not to participate declined for the following reasons: lack of time, refusal by husband, and lack of interest. The total number of questionnaires analysed for each visit is shown in Table 4.1 below. Some participants were lost due to death and change of address and phone number. The drop-out rate was very low due to many factors. Firstly Maldivians are very keen on participating in surveys and helping others. Secondly, mothers were invited to call the researcher at any time and get nutrition counselling regarding their infant. Thirdly, every mother had a phone so it was easy to follow them up. Finally, Malé and the islands are very small in size so even if a mother changes the phone number for some reason it is easy to find them as everyone knows where everyone lives.

4.1.1 Demographic data

Table 4.1 Response rates

Visit	Number of respondents	Response rates
Antenatal 36 weeks	458	99.3%
1 month	434	94.1%
3 months	430	93.3%
6 months	417	90.5%

Table 4.2 Demographic information of the participants

Variable	Number	Percentage
Mother's age (years)		
18-24	147	32.1
25-34	279	60.9
≥35	32	7
Marital status		
Married	453	98.9
Divorced	5	1.1
Mother's education		
Basic literacy level Primary	2 79	0.4 17.3
Secondary	295	64.4
Diploma and above	82	17.9
Type of accommodation		
Rented	195	42.6
Own home	263	57.4
Number of people living in a room		
≤3	238	52.1
4-6	206	45.1
≥7	13	2.8
Parity		
Primiparous	248	54.1
Multiparous (2)	124	27.1
Multiparous (≥3)	86	18.8
Mother's Occupation		
Housewife/elf-employed	289	63.1
Government employment	131	28.6
Private employment	35	7.6
Studying	3	0.7
Husband's Occupation		
Unemployed	10	2.2
Government employment	217	47.9
Private employment	225	49.7
Studying	1	0.2
Household annual income		
<MVR 90,000 (<A$6,209)	110	24.0
MVR 90,000-250,000 (A$6,209-17,249)	298	65.1
>MVR 250,000 (>A$17, 249)	50	10.9

In Table 4.2 above, the demographic details of the sample are reported. About one third of the mothers (32%) were aged between 18-24 years and the majority of the mothers were in the age range 25 to 34 years. Only 7% of the mothers were 35 years or above. The great majority of the mothers were married and, reflecting the conservative Islamic society in the Maldives, only five mothers were divorced. The majority of the mothers in the study had completed secondary school education. Seventeen of the mothers had completed a diploma and above. However, 17 of the mothers had only completed primary school education level. None of the mothers were illiterate and only two mothers were in the category of having only completed basic education (knowing how to read and write). A little more than half of the mothers lived in their own residences and almost half lived in rented accommodation.

Although the majority of the mothers slept in a room with three or less people, about 45% of mothers reported that 4-6 people slept in their one room. A minority of mothers (n=13) indicated that seven or more people slept in one room. The majority of the mothers (more than 50%) had one child, 27.1% of the mothers had two children and 18.8% of mothers reported as having three or more children. Most of the mothers were housewives or self-employed. A majority of the mothers who were employed worked in government posts while 7.6% of the mothers worked in private posts. A very small percentage (0.7%) of mothers were studying. About half of the husbands were employed by the government and half within the private sector. With a low unemployment rate on Malé, only 2.2% of the participants' husbands were unemployed. The majority of the mothers were in the middle income group. About a quarter of the mothers were living on a low income and 10% were in the high income group.

4.1.2 Edinburgh Postnatal Depression Scale

The Edinburgh Postnatal Depression Scale (EDPS) has been used widely as a screening tool in many different cultures. The frequencies of the mothers' responses during the interviews are shown in the following tables.

Table 4.3 EPDS responses at 36 weeks antenatal

EPDS item	Percentages			
	0 low	**1**	**2**	**3 high**
I have been able to laugh and see the funny side of things	59.2	34.9	5.0	0.9
I have looked forward with enjoyment to things	59.0	35.8	4.1	1.1
I have blamed myself unnecessarily when things went wrong	34.1	20.1	42.4	3.5
I have been anxious or worried for no good reason	45.4	6.6	39.5	8.5
I have felt scared or panicky for no very good reason	54.1	8.5	30.6	6.8
Things have been getting on top of me	35.4	39.1	19.7	5.9
I have been so unhappy that I have had difficulty sleeping	44.1	11.1	34.1	10.7
I have felt sad or miserable	38.0	13.5	40.6	7.9
I have been so unhappy that I have been crying	14.2	49.6	18.6	17.7
The thought of harming myself has occurred to me	93.9	2.4	3.5	0.2

Table 4.4 EPDS responses at 1 month postnatal

EPDS item	Percentages			
	0 low	**1**	**2**	**3 high**
I have been able to laugh and see the funny side of things	44.7	45.6	6.9	2.8
I have looked forward with enjoyment to things	42.6	50.2	6.0	1.2
I have blamed myself unnecessarily when things went wrong	43.5	18.9	34.1	3.5
I have been anxious or worried for no good reason	45.6	6.7	36.9	10.8
I have felt scared or panicky for no very good reason	63.1	9.9	21.7	5.3
Things have been getting on top of me	35.3	40.1	20.0	4.6
I have been so unhappy that I have had difficulty sleeping	58.8	7.1	22.4	11.8
I have felt sad or miserable	37.3	9.9	39.6	13.1
I have been so unhappy that I have been crying	19.8	35.9	26.0	18.2
The thought of harming myself has occurred to me	93.3	3.0	3.2	0.5

Table 4.5 EPDS responses at 3 months postnatal

EPDS item	Percentages			
	0 low	**1**	**2**	**3 high**
I have been able to laugh and see the funny side of things	76.0	18.8	4.0	1.2
I have looked forward with enjoyment to things	77.2	20.2	1.9	0.7
I have blamed myself unnecessarily when things went wrong	55.3	18.4	24.9	1.4
I have been anxious or worried for no good reason	56.3	14.9	21.6	7.2
I have felt scared or panicky for no very good reason	72.8	12.1	12.6	2.6
Things have been getting on top of me	49.5	39.3	8.4	2.8
I have been so unhappy that I have had difficulty sleeping	75.6	10.5	10.0	4.0
I have felt sad or miserable	52.8	14.9	25.3	7.0
I have been so unhappy that I have been crying	28.8	42.8	18.1	10.2
The thought of harming myself has occurred to me	95.6	3.3	0.7	0.5

Table 4.6EPDS responses at 6 months postnatal

EPDS item	Percentages			
	0 low	**1**	**2**	**3 high**
I have been able to laugh and see the funny side of things	92.1	5.5	1.9	0.5
I have looked forward with enjoyment to things	94.0	4.3	1.0	0.7
I have blamed myself unnecessarily when things went wrong	74.1	16.5	9.4	-
I have been anxious or worried for no good reason	76.5	11.8	8.9	2.9
I have felt scared or panicky for no very good reason	87.5	8.6	2.9	1.0
Things have been getting on top of me	65.9	29.3	3.4	1.4
I have been so unhappy that I have had difficulty sleeping	90.6	5.8	2.9	0.7
I have felt sad or miserable	76.5	14.4	7.7	1.4
I have been so unhappy that I have been crying	50.8	40.0	7.7	1.4
The thought of harming myself has occurred to me	97.6	1.4	0.7	0.2

As shown in Tables 4.3, 4.4, 4.5 and 4.6, the items that were scored highest by the Maldivian mothers scored highest on the EDPS, at both the antennal and postnatal interviews were; ‘I have been anxious or worried for no good reason’, ‘I have felt sad or miserable’ and ‘I have been so unhappy that I have been crying’. The item which mothers scored lowest on the EPDS scale was ‘the thought of harming myself has occurred to me’. However, at 36 weeks antenatal and one month postnatal, more than 3% of mothers have indicated that the thought of harming themselves had occurred to them sometimes or very often. The percentages of mothers with high scores on each item of the EPDS decreased from 36 weeks antenatal to 6 months postnatal.

Table 4.7 Cumulative % of EPDS scores at 36 weeks antenatal, 1, 3 and 6 months postnatal

EPDS score/30	36 Weeks Antenatal	One Month Postpartum	Three Months Postpartum	Six Months Postpartum
.00	3.9	3.9	9.3	24
1.00	7.6	9.2	21.9	48.3
2.00	10.5	14.3	34	68.3
3.00	17.7	22.4	44.2	76.4
4.00	22.9	29.3	51.6	82
5.00	28.6	35.3	58.4	87.3
6.00	33.6	42	64.7	90.9
7.00	41.5	46.4	70.2	92.5
8.00	47.4	51.5	77	94.5
9.00	56.1	57.5	81.9	95
10.00	**61.8**	**62.6**	**83.3**	**95.9**
11.00	**68.6**	**67.2**	**85.8**	**97.1**
12.00	**76.2**	**73.2**	**88.1**	**97.4**
13.00	**80.6**	**78.1**	**90.9**	**97.8**
14.00	86.0	81.3	93.7	98.3
15.00	90.6	87.3	94.9	98.6
16.00	93.7	88.7	96.5	99
17.00	95.9	92.4	97.4	99.5
18.00	96.9	94.5	98.4	99.5
19.00	97.6	95.8	98.6	99.5
20.00	98.5	97	99.1	99.8
21.00	98.9	97.9	99.5	99.8
22.00	99.6	98.8	99.8	99.8
24.00	99.8	99.8	99.8	99.8
27.00	99.8	99.8	99.8	100
29.00	100.0	100	100	100

Table 4.7 shows the cumulative percentages for mothers with different EPDS scores. The percentages of mothers with an EPDS of more than 10 (indicating minor depression) at 36 weeks antenatal, one month, three months and six months postnatal were 38.2%, 37.4%, 16.7% and 4.1%, respectively. The highest EPDS score recorded was 29/30. There was a gradual decrease in the percentages of mothers with an EPDS ≥ 13 from 36 weeks antenatal to six months postnatal. If minor depression is considered as ≥ 10, then the percentages of mothers with minor depression at 36 weeks antenatal, one month, three months and six months postnatal are 43.1%, 42.5%, 18.1% and 5%, respectively. Similarly, when major depression is considered

as EPDS ≥ 12, the percentages of mothers with major depression over the same time periods are 31.4%, 32.8%, 14.2% and 2.8%, respectively.

Table 4.8 Percentage of mothers with major postnatal depression

Visit	EPDS < 13	EPDS ≥ 13	Total
Antenatal	349 (76.2%)	109 (23.8%)	458
1 month	318 (73.3%)	116 (26.7%)	434
3 months	379 (88.1%)	51 (11.9%)	430
6 months	406 (97.4%)	11 (2.6%)	417

Table 4.8 shows the numbers and percentages of mothers with major postpartum depression (an EPDS ≥ 13). The percentage of mothers with an EPDS ≥ 13 at the antenatal visit was 23.8%. A few new cases were added at one month postpartum but the percentage decreased to 11.9% at three months. By six months, only 2.6% of mothers had postpartum depression.

4.1.3 Responses on infant feeding outcomes

Table 4.9 First feeds given to infants

Type of food	Frequency	Percentage
Breastmilk	334	76.9
Infant formula	18	4.1
Drop of honey rubbed on the baby's upper palate with the finger tip	46	10.6
A tiny piece of crushed date made into paste and rubbed on the baby's upper palate with finger tip	32	7.4
Glucose	3	0.7
Zam Zam water	1	0.2
Total	434	100.0

Table 4.9 shows the first feeds given to the infants in the Maldives. The majority of the infants were given breastmilk as the first feed. However, 23.1% of the infants were given prelacteal feeds including infant formula (4.1%), honey (10.6%), dates (7.4%), glucose (0.7%) and Zam Zam water (0.2%). Within the first week of birth, 38.0%, 15.0% and 19.6% of the infants received honey, dates and infant formula, respectively.

Table 4.10 Breastfeeding initiation

Time breastfeeding was initiated	Frequency	Percentage
Immediately after birth (< 1 hour)	364	83.9
Within 4 hours	42	9.7
After four hours	28	6.5
Total	434	100.0

Although prelacteal feeds were given to many infants, 100% of the mothers initiated breastfeeding. The majority of the mothers (83.9%) initiated breastfeeding within one hour after birth. The percentages of mothers who initiated breastfeeding within four hours of delivery and after were 9.7% and 6.5%, respectively (Table 4.10).

Table 4.11 Infant feeding rates at 1 month, 3 months and 6 months

Feeding methods	1 month	3 months	Up to 6 months	At 6 months
Exclusive breastfeeding	112 (25.8%)	71 (16.4%)	32 (7.5%)	0 (0%)
Full breastfeeding	291 (67.1%)	226 (52.2%)	127 (29.7%)	0 (0%)
Any breastfeeding	429 (98.8%)	413 (95.4%)	379 (90.7%)	379 (90.7%)
Formula feeds given	120 (27.6%)	172 (39.8%)	233 (54.9%)	344 (81.1%)

Table 4.11 illustrates the breastfeeding rates at one month, three months and six months. ‘Any breastfeeding’ rates were very high at one month (98.8%), three months (95.4%) and six months (90.7%). The exclusive breastfeeding rate was very low at one month (25.8%) compared with the ‘full breastfeeding’ rate (67.1%). Although ‘any breastfeeding’ rates stayed high up to six month (180 days), rates of ‘full breastfeeding’ and ‘exclusive breastfeeding’ dropped down to 29.7% and 7.5% respectively. All the mothers started giving either infant formula or solid food at six months (approximately 180 days) so ‘exclusive breastfeeding’ and ‘full breastfeeding’ were 0%. A high percentage of mothers (81.1%) fed infant formula to their babies at six months.

4.1.4 Mothers' IOWA Infant Feeding Attitude Scale

Table 4.12 Mothers' IIFAS item responses at the antenatal interview

Attitude Item	Percentages				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. The nutritional benefits of breastmilk last only until baby is weaned	84.6	1.3	5.3	2.4	6.4
b. Formula feeding is more convenient than breastfeeding	75.4	1.8	4.4	2.0	16.4
c. Breastfeeding increases mother-infant bonding	-	-	0.2	-	99.8
d. Breastmilk is lacking in iron	69.9	2.2	23.3	0.4	4.2
e. Formula fed babies are more likely to be overfed than breastfed babies	20.7	2.3	33.4	2.6	40.9
f. Formula feeding is the better choice if the mother works outside the home	62.6	5.1	8.4	7.5	16.5
g. Mothers who formula feed miss one of the great joys of motherhood	8.4	1.3	3.3	3.5	83.5
h. Women should not breastfeed in public places such as restaurants	38.0	7.9	7.7	7.9	38.5
i. Babies who are fed breastmilk are healthier	7.3	1.1	3.7	1.8	86.2
j. Breastfed babies are more likely to be overfed	44.8	1.4	34.5	1.1	18.0
k. Fathers feel left out if a mother breastfeeds	88.1	2.2	6.4	0.7	2.6
l. Breastmilk is the ideal food for babies	0.2	-	0.2	0.2	99.3
m. Breastmilk is more easily digested than formula	5.9	0.2	2.2	1.8	89.9
n. Formula is as healthy for an infant as breastmilk	91.0	3.5	3.1	0.4	2.0
o. Breastfeeding is more convenient than formula feeding	9.9	1.1	1.3	2.6	85.1
p. Breastmilk is less expensive than formula	7.7	2.4	2.2	2.0	85.7
q. A mother who smokes should formula feed	38.5	4.6	28.1	5.7	23.1

Table 4.13 Mothers IIFAS item responses at the 6 months interview

Attitude Item	Percentages				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. The nutritional benefits of breastmilk last only until baby is weaned	95.7	2.2	1.2	-	1
b. Formula feeding is more convenient than breastfeeding	90.2	4.1	0.2	1.2	4.1
c. Breastfeeding increases mother-infant bonding	0.7	-	0.2	-	99.0
d. Breastmilk is lacking in iron	77.9	5.8	13.0	0.5	2.9
e. Formula fed babies are more likely to be overfed than breastfed babies	20.7	6.3	21.4	-	49.3
f. Formula feeding is the better choice if the mother works outside the home	62.5	6.5	7.0	7.0	17.1
g. Mothers who formula feed miss one of the great joys of motherhood	7.9	1.9	2.6	3.4	84.1
h. Women should not breastfeed in public places such as restaurants	37.3	9.6	6.7	8.9	37.5
i. Babies who are fed breastmilk are healthier	6.5	3.8	2.9	1.2	85.6
j. Breastfed babies are more likely to be overfed	51.4	5.3	23.1	1.4	18.8
k. Fathers feel left out if a mother breastfeeds	88.7	3.1	4.8	1.0	2.4
l. Breastmilk is the ideal food for babies	0.5	-	0.2	0.2	99.0
m. Breastmilk is more easily digested than formula	1.9	-	1.2	1.7	95.2
n. Formula is as healthy for an infant as breastmilk	92.8	3.8	1.4	0.5	1.4
o. Breastfeeding is more convenient than formula feeding	4.8	0.5	1.0	2.2	91.6
p. Breastmilk is less expensive than formula	84.4	3.6	2.4	2.6	7.0
q. A mother who smokes should formula feed	41.3	5.3	26.2	5.0	22.1

The IOWA infant feeding attitudinal scale has been used in studies of infant feeding in a number of different cultures, as described in the literature review and the methodology. Tables 4.12 and 4.13 show the responses to the IOWA infant feeding attitudinal scale items at 36 weeks of pregnancy and six months after birth. At both of these times the majority of mothers answered each item in a way that reflected a positive attitude to breastfeeding. There were a few items on the scale which mothers felt unsure about. Although, at 36 weeks of pregnancy, 69.9% of the mothers disagreed that breastmilk lacks in iron, 23.3% of the mothers were neutral about the statement. At six months after delivery, the percentage of mothers who disagreed with the statement increased to 77.9%. Many mothers were unsure whether formula fed babies or breastfed babies were more likely to be overfed. Less than half of the mothers, (40.9% at 36 weeks of pregnancy and 49.3% at six months after delivery), agreed that formula fed babies were more likely to be overfed. At 36 weeks of pregnancy, 44.8% disagreed that breastfed babies were more likely to be overfed, and the percentage of mothers who disagreed about the statement increased to 51.4% at six months after birth. Many mothers, (28.8% at 36 weeks of pregnancy and 27.1% at six months after birth), agreed that mothers who smoke should formula feed their babies. Neutral answers to the statement were given by 28.1% and 26.2% of the mothers, respectively.

Table 4.14 Mothers' IIFAS scores at 36 weeks of pregnancy

IIFAS scores	**Antenatal (36 weeks of pregnancy)**	**Postnatal (1 month)**
Low (17 to 48)	-	-
Medium (49 to 69)	144 (31.6%)	73 (17.5%)
High (70 to 85)	311 (68.4%)	343 (82.5%)
Total	455 (100%)	416 (100%)

Table 4.14 shows the percentages of mothers with low, medium and high IIFAS scores. As illustrated in the table, the Maldivian mothers tend to have high scores in the IOWA infant feeding attitudinal scale. None of the mothers had a score less than 49 on the IIFAS and the majority of the mothers had high scores (70 to 85) at 36 weeks of pregnancy and six months after birth, indicating that mothers were in favour of breastfeeding. More mothers had a high IIFAS score at six months when compared with antenatal administration of the test.

4.1.5 Further questions on breastfeeding

Table 4.15 Further questions on knowledge about, and attitude towards, breastfeeding

Attitude Item	Percentages				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a) Honey or something sweet should be the first food given to the baby	27.5	1.3	8.3	2.4	60.0
b) Water should be given before six months	76.5	1.1	2.6	4.4	15.4
c) Fruit juice should be given before six months	77.9	2.2	4.8	3.1	12.1
d) Formula should be given until breastmilk comes in	60.1	1.5	4.8	7.7	25.9
e) Infants in developed countries do equally well whether formula fed or breastfed	89.3	2.4	5.7	0.4	2.2
f) Breastfeeding mothers should avoid traditional medicine	49.5	5.5	35.4	1.5	8.1
g) Breastfeeding mothers should avoid western medicine	49.7	16.5	18.0	7.7	8.1
h) I do not like breastfeeding	97.6	0.2	0.9	-	1.3
i) Breastfeeding will make breasts sag	78.2	4.0	10.3	3.1	4.4
j) Fathers can help if baby is formula fed	44.0	2.4	6.2	4.6	42.9
k) Breastfeeding is embarrassing	97.8	0.4	0.2	0.9	0.7
l) Breastfeeding will help to regain figure faster	17.6	1.3	20.4	6.2	54.5
m) I feel embarrassed if another mother breastfeeds in front of me	94.1	0.9	0.9	2.0	2.2
n) I do not care to breastfeed in front of others	20.5	7.9	9.3	7.3	55.1
o) Breastfeeding is more tiring than formula feeding	42.7	4.6	14.5	5.1	33.0

Table 4.15 shows the other breastfeeding questions that were asked to determine which attitudes were important to the Maldivian community. The majority of the mothers (60.0%) believed that honey or something sweet should be given to the infant as the infant's first feed. Many mothers (25.9%) thought that infant formula should be given until breastmilk 'comes in'. Some mothers were unsure whether they should avoid traditional or western medicine while breastfeeding. The percentage of mothers who agreed that the fathers can assist in feeding if the infants are formula fed was 42.9%, and only one third (33%) of the mothers agreed that breastfeeding was 'more tiring than formula feeding'. About half (54.5%) of the mothers agreed that breastfeeding would help them to regain their pre-pregnancy figure faster. All other items on this breastfeeding knowledge attitude scale were responded to in a very positive way by the majority of the mothers.

Table 4.16 Mothers' knowledge about colostrum

Importance of colostrum	Frequency	Percentage
It is important for the baby	438	96.1
It should be discarded	3	0.7
Do not know	15	3.3
Total	456	100.0

Most of the mothers believed that colostrum was important for the baby. However some mothers did not know what colostrum is and a very small percentage of mothers believed that it should be discarded (Table 4.16).

Table 4.17 Mothers' knowledge about best time to introduce infant formula

Time to introduce formula	Frequency	Percentage
Within 24 hours of birth	5	1.1
3-4 weeks	3	0.7
3 months	6	1.3
4-6 months	280	61.4
1 year	64	14.0
Does not matter which time	12	2.6
Never	64	14.0
Do not know	22	4.8
Total	456	100.0

The majority of the mothers (61.4%) reported that the best time to introduce infant formula is between 4-6 months (Table 4.17). Some mothers (14%) indicated that infant formula should be introduced after one year and 14% of mothers said it should never be given.

4.1.6 Intention to breastfeed

Table 4.18 Decision about method of feeding at 36 weeks of pregnancy

Method	Reasons	Percentage
Breastfeeding		99.8
	Baby's father wants me to breastfeed	5
	Breastmilk is better for baby	97.2
	Islam recommends breastfeeding	43.4
	Breastfeeding is cheaper	6.6
	Breastfeeding makes the baby intelligent	36.7
	Helps mothers to lose weight	17.7
	Mother suggests breastfeeding	3.5
	Mother-in-law suggests breastfeeding	2.4
	Others suggested breastfeeding	3.3
	Breastfeeding is more convenient	9.4
	Breastfed infants have fewer infections	46.5
	Breastfeeding is natural	31.9
	Breastfeeding increases mother-infant bonding	54.4
	Breastfeeding areas are available in the public	2.4
Bottle feeding		7.6
	Not enough milk	37.5
	Have to work or study	65.6
	Baby’s father disapproves	3.1
	Breastfeeding is restrictive	3.1
	Infant formula is better	3.1
	Baby grows bigger with infant formula	9.4
	Baby’s mother wants to smoke	3.1
	Baby’s mother plays a lot of sports	3.1
	Mother suggests bottle feeding	3.1
	Mother-in-law suggest bottle feeding	3.1
	Friends and relatives suggest bottle feeding	3.1
	Health professionals suggest bottle feeding	3.1
	It is the way infants are fed in the Maldives	3.1
	Other reason (pain, sickness of mother and/or baby)	6.3

Table 4.18 shows the reasons why mother decided to breastfeed or bottle feed. At the antenatal interview, almost all the mothers (99.8%) said that they were going to breastfeed and only 7.6% of the mothers said that they were going to bottle feed (as the sole supplementary food). The main reasons the mothers gave for their decisions to breastfeed were "breastfeeding is better for the baby', 'breastfed babies have fewer infections' and 'Islam recommends breastfeeding'. Of the 7.6% of mothers who wanted to bottle feed, the main reason was because they wanted go back to work or study (65.6%). Although only 7.6% had decided to bottle feed at the time of the antenatal interview, Table 4.12 indicates that 27% and 39.3% of mothers had introduced the bottle at one month and three months, respectively.

4.1.7 Maternal variables

Table 4.19 Maternal variables

Variables	**Number (%)**
Maternal weight at one month after giving birth	
< 50 kg	30 (11.3%)
50-65 kg	143 (49.1%)
> 65 kg	92 (34.7%)
Maternal weight at three months after giving birth	
< 50 kg	40 (15.3%)
50-65 kg	163 (62.5%)
> 65 kg	58 (22.2%)
Maternal weight at six months after giving birth	
< 50 kg	49 (17.9%)
50-65 kg	165 (60.2%)
> 65 kg	60 (21.9%)
Smoking	
Before pregnancy	15 (3.3%)
During pregnancy	2 (0.4%)
Before pregnancy (husband)	197 (43%)
During pregnancy (husband)	173 (37.8%)
Received help in looking after children and in household chores	400 (87.3%)
People who helped	
Husband	213 (52.9%)
Maternal mother	211 (52.4%)
Paternal mother	120 (29.8%)
Other family members	230 (57.1%)
Babysitter	13 (3.2%)
Servant	9 (2.0%)
Had stressful life event	24 (5.2%)

Table 4.19 shows the maternal variables including: maternal weight at one month, three months and six months; smoking status; percentage of mothers who received help; and mothers who had stressful life events. The percentages of mothers in the lower and middle categories of weight increased from one month to three months. The percentages of mothers in the middle and higher categories of weight decreased from three months to six months. The majority of the mothers (87.3%) received help with children and household chores from a husband, a maternal/paternal mother, a relative, a babysitter or a servant. A small percentage (5.2%) of mothers faced stressful life events. These stressful life events include marital problems and family problems. The main marital conflicts reported by the mothers were due to the husbands having affairs during pregnancy and when the babies were young. Mothers also reported the difficulties and conflicts that arise because big families have to live together due to the lack of space in Malé.

4.1.8 Infant variables

Table 4.20 Infant variables

Variable	Number (%)
Gender of the baby	
Male	213 (50.9%)
Female	221 (49.1%)
Type of delivery	
Vaginal	239 (55.1%)
Caesarean	195 (44.9%)
Birth weight (Full term infants)	
<2,500g	22 (5.1%)
2,500-3,900g	399 (92.1%)
≥4,000g	12 (2.8%)
Mean birth weight (kg)	(3.17±0.28)
Infant boys' weight at one month	
<3,300g (-2 z score)	12 (5.7%)
3,300-5,700g	197 (94.3%)
>5,700g (+2 z score)	-
Infant boys' weight at three months	
<5,000g (-2 z score)	14 (6.9%)
5,000-8,000g	188 (93.1%)
>8,000 (+2 z score)	-
Infant boys' weight at six months	13 (6.6%)
<6,300g (-2 z score)	182 (92.9%)
6,300-9,800g	1 (0.5%)
>9,800g (+2 z score)	
Infant boys' length at one month	
<50.5cm (-2 z score)	15 (8.9%)
50.5-58.2 cm	151 (89.9%)
>58.2cm (+2 z score)	2 (1.2%)
Infant boys' length at three months	
<57.2 (-2 z score)	27 (14.8%)
57.2 -65.5	155 (85.2%)
>65.5 (+2 z score)	-
Infant boys' length at six months	
<63.2 cm (-2 z score)	33 (18.3%)
63.2-71.8 cm	146 (81.1%)
>71.8 cm (+2 z score)	1 (0.6%)

Table 4.21 Infant variables (cont.)

Variable	Number (%)
Infant girls' weight at one month	
<3,100g (-2 z score)	6 (2.8%)
3,100-5,400g (-2 z score)	207 (96.7%)
>5,400g (+2 z score)	1 (0.5%)
Infant girls' weight at three months	
<4,500g (-2 z score)	3 (1.4%)
4,500-7,500g	207 (98.1%)
>7,500 (+2 z score)	1 (0.5%)
Infant girls' weight at six months	
<5,700g (-2 z score)	6 (2.8%)
5,700-9,300g	204 (96.7%)
>9,300g (+2 z score)	1 (0.5%)
Infant girls' length at one month	
<49.5cm (-2 z score)	10 (5.6%)
49.5-57.3 cm	163 (92.8%)
>57.3cm (+2 z score)	3 (1.7%)
Infant girls' length at three months	
<55.6 (-2 z score)	22 (11.6%)
55.6 -64.0	164 (86.8%)
>64.0 (+2 z score)	3 (1.6%)
Infant girls' length at six months	
<61.0 cm (-2 z score)	8 (4.2%)
61.0-70.1 cm	184 (95.8%)
>70.1 cm (+2 z score)	-
Infants who had diarrhoea	29 (6.7%)
Infants who had ARI	131 (30.2%)
Infants who had other health problems	9 (2.0%)

Table 4.20 and 4.21 shows variables related to the infants including their gender, type of delivery, weight and length and health problems. There was a high percentage (44.9%) of caesarean deliveries. Only 5.1% of the infants had a birth weight less than 2.5 kg. At one month, 5.7% of boys and 2.6% of girls were below (-2 Z scores) and 1.4% of girls were above (+2 Z scores) two standard deviations on the WHO growth standards, (z-score charts). The percentage of boys below two standard deviations at three months was 6.9%. The percentages of girls below and above two standard deviations in weight at three months were 1.4% and 0.5 %, respectively. At six months, the percentage of girls who were two standard deviations below the WHO standard increased to 2.8%. The percentage of babies who were short for their age was highest for girls at three months (11.6%) and for boys at six months (18.3%). Acute respiratory tract infections were the most common infection in this study, with 30.2% of babies having at least one ARI

infection before one month. Other infant health problems were diarrhoea, fever, vomiting, constipation and digestive problems.

4.1.9 Introduction of complementary foods and solid foods

Table 4.22 Cumulative percentages of mothers who introduced complementary and solid foods by one month, three months and six months

Types of food given	One month (%)	Four months (%)	Six months (%)
Water	20.5	46.5	99.8
Honey	40.5	41.2	41.7
Formula	27.6	45.8	81.1
Glucose	0.5	0.7	0.7
Pomegranate or other fruit juice	6.9	17.2	54.3
Ribena	-	-	1.0
Fruits	15.4	23.6	88.3
Vegetables	0.2	4.3	76.1
Cereal	-	6.2	79.9
Bottled food	-	1.7	12.0
Mashed food	0.2	2.6	64.6
Custard/ pudding/ yoghurt	0.2	2.6	28.5
Gripe water	4.3	5.0	5.0

Table 4.22 shows the percentages of mothers who had introduced different foods at one month, three months and six months. The percentages of mothers who had given fruits (dates) and honey at one month was high (40.5% and 15.7%, respectively) because very small amounts of both of these foods are commonly rubbed on the infant's upper palate as a ritual before breastmilk is commenced, or in the first week. Some mothers introduced other types of fruit by four months. The percentage of mothers who gave water was high, increasing from 20.5% at one month to 46.5% at four months. Giving small amounts of pomegranate juice was also common because it is a Maldivian cultural practice to cleanse the tongue of the infant. Many mothers (17.2%) had given pomegranate juice by four months. Although the 'any

breastfeeding' rates were high, almost half of the mothers had introduced infant formula by four months.

Table 4.23 Ages at which solid foods were introduced

Age (months)	Frequency	Percentage
1	1	0.2
3	7	1.7
4	32	7.7
5	123	29.6
6	253	60.8

Table 4.23 shows that the majority of the mothers (60.8%) introduced solid food at the infant age of six months. About 30% of the mothers introduced food at five months and a small percentage (7.7%) at four months.

Table 4.24 First solid foods that were given

Type of food	Frequency	Percentage
Fruit	173	41.4
Vegetable	16	3.8
Cereal (in packets)	125	29.9
Rice	19	4.5
Custard	9	2.2
Yogurt	29	6.9
Rotti	1	0.2
Millets mixed with milk	14	3.3
Rice with vegetables	1	0.2
Rotti with fish	1	0.2
Bottled food	22	5.3
Fish	1	0.2
Sweet potato	5	1.2
Not given	2	0.5
Total	418	100

There were many types of food that mothers gave as the first solid food. The most common first solid foods were fruits (41.4%) or cereals (29.9%). Many mothers also gave yoghurt (6.9%) or custard (2.2%), which both contain cow's milk, as first solid foods. Bottled food was given by 5.3% of mothers (Table 4.24).

4.1.10 Reasons for breastfeeding and bottle feeding

Table 4.25 Reasons for breastfeeding and bottle feeding up to six months

Method	Reasons	Percentage
Breastfeeding		97.5
	Baby's father wants me to breastfeed	5.3
	Breastmilk is better for baby	95.2
	Islam recommends breastfeeding	40.6
	Breastfeeding is cheaper	6.0
	Breastfeeding makes the baby intelligent	31.6
	Helps mothers to lose weight	15.5
	Mother suggests breastfeeding	3.0
	Mother-in-law suggests breastfeeding	2.1
	Others suggested breastfeeding	3.7
	Breastfeeding is more convenient	7.9
	Breastfed infants have fewer infections	52.4
	Breastfeeding is natural	30.3
	Breastfeeding increases mother-infant bonding	49.0
	Other reasons (Ideal way)	3.9
Bottle feeding		61.5
	Not enough milk	70.7
	Have to work or study	21.1
	Baby’s father disapproves	0.4
	Breastfeeding is restrictive	0.4
	Infant formula is better	0.4
	Baby grows bigger with infant formula	7.1
	Baby’s mother wants to smoke	0.4
	Baby’s mother plays a lot of sports	0.4
	Mother suggests bottle feeding	0.4
	Mother-in-law suggest bottle feeding	0.4
	Friends and relatives suggest bottle feeding	0.4
	Health professionals suggest bottle	2.6
	It is the way infants are fed in the Maldives	0.8
	Other reason (‘pain’, ‘mastitis’, ‘sickness of mother and baby’, ‘suckling problems’, ‘refusal by baby’, ‘crying baby’, ‘baby not sleeping well’)	20.8
Additional reasons why mothers think others stop breastfeeding and start bottle feeding	‘Afraid that breasts will sag or they may look ugly’, ‘having flat nipples’, ‘baby or mother being too sick’, ‘lazy’, ‘baby cries too much’, ‘baby not growing’, ‘baby refuses to breastfeed’, ‘food age’, ‘mother too busy’, ‘baby can’t sleep’ and ‘too difficult to breastfeed’	

Table 4.25 shows the reasons why mothers chose to breastfeed. The responses were similar to those given by the mothers at the antenatal interview about why they were going to breastfeed. However, the reasons why the mothers were bottle feeding were

different between the two interviews. At the antenatal interview the main reason why mothers thought they would bottle feed was because they wanted to go to work or study, but only 7.6% wanted to bottle feed. However, by the six month interview the majority of the mothers had introduced bottle feeds, at least occasionally, and the main reason given (70.7%) was not having enough breastmilk. The reasons why mothers thought other mothers stopped breastfeeding or started bottle feeding were 'afraid that breasts will sag or they may look ugly', 'having flat nipples', 'baby or mother being too sick', 'lazy', 'baby cries too much', 'baby not growing', 'baby refuses to breastfeed', 'age at which food is introduced', 'mother too busy', 'baby can't sleep' and 'too difficult to breastfeed'.

Table 4.26 Methods used to produce more breastmilk

Method	**Frequency**	**Percentage**
None	199	47.0
Drink coconut milk	7	1.7
Eat nutritional food	143	33.8
Others (Drink sweetened condensed milk)	74	17.5
Total	423	100.0

Table 4.26 summarises the methods mothers used to produce more breastmilk. The majority of the mothers said they did not use any methods to increase the milk supply. A high percentage of mothers drink sugary food (sweetened condensed milk) to increase the milk supply.

4.1.11Breastfeeding support

Table 4.27 Support for breastfeeding

Factor	**Frequency**	**Percentage**
Time of decision to breastfeed		
Before I became pregnant	287	68.8
During my pregnancy	94	22.5
After my baby was born	36	8.6
Mother's perception of where baby should sleep		
In the same bed with me	241	57.8
In the same room, but not in the same bed as me	173	41.5
In another room	3	.7
Received information from hospital		
Yes	202	48.4
No	215	51.6
Sources of information		
Lectures or classes on breastfeeding	114	27.3
Demonstrations on how to breastfeed	4	1.0
Video or TV show on how to breastfeed	2	.5
Individual consultation or discussion	74	17.7
Other forms of information (internet)	67	16.1
Did not receive any information	121	29.0
People who support breastfeeding		
Baby's father	274	65.7
Maternal mother	181	43.4
Paternal mother	22	5.3
Doctors	22	5.3
Nurses	27	6.5
Community Health Workers	11	2.6
Friends and other family members	45	10.8
Maternal mother's feeding method		
Breastfeeding	400	95.7
Bottle feeding	18	4.3
Father's preference of feeding method		
Prefers bottle feeding	1	.2
Prefers breastfeeding	407	88.9
Does not mind how the baby is fed	34	7.4
Never really discussed the matter with him	16	3.5
Maternal mother's preference of feeding method		
Prefers bottle feeding	5	1.1
Prefers breastfeeding	375	81.9
Does not mind how I feed our baby	27	5.9
Never really discussed the matter with her	51	11.1

Table 4.27 shows the responses mothers gave on the items which were in support of breastfeeding. The majority (68.8%) of the mothers said that they decided to breastfeed their babies even before pregnancy. More than half of the mothers

(57.8%) said they thought that babies should sleep in the same bed with the mother. Half of the mothers (51.4%) said they did not receive enough information about infant feeding from the hospitals. However, many mothers reported that they received information through breastfeeding classes (27.3%) and individual consultations (17.7%). The main people who supported breastfeeding were the babies' fathers (65.7%) and maternal mothers (43.4%). A majority of the mothers (95.7%) reported that their mothers breastfed them when they were infants. Most mothers indicated that the fathers of the babies (88.9%) and their own mothers (81.9%) preferred breastfeeding.

4.2 Factors associated with antenatal depression

4.2.1 Cross tabulation

Table 4.28 Demographic factors associated with antenatal depression

Variable	**EPDS≥13**	**EPDS<13**	**p-value**
Mother's age, years: <30	85	273	0.96
≥30	24	76	
Marital status: Married	105	348	**0.003**
Divorced	4	1	
Mother's education: Primary or lower	29	52	**0.005**
Secondary and higher	80	297	
Type of accommodation			
Rented	45	150	0.76
Own place	64	109	
Number of people living in a room: ≤3	87	296	0.29
>3	21	53	
Parity: Primiparous	49	199	0.07
Multiparous (2)	34	90	
Multiparous (≥3)	26	60	
Mother's occupation			
Housewife/self-employed	75	214	0.42
Government employment	26	105	
Private employment	8	27	
Studying	0	3	
Husband's occupation			
Unemployed	3	7	0.19
Government employment	41	176	
Private employment	61	164	
Studying	0	1	
Household annual income			
<MVR 90,000 (<A$6,209)	38	72	**0.001**
MVR 90,000-250,000 (A$6,209-17,249)	67	231	
>MVR 250,000 (>A$17, 249)	4	46	

Chi-square test between EPDS ≥ 13 and demographic factors

Table 4.28 shows factors associated with antenatal depression. Chi-square results indicated that the significant factors associated with antenatal depression were 'being divorced', 'lower maternal education' and 'lower household income'. Note that the number of those 'divorced' was very small.

Table 4.29 Maternal factors associated with antenatal depression

Variables	**EPDS≥13**	**EPDS<13**	**p-value**
Maternal weight at one month after delivery			
≤ 65 kg	39	134	0.72
> 65 kg	19	73	
Maternal weight at three months after delivery			
≤ 65 kg	50	153	0.53
> 65 kg	12	46	
Maternal weight at six months after delivery			
≤ 65 kg	52	162	0.49
> 65 kg	12	48	
Smoked before pregnancy			
Yes	7	8	**0.034**
No	102	341	
Smoked during pregnancy			
Yes	1	1	0.383
No	108	348	
Husband smoked before pregnancy			
Yes	55	142	0.07
No	54	207	
Husband smoked during pregnancy			
Yes	48	125	0.1
No	61	224	
Received help in looking after children and in household chores			
Yes	85	315	**0.001**
No	24	34	
Husband helped			
Yes	45	168	0.21
No	64	181	
Maternal mother helped			
Yes	45	166	0.25
No	64	183	
Paternal mother helped			
Yes	25	95	0.38
No	84	254	
Other family members helped			
Yes	51	179	0.41
No	58	170	
Babysitter helped			
Yes	3	10	0.63
No	106	339	
Servant helped			
Yes	1	8	0.33
No	108	341	
Had stressful life event			
Yes	17	7	**<0.001**
No	92	342	

Chi-square test between EPDS ≥ 13 and maternal factors

Table 4.29 shows the maternal factors associated with antenatal depression. Maternal factors which were significantly associated with antenatal depression were smoking before pregnancy, having received no help in looking after children from at least one person, and having stressful life events. Maternal weight, maternal smoking during pregnancy and husband's smoking were not associated with antennal depression. Not receiving help from a certain person also was not associated with antenatal depression.

Table 4.30 Feeding methods at one month associated with antenatal depression

Variable	**36 week of pregnancy**		
	EPDS≥13	**EPDS<13**	**p-value**
Initiation of breastfeeding			
Immediately after birth (< 1 hour)	86	278	**0.001**
Within 4 hours	3	39	
After 4 hours	13	15	
Feeding method:			
Exclusive breastfeeding at one month			
Yes	25	87	0.73
No	77	245	
Full breastfeeding at one month			
Yes	68	223	0.93
No	34	109	
Any breastfeeding at one month			
Yes	1	4	0.85
No	102	328	
Formula feeding at one month			
Yes	27	93	0.76
No	75	239	
Introduction of water at one month			
Yes	24	55	0.11
No	78	277	

Chi-square test between EPDS ≥ 13 and feeding methods

Table 4.30 shows the infant feeding methods, at one month, that were associated with antenatal depression. Depression at 36 weeks of pregnancy was associated with late initiation of breastfeeding. Antenatal depression did not have any significant association with infant feeding methods at one month after birth.

Table 4.31 Infant feeding attitudes and knowledge associated with antenatal depression

Variable	36 weeks of pregnancy		
	EPDS≥13	**EPDS<13**	**p-value**
IIFAS scores			
Low (17 to 48)	-	-	
Medium (49 to 69)	37 (25.6%)	107 (74.3%)	0.55
High (70 to 85)	72 (23.9%)	239 (76.8%)	
Intention to breastfeed: Baby's father wants it			
Yes	5 (21.7%)	18 (78.3%)	0.8
No	104 (23.9%)	331(76.1%)	
Breastmilk is better for baby			
Yes	104 (23.4%)	341 (76.6%)	0.21
No	5 (38.5%)	8 (61.5%)	
Islam recommends breastfeeding			
Yes	38 (19.1%)	161 (80.9%)	**0.038**
No	71 (27.4%)	188 (72.6%)	
Breastmilk is cheaper			
Yes	6 (20%)	24 (80%)	0.61
No	103 (24.1%)	325 (75.9%)	
Breastfeeding makes babies intelligent			
Yes	35 (20.8%)	133 (79.2%)	0.26
No	74 (25.5%)	216 (74.5%)	
Helps mothers to lose weight			
Yes	12 (14.8%)	69 (85.2%)	**0.036**
No	97 (25.7%)	280 (74.3%)	
Breastfeeding is natural			
Yes	26 (17.8%)	120 (82.2%)	**0.039**
No	83 (26.6%)	229 (73.4%)	
Breastfed infants have fewer infections			
Yes	46 (21.6%)	167 (78.4%)	0.31
No	63 (25.750	182 (74.3%)	
Breastfeeding is more convenient			
Yes	8 (18.6%)	35 (81.4%)	0.59
No	101 (24.3%)	314 (75.7%)	
Others suggest breastfeeding			
Yes	1 (6.7%)	14 (93.3%)	0.11
No	108 (24.4%)	335 (75.6%)	

Chi-square test between EPDS ≥ 13 and feeding knowledge

Table 4.31 shows the association of antenatal depression with knowledge and attitudes in regard to infant feeding. There was no significant association with antenatal depression according to the IIFAS scores. However, there was a higher percentage of mothers in the group of medium IIFAS scores for depression compared with mothers in the high IIFAS scores group (25.6% vs. 23.9%). There was a significant association between the mothers who did not have antenatal depression and the mothers who intended to breastfeed for the reasons; ‘Islam recommends breastfeeding’, ‘breastfeeding helps mothers to lose weight’ and ‘breastfeeding is natural’. All other reasons for breastfeeding intention were not significantly associated with depression. There was a lower percentage of mothers with depression in the group of mothers whose attitudes were positive, compared with mothers whose attitudes were negative, about reasons for intending to breastfeed.

Table 4.32 Infant variables associated with antenatal depression

Variable	**36 weeks antenatal**		
	EPDS≥13	**EPDS<13**	**p-value**
Type of delivery			
Vaginal	59	180	0.52
Caesarean	43	152	
Birth Weight (Full term infants)			
<2,500g	5	17	0.84
2,500-3,900g	95	304	
≥4,000g	2	10	
Infant boys’ weight at one month			
<3,300g (-2 z score)	2	10	0.65
3,300-5,700g	44	153	
>5,700g (+2 z score)	-	-	
Infant boys’ weight at three months			
<5,000g (-2 z score)	4	10	0.56
5,000-8,000g	41	147	
>8,000(+2 z score)	-	-	
Infant boys’ weight at six months			
<6,300g (-2 z score)	5	8	0.34
6,300-9,800g	40	142	
>9,800g (+2 z score)	-	-	
Infant boys’ length at one month			
<50.5cm (-2 z score)	5	10	0.33
50.5-58.2 cm	31	120	
>58.2cm (+2 z score)	1	1	
Infant boys’ length at three months			
<57.2 (-2 z score)	5	22	0.59
57.2 -65.5	36	119	
>65.5 (+2 z score)	-	-	
Infant boys’ length at six months			
<63.2 cm (-2 z score)	7	26	0.18
63.2-71.8 cm	33	113	
>71.8 cm (+2 z score)	0	1	

Table 4.33 Infant variables associated with antenatal depression (cont.)

Variable	36 weeks antenatal		
	EPDS≥13	EPDS<13	p-value
Infant girls' weight at one month			
<3,100g (-2 z score)	2	4	0.75
3,100-5,400g	51	156	
>5,400g (+2 z score)	0	1	
Infant girls' weight at three months			
<4,500g (-2 z score)	0	3	0.51
4,500-7,500g	53	154	
>7,500 (+2 z score)	0	1	
Infant girls' weight at six months			
<5,700g (-2 z score)	0	6	0.30
5,700-9,300g	53	151	
>9300g (+2 z score)	0	1	
Infant girls' length at one month			
<49.5cm (-2 z score)	1	9	0.44
49.5-57.3 cm	47	120	
>57.3cm (+2 z score)	1	2	
Infant girls' length at three months			
<55.6 (-2 z score)	4	18	0.31
55.6 -64.0	48	116	
>64.0 (+2 z score)	0	3	
Infant girls' length at six months			
<61.0 cm (-2 z score)	1	7	0.33
61.0-70.1 cm	52	132	
>70.1 cm (+2 z score)	-	-	
Infants who had diarrhoea			
Yes	7	22	0.93
No	95	310	
Infants who had ARI			
Yes	30	101	0.85
No	72	231	
Infants who had other health problems			
Yes	2	7	0.91
No	107	342	

Chi-square test between EPDS ≥ 13 and infant variable

Table 4.32 and 4.33 show the infant variables associated with antenatal depression. Antenatal depression at 36 weeks of pregnancy did not have a significant effect on the type of delivery, birth weight or weight/length of the infant at one month or at three months. There were no significant associations between antennal depression and infants having diarrhoea, acute respiratory infections and 'other health problems' (vomiting, constipation and digestive problems).

4.2.2 Multivariate analysis

The multivariate logistic regression model was used to explore the significant risk factors associated with antenatal depression. The significant results from cross tabulation and from the literature were put into the model. A separate multivariate logistic regression model was used to explore the association between antennal depression and infant feeding outcomes. The factors included in the full model were 'marital status', 'mother's education', 'smoking before pregnancy', received help in looking after children and in household chores', 'had stressful life events', 'parity' and 'household annual income'. Backward stepwise entry was engaged.

Table 4.34 Risk factors for antenatal depression

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Marital status				
Married	1		1	
Divorced	13.3	(1.5 – 119.9)*	4.2	(0.4 – 47.1)
Mother's education				
Primary or lower	1		1	
Secondary and higher	0.5	(0.3 – 0.8)**	0.7	(0.4 – 1.2)
Smoking before pregnancy				
Yes	1		1	
No	0.34	(0.1 – 0.96)*	0.6	(0.2 – 2.0)
Received help in looking after children and in household chores				
Yes	1		1	
No	2.6	(1.5 – 4.6)**	2.3	(1.2 – 4.3)*
Had stressful life event				
Yes	9.0	(3.6 – 22.4)***	6.7	(2.5 – 17.5)***
No	1		1	
Parity				
Primiparous	1		1	
Multiparous (2)	1.5	(0.9 – 2.5)	1.3	(0.7 – 2.2)
Multiparous (≥3)	1.8	(1.0 – 3.1)*	0.9	(0.5 – 1.9)
Household annual income				
<MVR 90,000 (<A$6209)	6.0	(2.0 – 18.1)**	4.1	(1.3 – 12.8)*
MVR 90,000-250,000 (A$6,209-7,249)	3.3	(1.2 – 9.6)	2.8	(0.97 – 8.2)
>MVR 250,000 (>A$17, 249)	1		1	

-2 Log likelihood (deviance) 453.911 df=6*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.34 shows the multivariate analysis of risk factors associated with antenatal depression. After adjustment for confounding factors, the significant risk factors for antenatal depression were 'not receiving help in looking after children and in household chores' (adjusted OR=2.3; 95% CI, 1.2-4.3), 'having stressful life event' (adjusted OR=6.7; 95% CI, 2.6-17.5) and 'a household annual income lower than MVR 90,000' (adjusted OR=4.1; 95% CI, 1.3-12.8).

Table 4.35 Antenatal depression and infant feeding outcomes in the first month

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Initiation of breastfeeding				
Immediately after birth (< 1 hour)	1		1	
Within 4 hours	0.2	(0.1 – 0.8)**	0.3	(0.1 – 0.8)*
After 4 hours	2.8	(1.3 – 6.1)*	3.0	(1.3 – 6.8)**
Feeding method:				
Exclusive breastfeeding at one month				
Yes	1		1	
No	1.02	(0.6 – 1.7)	1.02	(0.6 – 1.8)
Full breastfeeding at one month				
Yes	1		1	
No	1.01	(0.6 – 1.6)	1.4	(0.5 – 3.6)
Any breastfeeding at one month				
Yes	1		1	
No	0.8	(0.1 – 7.3)	1.2	(0.1 – 11.3)
Formula feeding at one month				
Yes	1		1	
No	0.6	(0.3 – 1.7)	0.6	(0.2 – 1.6)

-2 Log likelihood (deviance) 449.147 df=8*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.35 above, shows that the only infant feeding outcome that was significantly associated with antenatal depression was 'late initiation of breastfeeding'. The factors included in the full model were 'initiation of breastfeeding', 'exclusive breastfeeding', 'full breastfeeding', 'any breastfeeding' and 'formula feeding'. Mothers with an EPDS score above or equal to 13 were more likely to initiate breastfeeding after four hours (adjusted OR= 3.0; 95% CI, 1.3 – 6.8) compared with mothers who had an EPDS score less than 13. Antenatal depression did not have any effect on 'exclusive breastfeeding', 'full breastfeeding' or 'any breastfeeding' at one month after delivery.

4.3 Factors associated with postnatal depression

4.3.1 Cross tabulation

Table 4.36 Demographic factors associated with postnatal depression

Variable	**One month**			**Three months**			**Six months**		
	EPDS≥13	**EPDS<13**	**p-value**	**EPDS≥13**	**EPDS<13**	**p-value**	**EPDS≥13**	**EPDS<13**	**p-value**
Mother's age, years: <30	25	71	0.86	40	294	0.89	9	351	0.73
≥30	91	247		11	85		2	91	
Marital status: Married	111	318	**0.01**	48	377	**0.01**	9	404	**0.04**
Divorced	5	0		3	2		2	2	
Mother's education: Primary or lower	25	49	0.13	12	60	0.17	4	67	0.08
Secondary and higher	91	269		39	319		7	339	
Type of accommodation: Rented	46	142	0.35	26	161	0.25	4	176	0.64
Own place	70	176		25	218		7	230	
Number of people living in a room: ≤3	98	264	0.77	43	315	0.86	9	338	0.88
>3	18	53		8	63				
Parity: Primiparous	58	178	0.23	24	210	0.38	3	224	0.18
Multiparous (2)	30	86		14	101		5	107	
Multiparous (≥3)	28	54		13	68		3	75	
Mother's occupation: Housewife/self-employed	78	197	0.76	36	235	0.53	8	253	0.77
Government employment	28	94		13	110		3	118	
Private employment	8	25		2	31		0	32	
Studying	1	2		0	3		0	3	
Husband's occupation: Unemployed	46	160	0.30	2	8	0.75	0	9	0.11
Government employment	61	151		21	184		1	200	
Private employment	4	6		25	184		8	194	
Studying	0	1		0	1		0	1	
Annual household income									
<MVR 90,000 (<A$6,209)	41	65	**0.005**	19	86	**0.016**	6	95	**0.045**
MVR 90,000-250,000 (A$6,209-17,249)	66	214		31	247		5	265	
>MVR 250,000 (>A$17, 249)	9	39		1	46		0	46	

Chi-square test between EPDS ≥ 13 postnatal and demographic factors

Table 4.37 Maternal factors associated with postnatal depression

Variables	EPDS≥13	EPDS<13	p-value	EPDS≥13	EPDS<13	p-value	EPDS≥13	EPDS<13	p-value
Maternal weight at one month after delivery: ≤ 65 kg	43	130	0.87	17	156	0.57	3	168	0.57
> 65 kg	22	70		7	84		1	89	
Maternal weight at three months after delivery: ≤ 65 kg	57	146	0.26	26	177	**0.03**	4	197	0.69
> 65 kg	12	46		2	56		1	56	
Maternal weight at six months after delivery: ≤ 65 kg	63	151	0.15	26	188	0.08	5	209	0.60
> 65 kg	12	48		3	57		1	59	
Smoked before pregnancy: Yes	7	8	0.08	4	11	0.09	1	14	0.34
No	109	310		47	368		10	392	
Smoked during pregnancy: Yes	0	2	0.54	0	2	0.78	0	2	0.82
No	116	316		51	377		11	404	
Husband smoked before pregnancy: Yes	51	136	0.82	22	162	0.96	6	173	0.43
No	65	182		29	217		5	233	
Husband smoked during pregnancy: Yes	47	119	0.56	19	144	0.92	6	152	0.25
No	69	199		32	235		5	254	
Received help in looking after children and in household chores: Yes	97	283	0.1	39	388	**0.01**	7	359	**0.01**
No	19	35		12	41		4	47	
Husband helped: Yes	53	147	0.92	22	177	0.63	6	186	0.57
No	63	171		29	202		5	220	
Maternal mother helped: Yes	50	151	0.42	17	182	**0.048**	2	190	**0.05**
No	66	167		34	197		9	216	
Paternal mother helped: Yes	36	80	0.22	13	102	0.83	2	111	0.39
No	80	238		38	277		9	295	
Other family members helped: Yes	60	56	0.89	29	22	0.43	4	214	0.22
No	162	156		193	186		7	192	
Babysitter helped: Yes	3	8	0.60	2	9	0.38	0	11	0.74
No	113	310		49	370		11	395	
Servant helped: Yes	1	8	0.26	1	8	0.71	0	8	0.80
No	115	310		50	371		11	398	
Had stressful life event: Yes	19	5	**<0.001**	11	13	**<0.001**	3	21	**0.02**
No	97	313		40	366		8	385	

Chi-square test between EPDS ≥ 13 postnatal and maternal factors

Table 4.36 shows that the demographic factors which were associated with postnatal depression at one month, three months and six months were ‘being divorced’ and ‘having lower annual household income’. ‘Mother’s age’, ‘education level’, ‘type of accommodation’, ‘number of people living in a room’, ‘parity’, ‘mother’s occupation’ and ‘husband’s occupation’ were not associated with postnatal depression.

Table 4.37 shows that the only maternal factor which was associated with depression at one month after delivery was having a stressful life event. ‘Maternal weight’, ‘smoking status’ and ‘not receiving help from anyone in looking after children and household chores’ were not associated with depression at one month. At three months after delivery, the factors which were associated with postnatal depression were ‘maternal weight at three months’, ‘not receiving help from anyone in looking after children and household chores’, ‘not receiving help from maternal mother’, and ‘having stressful life events’. ‘Smoking status’ and ‘not receiving help from other people’ were not associated with postnatal depression at three months after delivery. The factors associated with depression at six months after delivery were ‘not receiving help from anyone’, ‘not receiving help from maternal mother’ and ‘having stressful life events’. No other factors were associated with postnatal depression at six months after delivery.

4.3.2 Multivariate analysis

Three different multivariate logistic regression models were used to explore the significant factors associated with postnatal depression at one month, three months and six months after giving birth. The significant results from cross tabulation and from the literature were put into these three full models. The significant infant variables identified from the cross tabulation also were combined in the same model, along with demographic factors and maternal variables. The factors included in the full model were ‘antenatal depression’, ‘maternal weight’, ‘received help in looking after children and household chores’, ‘had stressful life events’, ‘parity’, ‘type of accommodation’, ‘number of people living in a room’, ‘household annual income’ and ‘other infant health problems’. The table for six months postnatal is not discussed as there were no significant risk factors associated with depression at six months. The association between postnatal depression and feeding methods will be discussed in the next section, in the survival analysis.

Table 4.38 Risk factors for postnatal depression at one month after delivery

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Antenatal depression				
Yes	9.7	(5.9–16.0)***	12.6	(6.1–26.4)***
No	1		1	
Maternal weight				
≤ 65 kg	1		1	
> 65 kg	0.9	(0.5 – 1.7)	0.7	(0.2 – 1.6)
Received help in looking after children and in household chores				
Yes	1		1	
No	1.5	(0.9 – 2.9)	0.9	(0.3 – 2.8)
Had stressful life event				
Yes	12.3	(4.5–33.7)***	7.7	(1.7 – 33.9)**
No	1		1	
Parity				
Primiparous	1		1	
Multiparous (2)	1.1	(0.6 – 1.8)	0.78	(0.3 – 1.8)
Multiparous (≥3)	1.6	(0.9 – 2.7)	2.1	(0.7– 6.2)
Type of accommodation				
Rented	1		1	
Own place	1.2	(0.8 – 1.9)	0.95	(0.5 – 2.0)
Number of people living in a room				
≤3	1		1	
>3	0.9	(0.5 – 1.6)	0.5	(0.2 – 1.9)
Household annual income				
<MVR 90,000 (<A$6,209)	2.7	(1.2 – 6.2)*	2.2	(0.6 – 6.1)
MVR 90,000-250,000 (A$6,209-7,249)	1.3	(0.6 – 2.9)	1.8	(0.6 – 8.6)
>MVR 250,000 (>A$17, 249)	1		1	
Other infant health problems				
Yes	3.5	(0.9 - 13.4)	2.9	(0.3 –23.4)
No	1		1	

-2 Log likelihood (deviance) 217.149 df=8*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.38 shows the risk factors associated with postnatal depression at one month. After adjustment for confounding factors, the results were 'being depressed during pregnancy' (adjusted OR=12.6; 95% CI, 6.1 – 26.4) and 'having stressful life events' (adjusted OR=7.7; 95% CI, 1.7 – 33.9) 'Household annual income' was not significant after adjustment for covariates. Other factors that were not statistically significant include ‘maternal weight’, ‘receiving help’, ‘parity’, ‘type of accommodation’, ‘other infant problems’ and ‘number of people living in a room’.

Table 4.39 Risk factors for postnatal depression at three months after delivery

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Maternal weight				
≤ 65 kg	1		1	
> 65 kg	0.2	(0.6 – 1.0)	0.2	(0.04 – 1.0)
Received help in looking after children and in household chores				
Yes	1		1	
No	2.5	(1.2 – 5.2)*	0.8	(0.2 – 3.3)
Had stressful life event				
Yes	7.7	(3.2– 18.4)***	10.0	(3.2– 31.0)***
No	1		1	
Parity				
Primiparous	1		1	
Multiparous (2)	1.2	(0.6 – 2.4)	0.8	(0.3 – 2.4)
Multiparous (≥3)	1.6	(0.8 – 3.5)	1.2	(0.3 – 4.4)
Type of accommodation				
Rented	1		1	
Own place	0.7	(0.4 – 1.3)	0.57	(0.2 – 1.3)
Number of people living in a room				
≤3	1		1	
>3	0.9	(0.4 – 2.0)	1.5	(0.3 – 5.9)

-2 Log likelihood (deviance) 154.075 df=6*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.39 shows the factors associated with depression at three months. The factors included in the full model were ‘marital status’, ‘maternal weight’, ‘received help in looking after children and in household chores’, ‘received help in looking after children and in household chores from maternal mother’ ‘stressful life events’, ‘parity’, ‘type of accommodation’ and ‘number of people living in a room’. After adjustment for confounding factors, the only risk factor for postnatal depression at three months is ‘having stressful life events’ (adjusted OR=10.0; 95% CI, 3.2-31.0). Depression at three months was not associated maternal weight, ‘number of children’, ‘type of accommodation’ or ‘the number of people sleeping in the room’.

4.4 Postnatal depression and feeding methods

4.4.1 Cross tabulation

Table 4.40 shows the relationships of depression with feeding methods. Full breastfeeding at one month was significantly associated with mothers being depressed at six months. All other feeding methods were not associated with depression. However, the percentage of mothers with depression was higher in the group who formula fed their infants compared with mothers who didn't give infant formula at one month (33.3% vs. 25.5%). The percentage of mothers who were depressed at three months also was higher in the group who gave infant formula compared with mothers who did not give infant formula at one month (15.2% vs. 11.3%). The percentage of mothers who had depression at one month also was considerably higher in the group that didn't give any breastmilk compared with mothers who breastfed at one month (40.0% vs.26.5%). The mothers who stopped breastfeeding, compared with the mothers who were still breastfeeding at six months, were more highly represented in the depression group at three months (18.4% vs. 11.1%).

Table 4.40 Feeding methods associated with postnatal depression

Variables	EPDS≥13	EPDS<13	p-value	EPDS≥13	EPDS<13	p-value	EPDS≥13	EPDS<13	p-value
Initiation of breastfeeding									
Immediately after birth (<1 hour)	98 (26.9%)	266 (73.1%)	0.89	-	-	-	-	-	-
Within 4 hours	10 (13.8%)	32 (76.2%)		-	-	-	-	-	-
After 4 hours	8 (28.6%)	20 (71.4%)		-	-	-	-	-	-
Feeding method at one month									
Exclusive breastfeeding: Yes	30 (26.8%)	82 (73.2%)	0.54	14 (12.6%)	97 (87.4%)	0.45	1 (2.2%)	106 (97.8%)	0.19
No	86 (26.7%)	236 (73.3%)		37 (11.6%)	282 (88.4%)		10 (3.5%)	300 (96.4%)	
Full breastfeeding: Yes	77 (26.1%)	216 (73.9%)	0.68	35 (11.8%)	255 (88.2%)	0.96	7 (2.9%)	273 (97.1%)	0.39
No	39 (28.0%)	102 (72.0%)		16 (12.0%)	124 (88.0%)		4 (2.5%)	133 (97.5%)	
Any breastfeeding: Yes	114 (26.5%)	315 (73.4%)	0.50	50 (11.7%)	376 (88.3%)	0.41	11 (2.7%)	402 (97.3%)	0.74
No	2 (40.0%)	3 (60.0%)		1 (25.0%)	3 (75.0%)		0 (0.0%)	4 (100%)	
Formula feeding: Yes	22 (33.3%)	44 (66.7%)	0.18	10 (15.2%)	56 (84.8%)	0.37	2 (3.1%)	62 (96.9%)	0.79
No	94 (25.5%)	274 (74.5%)		41 (11.3%)	323 (88.7%)		9 (2.5%)	344 (97.5%)	
Feeding method at three months									
Exclusive breastfeeding: Yes	17 (23.9%)	54 (76.1%)	0.55	6 (8.5%)	65 (91.5%)	0.33	0 (2.6%)	66 (97.1%)	0.15
No	99 (27.3%)	263 (72.7%)		45 (12.5%)	314 (87.5%)		11 (2.9%)	340 (97.4%)	
Full breastfeeding: Yes	59 (26.1%)	167 (73.9%)	0.73	22 (9.8%)	203 (90.2%)	0.16	2 (0.9%)	215 (99.1%)	**0.02**
No	57 (27.5%)	150 (72.5%)		29 (14.1%)	176 (85.9%)		9 (4.5%)	191 (95.5%)	
Any breastfeeding: Yes	112 (27.1%)	301 (72.9%)	0.48	49 (10.5%)	362 (89.5%)	0.85	11 (2.8%)	387 (97.2%)	0.46
No	4 (20.0%)	16 (80.0%)		2 (11.9%)	17 (88.1%)		0 (0.0%)	19 (100%)	
Formula feeding: Yes	23 (23.5%)	75 (76.5%)	0.38	13 (13.4%)	84 (86.6%)	0.59	4 (4.3%)	89 (95.7%)	0.26
No	93 (27.9%)	240 (72.1%)		38 (11.4%)	295 (88.6%)		7 (2.2%)	317 (97.8%)	
Feeding method at six months									
Exclusive breastfeeding: Yes	9 (28.1%)	23 (71.9%)	0.87	4 (12.5%)	28 (87.5%)	0.93	0 (0.0%)	11 (100%)	0.33
No	106 (26.8%)	290 (73.2%)		47 (12.0%)	346 (88.0%)		32 (2.9%)	374 (97.1%)	
Full breastfeeding: Yes	33 (26.0%)	94 (74.0%)	0.79	13 (10.3%)	113 (89.7%)	0.49	1 (0.8%)	122 (99.2%)	0.13
No	82 (27.2%)	219 (72.8%)		38 (12.7%)	261 (87.3%)		10 (3.4%)	284 (96.6%)	
Any breastfeeding: Yes	101 (26.6%)	278 (73.4%)	0.58	42 (11.1%)	337 (88.9%)	0.18	10 (2.6%)	369 (97.4%)	0.99
No	12 (30.8%)	27 (69.2%)		7 (18.4%)	31 (81.6%)		1 (2.6%)	37 (97.4%)	
Formula feeding: Yes	58 (27.4%)	154 (72.6%)	0.90	21 (9.9%)	191 (90.1%)	0.23	7 (3.3%)	205 (96.7%)	0.39
No	55 (26.8%)	150 (73.2%)		28 (13.7%)	177 (86.3%)		4 (2.0%)	201 (98.0%)	

Chi-square test between EPDS ≥ 13 postnatal and feeding methods

Table 4.41 Breastfeeding knowledge, attitudes and postnatal depression at three months

Variables	**EPDS≥13**	**EPDS<13**	**p-value**
IIFAS scores: Low (17 to 48)	-	-	
Medium (49 to 69)	10 (13.7%)	63 (86.3%)	0.58
High (70 to 85)	39 (11.4%)	304 (88.6%)	
Reasons for breastfeeding			
Baby's father wants it: Yes	2 (8.7%)	21 (91.3%)	0.63
No	49 (12.1%)	357 (87.9%)	
Breastmilk is better for baby: Yes	49 (12.0%)	359 (88.0%)	0.73
No	2 (9.5%)	19 (90.5%)	
Islam recommends breastfeeding: Yes	16 (9.9%)	169 (90.9%)	0.14
No	35 (13.8%)	218 (86.2%)	
Breastmilk is cheaper: Yes	0 (0%)	26 (100%)	**0.03**
No	51 (12.7%)	352 (87.3%)	
Breastfeeding makes babies intelligent: Yes	11 (8.0%)	126 (92%)	0.09
No	40 (13.7%)	252 (86.3%)	
Helps mothers to lose weight: Yes	3 (4.5%)	64 (95.5%)	**0.03**
No	48 (13.3%)	314 (86.7%)	
Breastfeeding is natural: Yes	7 (5.3%)	124 (94.7%)	**0.005**
No	44 (14.8%)	254 (85.2%)	
Breastfed infants have fewer infections: Yes	21 (10.2%)	185 (89.8%)	0.30
No	30 (13.5%)	193 (86.5%)	
Breastfeeding is more convenient: Yes	0 (0%)	34 (100%)	**0.01**
No	51 (12.9%)	344 (87.1%)	
Others suggest breastfeeding: Yes	1 (6.25%)	15 (93.8%)	0.48
No	50 (12.1%)	363 (87.9%)	

Chi-square test between EPDS ≥ 13 postnatal depression, feeding attitudes and reasons for breastfeeding

Table 4.41 shows the associations between postnatal depression and the reasons why mothers were breastfeeding at three months. There was a significantly higher percentage of depressed mothers who answered negatively to the reasons for choosing to breastfeed: 'breastfeeding is cheap', 'breastfeeding helps mothers to lose weight', 'breastfeeding is natural' and 'breastfeeding is convenient' compared with mothers who gave positive reasons. In general, although not significant, the percentage of depressed mothers was higher in groups with mothers who answered negatively to the reasons for breastfeeding.

Table 4.42 Early complementary feeding and postnatal depression (Chi-square tests)

Variables	EPDS≥13	EPDS<13	p-value	EPDS≥13	EPDS<13	p-value	EPDS≥13	EPDS<13	p-value
Introduction of water at one month									
Yes	27 (34.2%)	52 (65.8%)	0.09	14 (18.2%)	63 (81.8%)	0.058	3 (3.9%)	73 (96.1%)	0.43
No	89 (25.1%)	266 (74.9%)		37 (10.5%)	316 (89.5%)		8 (2.3%)	333 (97.7%)	
Introduction of water at three months									
Yes	48 (32.2%)	101 (67.8%)	0.07	24 (16.1%)	125 (83.9%)	**0.047**	7 (4.9%)	137 (95.1%)	**0.04**
No	68 (24.1%)	214 (75.9%)		27 (9.6%)	254 (90.4%)		4 (1.5%)	269 (98.5%)	
Introduction of fruits at one month									
Yes	3 (75%)	1 (25%)	**0.03**	2 (50.0%)	2 (50.0%)	**0.02**	0 (0.0%)	4 (100%)	0.74
No	113 (26.3%)	317 (73.7%)		49 (11.5%)	377 (88.5%)		11 (2.7%)	402 (97.3%)	
Introduction of fruits at three months									
Yes	3 (60%)	2 (40%)	0.09	0 (0%)	5 (100%)	0.41	0 (0.0%)	5 (100%)	
No	113 (26.5%)	313 (73.5%)		51 (12.0%)	374 (88.0%)		11 (2.7%)	401 (97.3%)	0.71
Introduction of vegetables at one month									
Yes	2 (66.7%)	1 (11.3%)	0.11	0 (0%)	3 (100%)	0.52	0 (0%)	3 (100%)	0.78
No	114 (26.5%)	317 (73.5%)		51 (11.9%)	376 (88.1%)		11 (2.7%)	403 (97.3%)	
Introduction of vegetables at three months									
Yes	2 (100%)	0 (0%)	**0.02**	0 (0%)	2 (100%)	0.60	0 (0%)	2 (100%)	0.81
No	114 (26.6%)	315 (73.4%)		51 (11.9%)	377 (88.1%)		11(2.7%)	404 (97.3%)	
Introduction of rice at one month									
Yes	2 (100%)	0 (0%)	**0.02**	1 (50%)	1 (50%)	0.10	0 (0.0%)	2 (100%)	0.82
No	114 (26.4%)	318 (73.6%)		50 (11.7%)	378 (88.3%)		11 (2.7%)	404 (97.3%)	
Introduction of rice at three months									
Yes	1 (100%)	0 (0%)	0.10	0 (0%)	1 (100%)	0.71	0 (0.0%)	1 (100%)	0.87
No	115 (26.7%)	315 (73.3%)		51 (11.9%)	378 (88.1%)		11 (2.7%)	405 (97.3%)	
Introduction of cereals at one month									
Yes	1 (33.3%)	2 (66.7%)	0.8	1 (33.3%)	2 (66.7%)	0.25	0 (0%)	3 (100%)	0.78
No	115 (26.7%)	316 (73.3%)		50 (11.7%)	377 (88.3%)		11 (2.7%)	403 (97.3%)	
Introduction of cereals at three months									
Yes	1 (50%)	1 (50%)	0.46	1 (50%)	1 (50%)	0.10	0 (0%)	2 (100%)	0.82
No	115 (26.8%)	314 (74.2%)		50 (11.7%)	378 (88.3%)		11 (2.7%)	404 (97.3%)	

Chi-square test between EPDS ≥ 13 postnatal depression, feeding attitudes and reasons for breastfeeding

Table 4.42 shows the associations between depression and the introduction of complementary food. The mothers who were depressed at three months and six months were significantly more likely to give water to their infants at three months after birth. There was also a significant association between mothers who were depressed at one and three months and the introduction of fruits in the first month. Mothers who were depressed at one month were significantly more likely to introduce vegetables at three months. Mothers who gave rice at one month were significantly more likely to be depressed at one month. No significant association was found between depression and introduction of cereals.

4.4.2 Survival analysis

Figure 4.1 Plot of the Survival Functions of 'exclusive breastfeeding' at 180 days between mothers who were depressed and not depressed.

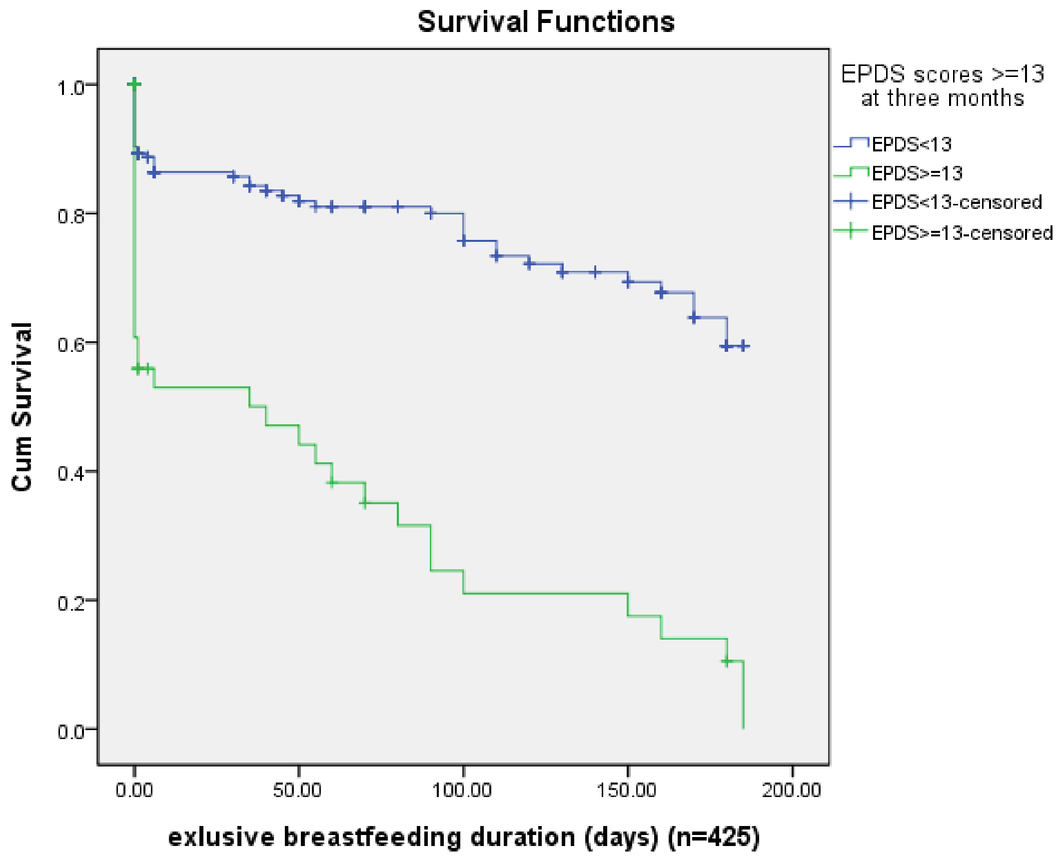


Fig 4.1 shows that there was a statistically significant difference (log rank chi-square 64.4, df 1, p<0.001) in the duration of 'exclusive breastfeeding' between mothers who were depressed and not depressed at three months after delivery. Mothers who had an EPDS score more than or equal to 13 had a shorter duration of 'exclusive breastfeeding' when compared with mothers with an EPDS score less than 13.

Figure 4.2 Plot of the Survival Functions of 'full breastfeeding' at 180 days between mothers who were depressed and not depressed.

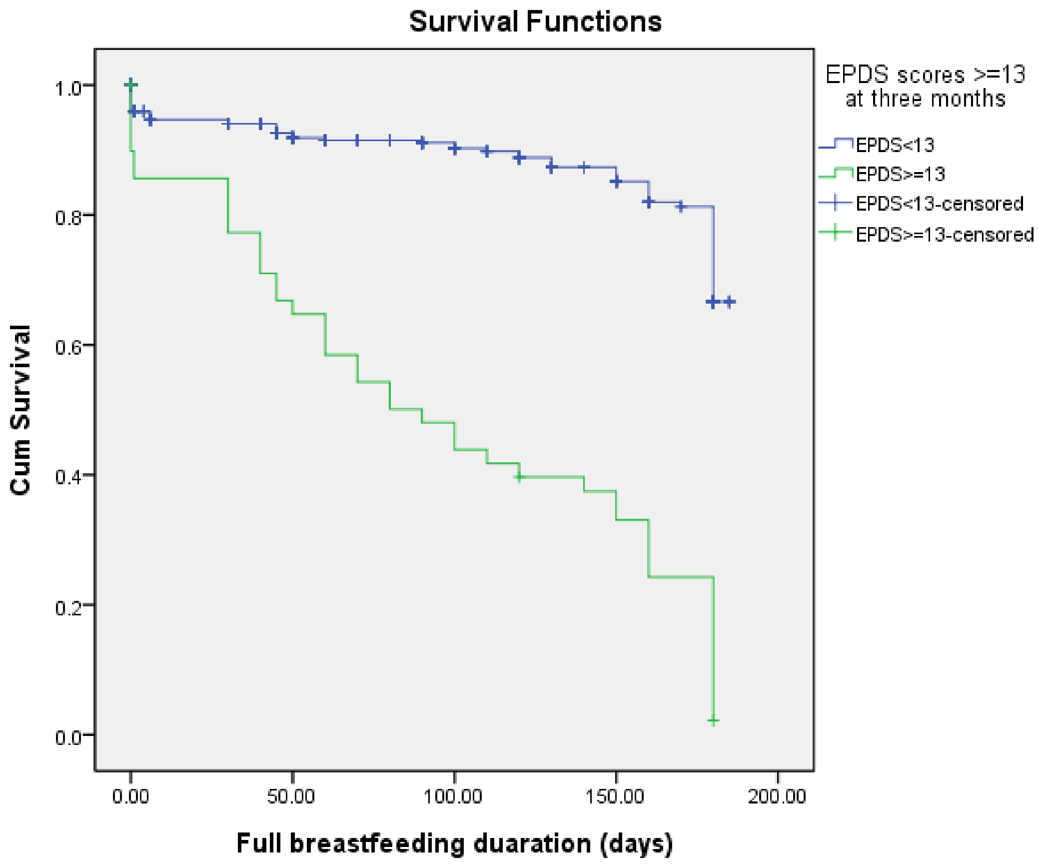


Fig 4.2, above, shows that there was a statistically significant difference (log rank chi-square 120.6, df 1, p<0.001) in the duration of 'full breastfeeding' between mothers who were depressed and not depressed. Mothers who had an EPDS score of more than or equal to 13 had a shorter duration of 'full breastfeeding' when compared with mothers with an EPDS score less than 13.

Figure 4.3 Plot of the Survival Functions of 'any breastfeeding' at 180 days between mothers who were depressed and not depressed.

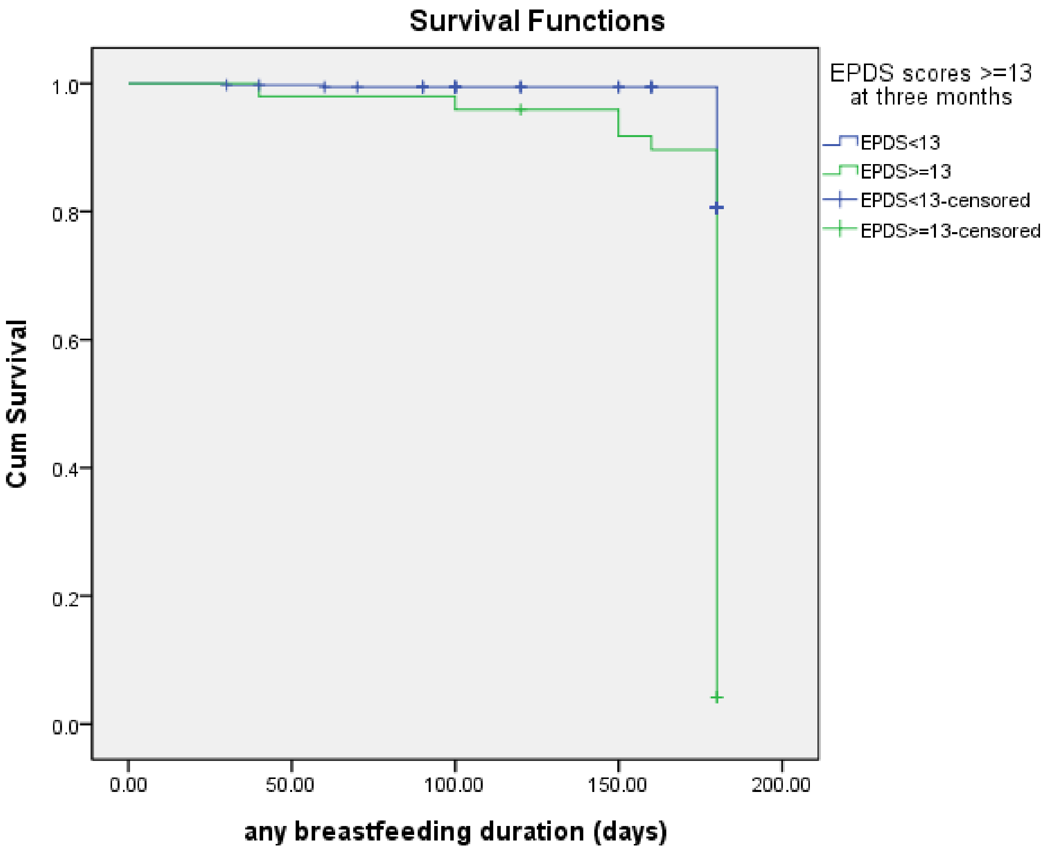


Fig 4.3 shows that there was a statistically significant difference (log rank chi-square 133.0, df 1, p<0.001) in the duration of 'any breastfeeding' between mothers who were depressed and not depressed at three months after delivery. Mothers who had an EPDS score of more than or equal to 13 had a shorter duration of 'any breastfeeding' when compared with mothers with an EPDS score less than 13.

Figure 4.4 Plot of the Survival Functions of 'full breastfeeding' at 180 days between mothers who were living in Malé and other islands after birth.

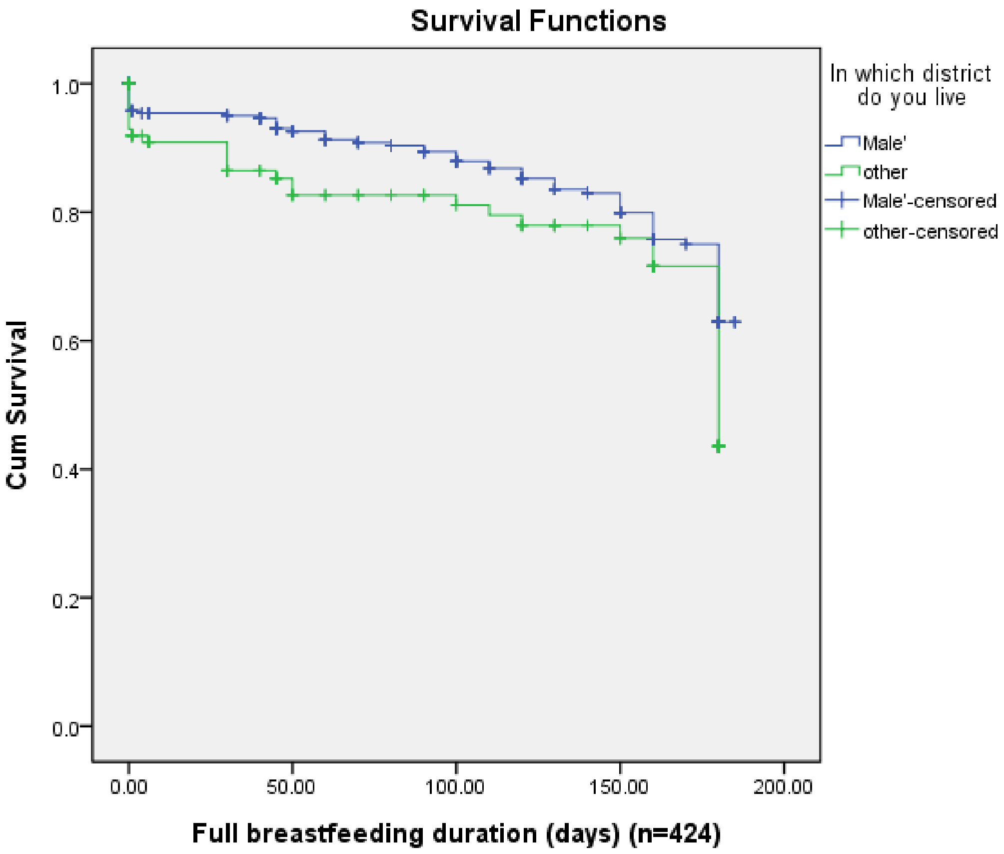


Fig 4.4, above, shows that there was a statistically significant difference (log rank chi-square 5.1, df 1, $p<0.02$) in the duration of 'full breastfeeding' between mothers who were living in Malé and those on other islands, after giving birth. Mothers who were living in the other islands had a shorter duration of 'full breastfeeding' when compared with mothers who were living in Malé.

4.5 Postnatal depression, infant growth and infant health outcomes

4.5.1 Cross tabulation

Table 4.43 Infant variables associated with postnatal depression

	One month postnatal			Three months postnatal			Six months postnatal		
Variable	**EPDS≥ 13**	**EPDS<13**	**p-value**	**EPDS≥13**	**EPDS<13**	**p-value**	**EPDS≥13**	**EPDS<13**	**p-value**
Gender of the baby									
Male	61	152	0.38	23	188	0.55	3	199	0.16
Female	55	166		28	191		8	207	
Type of delivery									
Vaginal	68	171	0.37	32	204	0.23	5	226	0.50
Caesarean	48	147		19	175		6	180	
Birth Weight (Full term infants)									
<2,500g	6	16	0.99	3	18	0.88	0	20	0.63
2,500-3,900g	107	292		47	359		11	374	
≥4,000g	3	9		1	11		0	12	
Infant boys' weight at one month									
<3,300g (-2 z score)	1	11	0.13	0	12	0.22	0	11	0.73
3,300-5,700g	56	141		22	173		2	185	
>5,700g (+2 z score)	-	-		-	-		-	-	
Infant boys' weight at three months									
<5,000g (-2 z score)	4	10	0.94	2	12	0.62	0	12	0.80
5,000-8,000g	52	136		19	169		1	182	
>8,000 (+2 z score)	-	-		-	-		-	-	

Chi-square test between EPDS ≥ 13 postnatal depression and infant variables

Table 4.44 Infant variables associated with postnatal depression (cont.)

Infant boys' weight at six months									
<6,300g (-2 z score)	7	6	**0.035**	3	10	0.36	1	12	0.17
6,300-9,800g	49	133		19	163		2	180	
>9800g (+2 z score)	-	-		0	1		0	1	
Infant boys' length at one month									
<50.5cm (-2 z score)	6	9	0.42	1	14	0.19	0	13	0.95
50.5-58.2 cm	40	111		17	133		1	144	
>58.2cm (+2 z-score)	1	1		1	1		0	2	
Infant boys' length at three months									
<57.2 (-2 z score)	6	21	0.43	1	26	0.17	0	25	0.68
57.2 -65.5	46	109		20	135		1	150	
>65.5 (+2 z score)	-	-		-	-		-	-	
Infant boys' length at six months									
<63.2 cm (-2 z score)	9	24	0.29	1	32	0.06	0	33	0.79
63.2-71.8 cm	45	101		19	127		2	144	
>71.8 cm (+2 z score)	1	0		1	0		0	1	
Infant girls' weight at one month									
<3100g (-2 z score)	1	5	0.76	0	6	0.60	0	6	0.88
3100-5400g	52	155		26	179		7	196	
>5400g (+2 z score)	0	1		0	1		0	1	
Infant girls' weight at three months									
<4500g (-2 z score)	0	3	0.50	0	3	0.75	0	3	0.93
4500-7500g	53	154		26	181		7	198	
>7500 (+2 z score)	0	1		0	1		0	1	

Chi-square test between EPDS ≥ 13 postnatal depression and infant variables

Table 4.45 Infant variables associated with postnatal depression (cont.)

Infant girls' weight at six months									
<5700g (-2 z score)	1	5	0.75	0	6	0.60	0	6	0.88
5700-9300g	52	152		26	178		7	197	
>9300g (+2 z score)	0	1		0	1		0	1	
Infant girls' length at one month									
<49.5cm (-2 z score)	2	8	0.87	0	10	0.34	1	9	0.57
49.5-57.3 cm	44	123		24	142		6	158	
>57.3cm (+2 z score)	1	2		0	3		0	3	
Infant girls' length at three months									
<55.6 (-2 z score)	5	17	0.52	1	21	0.34	0	21	0.59
55.6 -64.0	45	119		24	140		7	156	
>64.0 (+2 z score)	0	3		0	3		0	3	
Infant girls' length at six months									
<61.0 cm (-2 z score)	3	5	0.45	1	7	0.96	0	8	0.60
61.0-70.1 cm	47	137		24	160		6	178	
>70.1 cm (+2 z score)	-	-		-	-		-	-	
Infants who had diarrhoea									
Yes	8	21	0.91	5	24	0.35	1	27	0.75
No	108	297		46	355		10	379	
Infants who had ARI									
Yes	38	93	0.48	15	116	0.86	3	128	0.76
No	78	225	115	36	263		8	278	
Other infant health problems									
Yes	5	4	**0.048**	2	7	0.33	0	8	0.64
No	111	314		49	372		11	398	

Chi-square test between EPDS ≥ 13 postnatal depression and infant variables

Table 4.43, 4.44 and 4.45 shows the association of postnatal depression and infant variables. The infants (boys) of mothers having postnatal depression at one month were significantly more likely to be below two standard deviations on the weight for age z-score (World Health Organisation, 2006) growth chart at six months. They were also more likely to have 'other health problems' (vomiting, constipation and digestive problems). When mothers were depressed at three months post-delivery, the infants (boys) were significantly more likely to be below two standard deviations on the length for age z-score (World Health Organisation, 2006) growth chart at six months. There were no associations for postnatal depression at six months with 'growth of the infant in the first six months', 'having acute respiratory infections' or 'other infant health problems'.

4.5.2 Survival analysis

Figure 4.5 Plot of the survival functions of 'exclusive breastfeeding' up to 180 days between infants who were below two standard deviations, normal and above two standard deviations (mother's depression as a status)

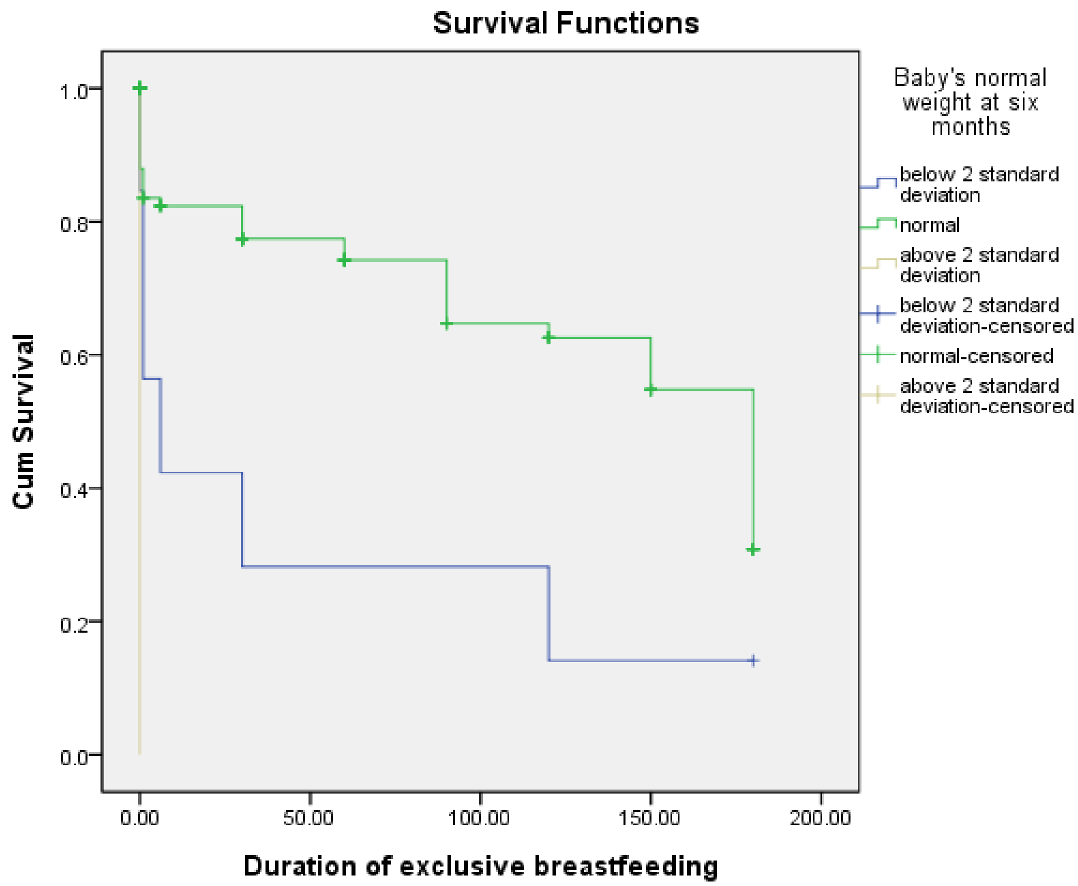


Fig 4.5 above shows that there was a statistically significant difference (log rank chi-square 11.8, df 2, $p<0.03$) in the duration of ‘exclusive breastfeeding’ between infants who were below two standard deviation, normal, and above two standard deviations on the (World Health Organisation, 2006) weight for age at six months chart for boys. Compared with mothers with infants with normal weight and weight below two standard deviations, a higher proportion of mothers with infants above two standard deviations stopped exclusive breastfeeding earlier. Compared with mothers with infants who are in the normal weight range, a higher proportion of mothers who had infants below two standard deviations stopped breastfeeding earlier.

4.6 Factors associated with introduction of prelacteal feeds (Thahneek)

4.6.1 Cross tabulation

Table 4.46 shows that the demographic, maternal and infant variables contributing to the introduction of ritual feeds as prelacteal feeds were ‘maternal age (18 – 24 years)’, ‘mother being employed’, ‘gender of the infant being a boy’ and ‘lower IIFAS score’. Introduction of ritual feeds as prelacteal feeds was not associated with ‘district’, ‘parity’, ‘maternal educational level’, ‘maternal mother’s feeding method’, ‘EPDS score’, ‘having stressful life events’, ‘receiving help’, ‘type of delivery’, ‘diarrhoeal episodes’, ‘acute respiratory infections’ or ‘other health problems faced by the baby’.

Table 4.46 Demographic and maternal factors and infant variables associated with introduction of ritual feeds ('Thahneek') as prelacteal feeds.

Variable	'Thahneek' Given	'Thahneek' not given	P-value
District			
Malé	63	255	0.15
Other Island	16	100	
Number of births			
Primiparous	52	184	0.08
Multiparous (2)	16	100	
Multiparous (3 or more)	11	71	
Maternal educational level			
Primary and below	10	64	0.25
Secondary and above	69	291	
Mother's age			
18 – 24	28	81	**0.049**
25 – 35	49	255	
>35	2	19	
Maternal mother's feeding method			
Breastfeed	75	325	0.60
Bottle feed	3	14	
Maternal employment			
Housewife/self-employed	39	239	**0.003**
Government/private employment	40	116	
EPDS			
≥13	20	82	0.67
<13	59	273	
Had stressful life event			
Yes	3	21	0.33
No	76	334	
Received help			
Yes	73	307	0.15
No	6	48	
Honey, date or sweet should be first feed			
Agree	63	211	**0.003**
Neutral	4	29	
Disagree	12	115	
Type of delivery			
Vaginal	43	196	0.90
Caesarean	36	159	
Gender of the infant			
Boy	48	165	**0.02**
Girl	31	190	
Diarrhoea Yes	4	25	0.52
No	75	330	
ARI			
Yes	25	106	0.75
No	54	249	
Other problems with the baby			
Yes	2	7	0.51
No	77	348	
IIFAS			
Medium	32	105	**0.042**
High	47	249	

Chi-square test prelacteal feeds and demographic, maternal factors and infant variables

4.6.2 Multivariate Analysis

Multivariate logistic regression was employed to further explore the factors associated with the use of ritual feeds as prelacteal feeds. The significant infant variables identified from the cross tabulation and literature review were put into the full model. The factors included in the full model were 'Honey or date should be given to infant as first feed', 'maternal age', 'gender of the infant', 'maternal employment', 'depression score, antenatal', 'type of delivery', and 'IIFAS score'

Table 4.47 Factors associated with the use of ritual feeds as prelacteal feeds

Variable	**Crude Odds Ratio**	**95% CI**	**Adjusted Odds Ratio**	**(95% CI)**
Honey or date should be given to infant as first feed				
Disagree	1.00		1.00	
Agree	2.86	(1.5 -5.5)**	2.87	(1.5-5.6)**
Neutral	1.32	(0.4-4.4)	1.60	(0.5 –5.4)
Maternal age				
18 – 24	1		1	
24- 35	0.5	(0.3 – 0.9)*	0.5	(0.3 – 0.9)*
>35	0.3	(0.7 – 1.4)	0.3	(0.6 – 1.3)
Maternal employment				
Housewife/self-employed	1		1	
Government/private employment	2.1	(1.3 – 3.5)**	2.3	(1.4 – 3.9)**
Gender of the infant				
Girl	1.00		1.00	
Boy	1.78	(1.1-2.9)*	1.65	(1.0-3.0)*
Depression score, antenatal				
≥13	1		1.1	(0.6 – 1.9)
<13	1.2	(0.6 – 2.0)	1	
Type of delivery				
Vaginal	1		1	
Caesarean	1.03	(0.6 – 1.7)	1.1	(0.6 – 1.7)
IIFAS score				
Medium	1		1	
High	0.62	(0.4 – 1.0)	0.7	(0.4 – 1.3)

-2 Log likelihood (deviance) 3765.539 df=8*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.47 shows the factors associated with introduction of ritual feeds as prelacteal feeds. The boys were more likely to receive a ritual feed as their first feed (adjusted OR=1.78; 95% CI, 1.07-2.98). Mothers who agreed with the statement were more likely to give honey or dates as the first feed (adjusted OR= 2.87; 95% CI, 1.48-5.58). Maternal age between 24 and 35 decreased the likelihood of introducing ritual feeds as prelacteal feeds compared with mothers in the age group of 18- 24 years. Employed mothers also were more likely to introduce ritual feeds as prelacteal feeds. Introduction of prelacteal feeds (ritual feeds) were not associated with the IIFAS score, type of infant delivery or depression score at 36 weeks of pregnancy.

4.7 Factors associated with introduction of prelacteal feeds (Infant formula)

4.7.1 Cross tabulation

Table 4.48 shows that the factors contributing to the introduction of infant formula as prelacteal feeds were 'maternal mother's feeding method being bottle feeding' and 'delivery by caesarean section'. There was no association with 'district', 'parity', 'maternal educational level', 'maternal employment', 'EPDS score', 'having stressful life events', 'receiving help' 'infant gender', 'diarrhoeal episodes', 'acute respiratory infections', 'other infant health problems' or IIFAS scores.

Table 4.48 Demographic and maternal factors and infant variables associated with the use of infant formula as prelacteal feeds.

Variable	**Infant formula given**	**Not given**	**P-value**
District			
Malé	16	302	0.76
Other Island	5	111	
Number of births			
Primiparous	10	226	0.76
Multiparous (2)	7	109	
Multiparous (3 or more)	4	78	
Maternal educational level			
Primary and below	1	73	0.13
Secondary and above	20	340	
Mother's age			
18 – 24	2	107	0.17
25 – 35	17	287	
>35	2	19	
Maternal mother's feeding method			
Breastfeed	17	383	**0.04**
Bottle feed	3	14	
Maternal employment			
Housewife/self-employed	13	265	0.83
Government/private employment	8	148	
EPDS			
≥13	6	96	0.37
<13	15	317	
Had stressful life event			
Yes	1	23	0.67
No	20	390	
Received help			
Yes	18	362	0.50
No	3	51	
Type of delivery			
Vaginal	5	234	**0.003**
Caesarean	16	179	
Gender of the infant			
Boy	10	212	0.47
Girl	11	202	
Diarrhoea			
Yes	2	27	0.41
No	19	386	
ARI			
Yes	5	126	0.35
No	16	287	
Other problems with the baby			
Yes	1	8	0.36
No	20	405	
IIFAS			
Medium	3	134	0.06
High	18	278	

Chi-square test prelacteal feeds and demographic, maternal factors and infant variables

4.7.2 Multivariate Analysis

Multivariate logistic regression was employed to further explore the factors associated with the use of infant formula as a prelacteal feed. The significant infant variables identified from the cross tabulation and literature review were put into the full model. The factors included in the full model were 'type of delivery', 'maternal mother's feeding practice', 'EPDS score' and 'IIFAS score',

Table 4.49 Factors associated with the use of infant formula as prelacteal feeds

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Type of infant delivery				
Vaginal	1.00		1.00	
Caesarean section	4.18	(1.5 – 11.6)**	4.61	(1.6-13.3)**
Maternal mother's breastfeeding practice				
Did not breastfeed	1.00		1.00	
Breastfed	0.21	(0.1 – 0.8)*	0.15	(0.04- 0.6)*
EPDS score at antenatal				
≥13	1.3	(0.5 – 3.5)	1.4	(0.5 – 3.8)
<13	1		1	
IIFAS score				
Medium	1		1	
High	2.9	(0.9 – 10.0)	3.0	(0.8 – 10.7)

-2 Log likelihood (deviance) 114.964 df=7*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.49 shows the factors associated with the introduction of infant formula as prelacteal feeds. Compared with mothers who had vaginal delivery, mothers who had undergone caesarean sections were significantly more likely to give their infants infant formula as the prelacteal feed (adjusted OR: 4.61, 95% CI: 1.60- 13.26). Maternal mother's breastfeeding practice was inversely associated with the introduction of infant formula as the infant's prelacteal feed (adjusted OR: 0.15, 95% CI: 0.04-0.64). Introduction of infant formula was not associated with IIFAS score or maternal experiences of stressful life events.

4.8 Factors associated with exclusive breastfeeding

4.8.1 Cross tabulation

Table 4.50, shows that there were no demographic factors associated with exclusive breastfeeding at any point of time.

Table 4.50 Demographic factors associated with exclusive breastfeeding

	One month			Three months			Six months		
Variable	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**
Mother's age, years									
<24	28	81		16	93		6	100	
<24 - 35	79	225	0.98	53	250	0.54	25	276	0.60
≥35	5	16		2	19		1	20	
Marital status									
Married	111	318	0.77	71	357	0.30	32	391	0.52
Divorced	1	4		0	5		0	5	
Mother's education									
Primary or lower	21	53	0.58	9	64	0.30	4	68	0.50
Secondary and higher	91	269		62	298		28	328	
Type of accommodation									
Rented	47	141	0.74	33	155	0.57	15	170	0.67
Own place	65	181		38	207		17	226	
Number of people living in a room									
≤3	89	273	0.17	57	304	0.41	26	331	0.71
>3	23	48		14	57		6	64	
Parity									
Primiparous	54	182	0.25	36	200	0.64	16	217	0.64
Multiparous (2)	32	84		19	97		8	107	
Multiparous (≥3)	26	56		16	65		8	72	
Mother's occupation									
Housewife/self-employed	74	204	0.61	49	228	0.78	21	252	0.82
Government/private employment	48	118		26	130		11	144	
Husband's occupation									
Unemployed	107	311	0.71	1	15	0.2	1	15	0.85
Government/private employment	4	10		74	343		31	381	
Household annual income									
<MVR 90,000 (<A$6,209)	32	74	0.49	18	87	0.85	6	97	0.76
MVR 90,000-250,000	68	212		44	236		22	256	
>MVR 250,000 (>A$17, 249)	12	36		9	39		4	43	

Table 4.51 Maternal factors associated with 'exclusive breastfeeding'

	One month			Three months			Up to six months		
Variables	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**
Maternal weight at one month after									
< 50	11	19	0.21	7	23	0.20	4	26	0.42
50-65	31	112		28	125		9	133	
> 65	24	68		18	74		8	84	
Maternal weight at three months after									
< 50	14	26	0.20	8	32	0.69	6	34	0.10
50-65	41	122		25	138		12	150	
> 65	11	47		8	50		2	56	
Maternal weight at six months after									
< 50	16	33	0.09	9	40	0.43	6	43	0.10
50-65	40	125		26	139		13	152	
> 65	9	51		6	54		1	59	
Smoking:									
Before pregnancy									
Yes	2	13	0.21	1	14	0.26	1	14	0.90
No	110	309		70	348		31	382	
During pregnancy									
Yes	1	1	0.45	0	2	0.53	0	2	0.69
No	111	321		71	360		32	394	
Before pregnancy (husband)									
Yes	46	141	0.62	27	160	0.34	12	173	0.50
No	66	181		44	202		20	223	
During pregnancy (husband)									
Yes	39	127	0.39	24	142	0.40	11	153	0.63
No	73	195		47	220		21	243	

Table 4.52 Maternal factors associated with 'exclusive breastfeeding' (cont.)

	One month			Three months			Up to six months		
Variables	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**
Received help in looking after children and in household chores									
Yes	100	280	0.52	66	313	0.89	28	346	0.98
No	12	42		9	45		4	50	
People who helped:									
Husband									
Yes	49	151	0.56	32	167	0.53	15	181	0.90
No	63	171		43	191		17	215	
Maternal mother									
Yes	54	147	0.64	32	169	0.47	15	182	0.92
No	58	175		43	189		17	214	
Paternal mother									
Yes	28	88	0.63	21	94	0.76	6	107	0.30
No	84	234		54	264		26	289	
Other family members									
Yes	53	169	0.34	32	190	0.10	11	210	**0.04**
No	59	153		43	168		21	186	
Babysitter									
Yes	6	5	**0.027**	3	8	0.37	3	8	**0.01**
No	106	317		72	350		29	388	
Servant									
Yes	2	7	0.80	1	8	0.62	0	9	0.39
No	110	315		74	350		32	387	
Had stressful life event									
Yes	6	18	0.93	4	338	0.93	4	20	0.07
No	106	304		71	20		28	376	

Chi-square test between exclusive breastfeeding and maternal factors

Table 4.51 and 4.52, show the maternal factors associated with exclusive breastfeeding at one month, three months and six months after giving birth. Mothers who received help from a babysitter were more likely to breastfeed at one month and six months but not at three months. No specific maternal factors associated with exclusive breastfeeding at three months were found in this study. Mothers who received help from ‘other family members’ (sister, niece or cousin) were less likely to ‘exclusively breastfeed’ at six months. ‘Maternal weight’ and ‘smoking status’ were not associated with exclusive breastfeeding. Although not significant, a higher percentage of the mothers who didn’t exclusively breastfeed weighed above 65 kg, compared with mothers who breastfed.

Table 4.53 Infant variables associated with 'exclusive breastfeeding'

	One month			Three months			Six months		
Variable	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**
Gender of the baby									
Male	57	156	0.99	38	175	0.78	17	192	0.61
Female	59	162		37	183		15	204	
Type of delivery									
Vaginal	66	173	0.64	42	196	0.84	18	217	0.87
Caesarean	50	145		33	162		14	179	
Prelacteal feeds (ritual)									
Given	0	79	**<0.001**	0	79	**<0.001**	0	79	**<0.001**
Not given	112	243		71	283		32	317	
Prelacteal feeds (formula)									
Given	0	21	**0.002**	0	21	**0.02**	0	21	0.19
Not given	112	301		71	341		71	341	
Initiation of breastfeeding									
Within one hour	103	261	**0.009**	68	296	**0.009**	31	328	0.11
1-4 hours	8	34		3	38		1	40	
> 4 hours	1	27		0	28		0	28	
Birth weight (Full term infants)									
<2,500g	6	16	0.99	3	18	0.72	1	20	0.89
2,500-3,900g	106	293		68	331		30	365	
≥4,000g	3	9		3	9		1	11	
Infant boys' weight at one month									
<3,300g (-2 z score)	1	11	0.12	1	11	0.36	1	11	0.99
3,300-5,700g	56	141		37	160		16	177	
>5,700g (+2 z score)	-	-							
Infant boys' weight at three months									
<5,000g (-2 z score)	1	13	0.09	1	11	0.36	0	13	0.27
5,000-8,000g	52	136		37	160		16	170	
>8,000 (+2 z score)	-	-							

Table 4.54 Infant variables associated with 'exclusive breastfeeding' (cont.)

	One month			Three months			Six months		
Variable	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**
Infant boys' weight at six months									
<6,300g (-2 z score)	2	11	0.55	1	13	0.29	1	12	0.95
6,300-9,800g	49	133		34	154		15	167	
>9,800g (+2 z score)	0	1					0	1	
Infant boys' length at one month									
<50.5cm (-2 z score)	4	11	0.69	1	14	0.47	0	14	0.44
50.5-58.2 cm	40	111		26	125		14	136	
>58.2cm (+2 z score)	0	2		0	2		0	2	
Infant boys' length at three months									
<57.2 (-2 z score)	6	21	0.60	5	22	0.83	2	24	0.82
57.2 -65.5	42	113		26	129		14	140	
>65.5 (+2 z score)									
Infant boys' length at six months									
<63.2 cm	11	22	0.13	7	26	0.68	4	29	0.74
63.2-71.8 cm	35	111		23	123		12	134	
>71.8 cm (+2 z score)	1	0		0	1		0	1	
Infant girls' weight at one month									
<3,100g (-2 z score)	0	6	0.27	0	6	0.49	0	6	0.78
3,100-5,400g	57	150		35	171		14	192	
>5,400g (+2 z score)	0	1		0	1		0	1	
Infant girls' weight at three months									
<4,500g (-2 z score)	1	2	0.81	1	2	0.68	0	3	0.86
4,500-7,500g	55	152		35	172		15	192	
>7,500 (+2 z score)	0	1		0	1		0	1	
Infant girls' weight at six months									
<5,700g (-2 z score)	3	3	0.37	3	3	0.09	1	5	0.63
5,700-9,300g	54	150		33	171		14	190	
>9,300g (+2 z score)	0	1		0	1		0	1	

Table 4.55 Infant variables associated with 'exclusive breastfeeding' (cont.)

	One month			**Three months**			**Six months**		
Variable	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**	**BF exclusive**	**BF not exclusive**	**p-value**
Infant girls' length at one month									
<49.5cm (-2 z score)	4	6	0.34	1	9	0.59	1	9	0.84
49.5-57.3 cm	42	125		30	137		12	155	
>57.3cm (+2 z score)	0	3		0	3		0	3	
Infant girls' length at three months									
<55.6 (-2 z score)	6	16	**0.01**	3	19	0.69	0	22	0.10
55.6 -64.0	41	123		29	135		14	150	
>64.0 (+2 z score)	3	0		1	2		1	2	
Infant girls' length at six months									
<61.0 cm (-2 z score)	0	8	0.07	0	35	0.17	0	8	0.40
61.0-70.1 cm	53	131		35	149		15	169	
>70.1 cm (+2 z score)									
Infants who had diarrhoea									
Yes	9	20	0.59	6	23	0.62	3	26	0.54
No	107	298		69	335		29	370	
Infants who had ARI									
Yes	32	99	0.48	16	115	**0.04**	5	126	**0.038**
No	84	219		59	243		27	270	
Other infant health problems									
Yes	3	6	0.65	1	8	0.52	0	9	0.39
No	113	312		74	350		32	387	

Chi-square test between 'exclusive breastfeeding' and baby health problems

Table 4.53, 4.54 and 4.55 show the infant variables associated with exclusive breastfeeding. Infants who were given prelacteal feeds and infants who had delayed initiation of breastfeeding were less likely to be ‘exclusively breastfed at one month. Infants who were exclusively breastfed at three months and six months were less likely to have acute respiratory infections. ‘Higher infant length at three months’ was associated with ‘exclusive breastfeeding at one month’ (will be included in the model of factors that affect infant growth). Neither ‘gender of the baby’, ‘type of delivery’, ‘diarrhoeal episodes’ nor ‘other infant health problems’ were associated with ‘exclusive breastfeeding’ in this study.

Table 4.56 Factors that support 'exclusive breastfeeding' at one month

Factor	Exclusive	Not exclusive	P-value
Time of decision to breastfeed			
Before I became pregnant	74	213	0.96
During my pregnancy	24	70	
After my baby was born	10	26	
Mother's perception of where baby should sleep			
In the same bed with me	55	186	0.24
In the same room, but not in the same bed	52	121	
In another room	1	2	
Received information from hospital			
Yes	56	146	0.4
No	52	163	
Sources of information			
Pamphlets or booklets on breastfeeding	11	24	0.14
Lectures or classes on breastfeeding	35	79	
Demonstrations on how to breastfeed	0	4	
Video or TV show on how to breastfeed	0	2	
Individual consultation or discussion	24	50	
Did not receive any information	22	99	
Other forms of information (internet)	16	51	
People who support breastfeeding			
Baby's father: Yes	75	199	0.34
No	33	110	
Maternal mother: Yes	41	140	0.18
No	67	169	
Paternal mother: Yes	9	13	0.10
No	99	296	
Doctors: Yes	6	16	0.88
No	102	293	
Nurses: Yes	9	18	0.36
No	99	291	
Community health workers: Yes	6	5	**0.03**
No	102	304	
Friends and other family members: Yes	10	35	0.55
No	98	274	
Maternal mother's feeding method			
Breastfeed	106	294	0.14
Bottle feed	2	15	
Father's preference of feeding method			
Prefers bottle feeding	1	0	0.43
Prefers breastfeeding	102	281	
Does not mind how the baby is fed	9	25	
Never really discussed the matter with him	4	12	
Maternal mother's preference of feeding method			
Prefers bottle feeding	1	4	0.81
Prefers breastfeeding	92	262	
Does not mind how I feed our baby	9	18	
Never really discussed the matter with her	14	34	

Chi-square test between 'exclusive breastfeeding feeding and variables which support breastfeeding

Table 4.57 Factors that support 'exclusive breastfeeding' at three months

Factor	**Exclusive**	**Not exclusive**	**P-value**
Time of decision to breastfeed			
Before I became pregnant	54	233	0.15
During my pregnancy	12	82	
After my baby was born	3	33	
Mother's perception of where baby should sleep			
In the same bed with me	39	202	0.71
In the same room, but not in the same bed	30	143	
In another room	0	3	
Received information from hospital Yes	33	169	0.91
No	36	179	
Sources of information			
Pamphlets or booklets on breastfeeding	29	6	0.90
Lectures or classes on breastfeeding	94	20	
Demonstrations on how to breastfeed	4	0	
Video or TV show on how to breastfeed	2	0	
Individual consultation or discussion	60	14	
Did not receive any information	104	17	
Other forms of information (internet)	55	12	
People who support breastfeeding			
Baby's father: Yes	50	224	0.20
No	19	124	
Maternal mother: Yes	25	156	0.19
No	44	192	
Paternal mother: Yes	6	16	0.16
No	63	332	
Doctors: Yes	2	20	0.33
No	67	328	
Nurses: Yes	4	23	0.80
No	65	325	
Community health workers: Yes	2	9	0.88
No	67	339	
Friends and other family members: Yes	6	39	0.54
No	63	309	
Maternal mother's feeding method			
Breastfeed	69	331	**0.04**
Bottle feed	0	17	
Father's preference of feeding method			
Prefers bottle feeding	1	0	**0.02**
Prefers breastfeeding	71	331	
Does not mind how the baby is fed	2	32	
Never really discussed the matter with him	1	15	
Maternal mother's preference of feeding method			
Prefers bottle feeding	0	5	0.59
Prefers breastfeeding	63	293	
Does not mind how I feed our baby	3	24	
Never really discussed the matter with her	9	39	

Chi-square test between 'exclusive breastfeeding' and variables which support breastfeeding

Table 4.58 Factors that support 'exclusive breastfeeding' at six months

Factor	exclusive	Not exclusive	P-value
Time of decision to breastfeed			
Before I became pregnant	25	261	
During my pregnancy	7	87	0.18
After my baby was born	0	36	
Mother's perception of where baby should sleep			
In the same bed with me	16	224	0.55
In the same room, but not in the same bed	16	157	
In another room	0	3	
Received information from hospital			
Yes	14	187	0.59
No	18	197	
Sources of information			
Pamphlets or booklets on breastfeeding	3	32	0.99
Lectures or classes on breastfeeding	10	103	
Demonstrations on how to breastfeed	0	4	
Video or TV show on how to breastfeed	0	2	
Individual consultation or discussion	6	68	
Did not receive any information	8	113	
Other forms of information (internet)	5	62	
People who support breastfeeding			
Baby's father: Yes	24	249	0.25
No	8	135	
Maternal mother: Yes	14	167	0.98
No	18	217	
Paternal mother: Yes	1	21	0.57
No	31	363	
Doctors: Yes	0	22	0.16
No	32	362	
Nurses: Yes	2	25	0.95
No	30	359	
Community health workers: Yes	2	9	0.19
No	30	375	
Friends and other family members: Yes	3	42	0.79
No	29	342	
Maternal mother's feeding method			
Breastfeed	32	367	0.22
Bottle feed	0	17	
Father's preference of feeding method			
Prefers bottle feeding	1	0	**0.002**
Prefers breastfeeding	30	347	
Does not mind how the baby is fed	1	33	
Never really discussed the matter with him	0	16	
Maternal mother's preference of feeding method			
Prefers bottle feeding	0	5	0.44
Prefers breastfeeding	28	321	
Does not mind how I feed our baby	0	26	
Never really discussed the matter with her	4	44	

Chi-square test between 'exclusive breastfeeding' and variables which support breastfeeding

Table 4.56 shows that the only statistically significant factor that supported 'exclusive breastfeeding' was 'getting breastfeeding support from health workers'. All other factors were not significant.

Table 4.57 shows the 'breastfeeding supporting factors' that were associated with 'exclusive breastfeeding' at three months. Factors that support 'exclusive breastfeeding' which were significant were 'father's preference of feeding method' and 'maternal mother's feeding method'.

Table 4.58 shows that the only significant factor which supported exclusive breastfeeding up to six months was 'father's preferred feeding method being breastfeeding'. All other factors were not statistically significant. The factors which were significantly associated with exclusive breastfeeding at one month from cross tabulation includes, 'infants who were given prelacteal feeds (ritual)', 'infants who were given prelacteal feeds (infant formula)', 'delayed initiation of breastfeeding', 'higher infant length at three months' and 'mothers who received help from a babysitter'. These factors were then incorporated into the multivariate model as shown below.

4.8.2 Multivariate Analysis

Multivariate logistic regression was used to further analyse the factors associated with the 'exclusive breastfeeding'. The significant infant variables identified from the cross tabulation were put in the full model. Three different models were used to identify the factors associated with 'exclusive breastfeeding' at one month, three months and six months.

Table 4.59 Factors associated with 'exclusive breastfeeding' at one month

Variable	**Crude Odds Ratio**	**95% CI**	**Adjusted Odds Ratio**	**95% CI**
Initiation of breastfeeding				
Within one hour	1		1	
1-4 hours	0.6	(0.3 – 1.3)	0.5	(0.2 – 1.2)
>4 hours	0.09	(0.01 – 0.7)*	0.08	(0.01 – 0.6)*
First feed (ritual)				
Yes	1		1	
No	<0.00	(0.0 – 0.0)	<0.00	(0.0 – 0.0)
Decided feeding method				
Before pregnancy	1		1	
During pregnancy	0.99	(0.6 – 1.7)	0.85	(0.5 – 1.5)
After the baby is born	1.17	(0.5 – 2.5)	0.99	(0.4 – 2.2)
Received babysitter's help				
Yes	1		1	
No	0.27	(0.08 – 0.9)*	0.24	(0.1 – 0.96)*
Health worker supports breastfeeding				
Yes	1		1	
No	0.27	(0.08 – 0.9)*	0.17	(0.04 – 0.7)*

-2 Log likelihood (deviance) 397.296 df=4*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.59 shows the factors associated with 'exclusive breastfeeding' at one month. As shown in the table, mothers who delayed breastfeeding for more than four hours were less likely to exclusively breastfeed up to one month after delivery. Mothers who did not receive help from a babysitter and mothers who did not get breastfeeding support from a health worker also were less likely to 'exclusively breastfeed' up to one month after delivery. There were no specific factors associated with exclusive breastfeeding at three months in this study.

Table 4.60 Factors associated with 'exclusive breastfeeding' at six months

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Had ARI				
Yes	0.4	(0.1 – 1.1)	0.4	(0.1 – 1.1)
No	1		1	
First feed (ritual)				
Yes	1		1	
No	<0.00	(0.0 – 0.0)	<0.00	(0.0 – 0.0)
Received babysitter's help				
Yes	1		1	
No	0.27	(0.08 – 0.9)*	0.3	(0.06 – 1.2)
Received other's help				
Yes	1		1	
No	2.2	(1.0 -4.6)*	2.2	(1.0 -4.8)*

-2 Log likelihood (deviance) 194.646 df=6*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom. The factors included in the full model were 'had acute respiratory infections', 'first feed', 'received baby sitter's help' and 'received other's help'.

As shown in Table 4.60 after adjustment for covariates, 'receiving help from other family members' was the only significant factor associated with exclusive breastfeeding in this study. 'Receiving help from other family members' was inversely associated with 'exclusive breastfeeding'.

4.9 Factors associated with 'full breastfeeding'

4.9.1 Cross tabulation

Table 4.61 shows the demographic factors associated with full breastfeeding at one month, three months and six months after delivery. There were no significant associations between full breastfeeding and demographic factors at one month and six months. At three months, mothers less than 24 years old were more likely to 'fully breastfeed' their infants compared with mothers in the age groups of 24-35 years and above 35 years.

Table 4.61 Demographic factors associated with full breastfeeding

	One month			Three months			Six months		
Variable	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**
Mother's age, years									
<24	78	31		68	41	**0.03**	31	75	
24 - 35	198	106	0.43	149	154		89	212	0.93
≥35	13	8		8	13		7	14	
Marital status									
Married	285	144	0.53	222	206	0.53	126	297	0.63
Divorced	4	1		3	2		1	4	
Mother's education									
Primary or lower	47	27	0.54	37	36	0.81	22	50	0.86
Secondary and higher	242	118		188	172		105	251	
Type of accommodation									
Rented	131	57	0.23	100	88	0.65	59	126	0.38
Own place	158	88		125	120		68	175	
Number of people living in a room									
≤3	241	121	0.87	188	173	0.99	107	250	0.82
>3	48	23		37	34		20	50	
Parity									
Primiparous	157	79	0.59	125	111	0.21	67	166	0.50
Multiparous (2)	74	42		53	63		32	83	
Multiparous (≥3)	58	24		47	34		28	52	
Mother's occupation									
Housewife/self-employed	189	89	0.41	153	124	**0.04**	87	186	0.18
Government/private employment	100	56		72	84		40	115	
Husband's occupation									
Unemployed	12	4	0.56	7	9	0.78	5	9	0.58
Government/private employment	277	141		218	199		122	290	
Household annual income									
<MVR 90,000 (<A$6,209)	74	32	0.64	61	44	0.29	32	71	0.94
MVR 90,000-250,000 (A$6,209-17,249)	185	95		142	138		81	197	
>MVR 250,000 (>A$17, 249)	30	18		22	27		14	33	

Chi-square test between full breastfeeding and demographic factors

Table 4.62 Maternal factors associated with 'full breastfeeding'

	One month			Three months			Six months		
Variables	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**
Maternal weight at one month after delivery									
< 50 kg	23	7	0.63	20	10	0.36	10	20	0.77
50-65 kg	97	46		75	68		46	96	
> 65 kg	64	28		50	42		26	66	
Maternal weight at three months after delivery									
< 50 kg	31	9	0.14	24	16	0.41	14	26	0.08
50-65 kg	111	52		87	76		51	111	
> 65 kg	34	24		27	31		10	48	
Maternal weight at six months after delivery									
< 50 kg	36	13	0.43	31	18	0.62	16	33	0.21
50-65 kg	111	54		87	78		52	113	
> 65 kg	37	23		29	31		12	48	
Smoking :									
Before pregnancy									
Yes	10	5	0.62	7	8	0.62	3	12	0.40
No	279	140		222	196		124	289	
During pregnancy									
Yes	2	0	0.44	0	2	0.13	0	2	0.36
No	287	145		229	202		127	299	
Before pregnancy (husband)									
Yes	120	67	0.35	93	94	0.25	50	135	0.30
No	169	78		136	110		77	166	
During pregnancy (husband)									
Yes	104	62	0.17	82	84	0.25	47	117	0.72
No	185	83		147	120		80	184	
Received help in looking after children and in household chores									
Yes	260	121	0.44	198	181	0.76	109	265	0.53
No	34	20		27	27		18	36	

Table 4.63 Maternal factors associated with 'full breastfeeding' (cont.)

	One month			Three months			Six months		
Variables	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**
People who helped:									
Husband									
Yes	132	68	0.51	101	98	0.64	56	140	0.65
No	162	73		124	110		71	161	
Maternal mother									
Yes	134	67	0.70	99	102	0.29	56	141	0.60
No	160	74		126	106		71	160	
Paternal mother									
Yes	83	33	0.29	61	54	0.79	32	81	0.71
No	211	108		164	154		95	220	
Other family members									
Yes	148	74	0.68	111	111	0.40	64	157	0.74
No	146	67		114	97		63	144	
Babysitter									
Yes	9	2	0.31	6	5	0.86	6	5	0.07
No	285	139		219	203		121	296	
Servant									
Yes	6	3	0.95	2	7	0.07	1	8	0.22
No	288	133		223	201		126	293	
Had stressful life event									
Yes	18	6	0.43	15	9	0.28	14	10	**0.002**
No	276	135		210	199		113	291	

Chi-square test between 'full breastfeeding' and maternal factors

Table 4.62 and 4.63 show the maternal factors associated with ‘full breastfeeding’. Full breastfeeding at one month and three months after delivery was not associated with ‘maternal factors’ in this study. A mother who had a stressful life event was more likely to ‘fully breastfeed’ at six months.

Table 4.64 Infant variables associated 'full breastfeeding'

	One month			Three months			Six months		
Variable	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**
Gender of the baby									
Male	144	69	0.97	114	99	0.80	61	148	0.83
Female	149	72		115	105		66	153	
Type of delivery									
Vaginal	172	67	**0.028**	135	103	0.08	76	159	0.18
Caesarean	121	74		94	101		51	142	
Prelacteal feeds (ritual)									
Given	52	27	0.80	38	41	0.42	25	102	0.67
Not given	239	116		188	166		54	247	
Prelacteal feeds (formula)									
Given	0	21	**<0.001**	0	21	**<0.001**	0	21	**<0.001**
Not given	291	122		226	186		127	280	
Initiation of breastfeeding									
Within one hour	262	102	**<0.001**	203	161	**<0.001**	117	241	**0.003**
1-4 hours	22	20		18	23		9	32	
> 4 hours	7	21		5	23		1	27	
Birth weight (Full term infants)									
<2,500g	16	6	0.86	8	13	0.25	6	15	0.93
2,500-3,900g	268	131		212	187		118	277	
≥4,000g	8	4		8	4		3	9	
Infant boys' weight at one month									
<3,300g (-2 z score)	7	5	0.44	5	7	0.38	4	8	0.78
3,300-5,700g	136	61		108	89		57	136	
Infant boys' weight at three months									
<5,000g (-2 z score)	6	8	**0.04**	6	8	0.43	3	10	0.61
5,000-8,000g	130	58		101	87		55	131	
>8,000 (+2 z score)	-	-		-	-		-	-	
Infant boys' weight at six months									
<6,300g (-2 z score)	9	4	0.77	7	6	0.65	3	10	0.26
6,300-9,800g	122	60		97	85		53	129	
>9,800g (+2 z score)	1	0		1	0		1	0	

Table 4.65 Infant variables associated 'full breastfeeding' (cont.)

	One month			Three months			Six months		
Variable	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**
Infant boys' length at one month									
<50.5cm (-2 z score)	10	5	0.88	7	8	0.91	3	11	0.53
50.5-58.2 cm	101	10		79	72		45	105	
>58.2cm (+2 z score)	1	1		1	1		0	2	
Infant boys' length at three months									
<57.2 (-2 z score)	17	10	0.68	14	13	0.93	7	19	0.81
57.2 -65.5	104	51		79	76		45	109	
>65.5 (+2 z score)	-	-		-	-		-	-	
Infant boys' length at six months									
<63.2 cm (-2 z score)	24	9	0.55	19	14	0.47	11	22	0.68
63.2-71.8 cm	95	51		75	71		41	105	
>71.8 cm (+2 z score)	1	0		0	1		0	1	
Infant girls' weight at one month									
<3,100g (-2 z score)	4	2	0.36	1	5	0.12	1	5	0.63
3,100-5,400g	140	67		110	96		62	144	
>5,400g (+2 z score)	0	1		0	1		0	1	
Infant girls' weight at three months									
<4,500g (-2 z score)	2	1	0.36	1	2	0.45	0	3	0.42
4,500-7,500g	139	68		110	97		63	144	
>7,500 (+2 z score)	0	1		0	1		0	1	
Infant girls' weight at six months									
<5,700g (-2 z score)	5	1	0.25	3	3	0.57	1	5	0.62
5,700-9,300g	137	67		108	96		62	142	
>9,300g (+2 z score)	0	1		0	1		0	1	
Infant girls' length at one month									
<49.5cm (-2 z score)	4	6		2	8	0.09	2	8	0.72
49.5-57.3 cm	112	55	0.11	90	77		54	113	
>57.3cm (+2 z score)	1	2		1	2		1	2	

Table 4.66 Infant variables associated 'full breastfeeding' (cont.)

	One month			Three months			Six months		
Variable	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**	**Full BF**	**Not full**	**p-value**
Infant girls' length at three months									
<55.6 (-2 z score)	15	7	0.43	11	11	0.86	6	16	0.87
55.6 -64.0	106	58		86	78		54	110	
>64.0 (+2 z score)	3	0		2	1		1	2	
Infant girls' length at six months									
<61.0 cm (-2 z score)	4	4	0.27	2	6	0.10	1	7	0.23
61.0-70.1 cm	126	58		101	83		60	124	
>70.1 cm (+2 z score)	-	-		-	-		-	-	
Infants who had diarrhoea									
Yes	18	11	0.52	13	16	0.37	5	24	0.09
No	275	130		216	188		122	277	
Infants who had ARI									
Yes	86	45	0.59	57	74	**0.01**	24	107	**0.01**
No	207	96		172	130		103	194	
Other infant health problems									
Yes	5	4	0.44	2	7	0.06	1	8	0.20
No	288	137		227	197		126	293	

Chi-square test between 'full breastfeeding' and baby health problems

Table 4.64, 4.65 and 4.66 show the infant variables associated with full breastfeeding. Mothers who delivered by vaginal delivery were more likely to ‘fully breastfeed’ at one month, compared with mothers who delivered by caesarean section. Infants (boys) of mothers who did not ‘fully breastfeed’ at one month were more likely to be below two standard deviations on the (World Health Organisation, 2006) length for age z-score growth chart. Infants who were ‘fully breastfed’ at three months and six months were less likely to have acute respiratory infections, compared with infants who were not ‘fully breastfed’.

Table 4.67 Factors that support 'full breastfeeding' at one month

Factor	Full	Not full	P-value
Time of decision to breastfeed			
Before I became pregnant	201	86	**0.001**
During my pregnancy	64	30	
After my baby was born	14	22	
Mother's perception of where baby should sleep			
In the same bed with me	162	79	0.99
In the same room, but not in the same bed as me	115	58	
In another room	2	1	
Received information from hospital			
Yes	136	66	0.86
No	143	72	
Sources of information			
Pamphlets or booklets on breastfeeding	25	10	**0.02**
Lectures or classes on breastfeeding	74	40	
Demonstrations on how to breastfeed	1	3	
Video or TV show on how to breastfeed	1	1	
Individual consultation or discussion	55	19	
Did not receive any information	70	51	
Other forms of information (internet)	53	14	
People who support breastfeeding			
Baby's father: Yes	183	91	0.94
No	96	47	
Maternal mother: Yes	121	60	0.98
No	158	78	
Paternal mother: Yes	17	5	0.28
No	262	133	
Doctors: Yes	13	9	0.42
No	266	129	
Nurses: Yes	17	10	0.65
No	262	128	
Community health workers: Yes	7	4	0.82
No	272	134	
Friends and other family members: Yes	32	13	0.53
No	247	125	
Maternal mother's feeding method			
Breastfeed	272	7	**0.02**
Bottle feed	128	10	
Father's preference of feeding method			
Prefers bottle feeding	1	0	**0.02**
Prefers breastfeeding	265	118	
Does not mind how the baby is fed	15	19	
Never really discussed the matter with him	12	4	
Maternal mother's preference of feeding method			
Prefers bottle feeding	4	1	0.52
Prefers breastfeeding	242	112	
Does not mind how I feed our baby	15	12	
Never really discussed the matter with her	32	16	

Chi-square test between 'full breastfeeding' and variables which support breastfeeding

Table 4.67 above, shows the factors that support 'full breastfeeding' at one month. Mothers who decided to breastfeed before getting pregnant were more likely to 'fully breastfeed' at one month compared with mothers who decided to breastfeed after getting pregnant or after the baby was born. 'Full breastfeeding' also was associated with the 'source of breastfeeding information', 'fathers' preferred method for feeding being breastfeeding' and 'maternal mother's feeding method being breastfeeding'.

Table 4.68 Factors that support 'full breastfeeding' at three months

Factor	**full**	**Not full**	**P-value**
Time of decision to breastfeed			
Before I became pregnant	167	120	**<0.001**
During my pregnancy	45	49	
After my baby was born	6	30	
Mother's perception of where baby should sleep			
In the same bed with me	131	110	0.52
In the same room, but not in the same bed as me	86	87	
In another room	2	1	
Received information from hospital			
Yes	101	101	0.37
No	117	98	
Sources of information			
Pamphlets or booklets on breastfeeding	21	14	0.11
Lectures or classes on breastfeeding	53	16	
Demonstrations on how to breastfeed	1	3	
Video or TV show on how to breastfeed	0	2	
Individual consultation or discussion	41	33	
Did not receive any information	59	62	
Other forms of information (internet)	43	24	
People who support breastfeeding			
Baby's father: Yes	140	134	0.50
No	78	65	
Maternal mother: Yes	93	88	0.75
No	125	111	
Paternal mother: Yes	11	11	0.83
No	207	188	
Doctors: Yes	8	14	0.13
No	210	185	
Nurses: Yes	11	16	0.21
No	207	183	
Community health workers: Yes	4	7	0.28
No	214	192	
Friends and other family members: Yes	26	19	0.43
No	192	180	
Maternal mother's feeding method			
Breastfeed	213	187	**0.046**
Bottle feed	5	12	
Father's preference of feeding method			
Prefers bottle feeding	1	0	**0.003**
Prefers breastfeeding	212	170	
Does not mind how the baby is fed	8	26	
Never really discussed the matter with him	8	8	
Maternal mother's preference of feeding method			
Prefers bottle feeding	3	2	**0.036**
Prefers breastfeeding	192	161	
Does not mind how I feed our baby	7	20	
Never really discussed the matter with her	27	21	

Chi-square test between 'full breastfeeding' and variables which support breastfeeding

Table 4.68 shows that 'full breastfeeding' was associated with 'taking the decision to breastfeed before pregnancy', 'maternal mother's feeding method being breastfeeding', father's and maternal mother's 'preferred feeding method being breastfeeding'.

Table 4.69 Factors that support 'full breastfeeding' at six months

Factor	**full**	**Not full**	**P-value**
Time of decision to breastfeed			
Before I became pregnant	93	193	**0.001**
During my pregnancy	28	66	
After my baby was born	1	35	
Mother's perception of where baby should sleep			
In the same bed with me	70	170	0.98
In the same room, but not in the same bed as me	51	122	
In another room	1	2	
Received information from hospital			
Yes	57	144	0.68
No	65	150	
Sources of information			
Pamphlets or booklets on breastfeeding	9	26	0.25
Lectures or classes on breastfeeding	28	85	
Demonstrations on how to breastfeed	0	4	
Video or TV show on how to breastfeed	0	2	
Individual consultation or discussion	23	51	
Did not receive any information	35	86	
Other forms of information (internet)	27	40	
People who support breastfeeding			
Baby's father: Yes	79	194	0.81
No	43	100	
Maternal mother: Yes	49	132	0.38
No	73	162	
Paternal mother: Yes	6	16	0.83
No	116	278	
Doctors: Yes	4	18	0.24
No	118	276	
Nurses: Yes	7	20	0.69
No	115	274	
Community Health Workers: Yes	2	9	0.33
No	120	285	
Friends and other family members: Yes	11	34	0.45
No	111	260	
Maternal mother's feeding method			
Breastfeed	118	281	0.59
Bottle feed	4	13	
Father's preference of feeding method			
Prefers bottle feeding	1	0	**0.03**
Prefers breastfeeding	119	258	
Does not mind how the baby is fed	4	30	
Never really discussed the matter with him	3	13	
Maternal mother's preference of feeding method			
Prefers bottle feeding	2	3	0.05
Prefers breastfeeding	105	244	
Does not mind how I feed our baby	2	24	
Never really discussed the matter with her	18	30	

Chi-square test between 'full breastfeeding' and variables which support breastfeeding

Table 4.69 shows the factors that support 'full breastfeeding' at six months. Mothers who decided to breastfeed before pregnancy were more likely to 'fully breastfeed' their infants up to six months. Infants were more likely to be 'fully breastfed' up to six months if the father's preferred feeding method was breastfeeding. All other factors were not significant.

4.9.2 Multivariate analysis

A multivariate logistic regression was applied to explore the significant factors associated with 'full breastfeeding' at one month, three months and six months. The factors that were put into the multivariate regression model were the factors identified from the univariate analysis. The factors included in the full model were 'type of delivery', 'time feeding method was decided', 'maternal feeding methods', 'father's preference of feeding method' and maternal mother's feeding method'. The non-significant factors were then removed using a backward stepwise method. The variables that were in the final model were factors for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.70 Factors associated with 'full breastfeeding' at one month

Variable	**Crude Odds Ratio**	**95% CI**	**Adjusted Odds Ratio**	**95% CI**
Type of delivery				
Vaginal	1		1	
Caesarean	0.6	(0.4 – 0.9)*	0.6	(0.4 – 0.9)*
Decided on feeding method				
Before pregnancy	1		1	
During pregnancy	0.9	(0.6 – 1.6)	1	(0.6 – 1.7)
After the baby was born	0.3	(0.1 – 0.6)**	0.3	(0.1 – 0.6)***
Maternal mother's feeding method was breastfeeding				
Yes	1		1	
No	0.3	(0.1- 0.9)*	0.3	(0.1 – 0.8)*

-2 Log likelihood (deviance) 509.314 df=3*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.70 shows the factors associated with 'full breastfeeding'. Mothers who delivered by caesarean section were less likely to 'fully breastfeed' at one month after delivery. Mothers who decided upon a feeding method after the baby was born also were less likely to 'fully breastfeed' up to one month. Mothers whose own mothers did not breastfeed their children were less likely to 'fully breastfeed' at one month.

Table 4.71 Factors associated with 'full breastfeeding' at three months

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Maternal age (years)				
18 - 24	1		1	
25 - 35	0.6	(0.38 – 0.93)*	0.6	(0.36 – 0.95)*
>35	0.4	(0.14 – 0.97)*	0.3	(0.12 – 0.90)*
Initiation of breastfeeding				
Within four hours	1		1	
1-4 hours	0.6	(0.32 – 1.19)	0.8	(0.37 – 1.58)
> 4 hours	0.2	(0.06 – 0.47)***	0.2	(0.07 – 0.51)**
Decided upon feeding method				
Before pregnancy	1		1	
During pregnancy	0.7	(0.41 – 1.04)	0.6	(0.38 – 1.02)
After the baby was born	0.1	(0.06 – 0.37)***	0.1	(0.05 –0.32)***
Maternal mother's feeding method was breastfeeding				
Yes	1		1	
No	0.4	(0.13 – 1.1)	0.4	(0.15 – 1.38)
Maternal employment				
Yes	1		0.7	(0.44 – 1.04)
No	0.7	(0.48 – 1.05)	1	
Baby had ARI				
Yes	0.6	(0.38 – 0.88)*	0.7	(0.43 – 1.04)
No	1		1	

-2 Log likelihood (deviance) 519.739 df=8*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.71 shows the factors associated with 'full breastfeeding' up to three months. The factors included in the full model were 'maternal age', 'initiation of breastfeeding', 'time a feeding method was decided', 'maternal mother's feeding method', 'maternal mothers preference on the feeding method', father's preference on the feeding method and 'acute respiratory infections'. In the unadjusted model, there was an inverse association with 'full breastfeeding' and acute respiratory infections. In the adjusted model, the factors that were associated with 'full breastfeeding' were 'maternal age', 'initiation of breastfeeding' and 'the time breastfeeding was decided'. Acute respiratory infections were not significant factors for 'full breastfeeding' at three months.

Table 4.72 Factors associated with 'full breastfeeding' at six months

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Initiation of breastfeeding				
Within four hours	1		1	
1-4 hours	0.6	(0.27 – 1.26)	0.6	(0.27 – 1.46)
> 4 hours	0.08	(0.10 – 0.57)*	0.06	(0.01 – 0.44)**
Decided upon feeding method				
Before pregnancy	1		1	
During pregnancy	0.9	(0.53 – 1.46)	0.8	(0.50 – 1.43)
After the baby was born	0.06	(0.01 – 0.43)**	0.06	(0.01 –0.41)**
Had stressful life event				
Yes	3.6	(1.56 – 8.35)**	4.4	(1.73 – 11.22)**
No	1		1	

-2 Log likelihood (deviance) 457.994 df=3*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.72 shows the factors associated with 'full breastfeeding' up to six months. The variables in the full model were 'initiation of breastfeeding', 'time a feeding method was decided', 'had stressful life events', 'acute respiratory infections', and 'father's preference in the feeding method'. Mothers who initiated breastfeeding after four hours were less likely to be 'fully breastfeeding' up to six months. Mothers who decided upon breastfeeding after the baby was born also were less likely to 'fully breastfeed' up to six months. 'Having stressful life events' (death of a family member, problems with husband or other family members) had a positive association with 'full breastfeeding'.

4.10 Factors associated with 'any breastfeeding'

4.10.1 Cross tabulation

Table 4.73 shows the demographic factors associated with 'any breastfeeding' at one month, three months and six months after giving birth. 'Any breastfeeding' at six months was significantly associated with the 'number of people who were living in the room', 'number of children being more than three' and 'low household income'. There were no significant associations between demographic factors and 'any breastfeeding' at three months and six months.

Table 4.73 Demographic factors associated with any breastfeeding

	One month			Three months			Six months		
Variable	**Any BF**	**None BF**	**p-value**	**Any BF**	**None BF**	**p-value**	**Any BF**	**None BF**	**p-value**
Mother's age, years									
<24	108	1	0.28	106	3	0.35	97	9	
24 - 35	301	3		288	15		263	28	0.94
≥35	20	1		19	2		19	2	
Marital status									
Married	425	5	0.81	408	20	0.78	375	39	0.52
Divorced	5	0		5	0		4	0	
Mother's education									
Primary or lower	74	0	0.31	71	1	0.12	68	3	0.11
Secondary and higher	356	5		341	19		311	36	
Type of accommodation									
Rented	186	2	0.88	178	10	0.54	164	16	0.79
Own place	244	3		235	10		215	23	
Number of people living in a room									
≤3	358	5	0.32	342	19	0.16	311	67	**0.03**
>3	71	0		70	1		67	2	
Parity									
Primiparous	233	3	0.52	224	12	0.07	204	23	**0.016**
Multiparous (2)	115	2		108	8		98	15	
Multiparous (≥3)	82	0		81	0		77	1	
Mother's occupation									
Housewife/self-employed	274	4	0.40	264	13	0.92	241	24	0.80
Government/private employment	155	1		149	7		138	15	
Husband's occupation									
Unemployed	16	0	0.82	16	0	0.37	13	1	0.78
Government/private employment	413	5		397	20		366	38	
Household annual income									
<MVR 90,000 (<A$6,209)	105	1	0.11	3	102	0.11	96	5	**0.006**
MVR 90,000-250,000 (A$6,209-17,249)	279	2		12	268		246	24	
>MVR 250,000 (>A$17, 249)	46	2		5	43		37	10	

Chi-square test between any breastfeeding and demographic factors

Table 4.74 Maternal factors associated with 'any breastfeeding'

	One month			**Three months**			**Six months**		
Variables	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**
Maternal weight at one month after delivery									
< 50	30	0	0.83	29	1	0.99	28	2	0.93
50-65	142	1		138	5		129	12	
> 65	91	1		89	3		83	7	
Maternal weight at three months after delivery									
< 50	40	0	0.40	37	3	0.38	35	5	0.45
50-65	160	3		156	7		146	15	
> 65	58	0		57	1		54	3	
Maternal weight at six months after delivery									
< 50	49	0	0.37	46	3	0.49	43	6	0.39
50-65	162	3		158	7		151	14	
> 65	60	0		59	1		57	3	
Smoking:									
Before pregnancy									
Yes	15	0	0.67	13	2	0.10	13	2	0.59
No	415	5		400	18		366	37	
During pregnancy									
Yes	2	0	0.88	1	19	**0.002**	1	1	**0.047**
No	428	5		1	412		378	38	
Before pregnancy (husband)									
Yes	184	3	0.44	180	7	0.45	164	16	0.79
No	2	246		233	13		215	23	
During pregnancy (husband)									
Yes	163	3	0.31	161	5	0.21	145	14	0.77
No	267	2		252	15		234	25	
Received help in looking after children and in household chores									
Yes	377	4	0.61	361	18	0.73	331	35	0.66
No	53	1		52	2		48	4	

Table 4.75 Maternal factors associated with 'any breastfeeding' (cont.)

	One month			**Three months**			**Six months**		
Variables	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**
People who helped:									
Husband									
Yes	198	2	0.79	186	13	0.08	165	27	**0.02**
No	232	3		227	7		214	12	
Maternal mother									
Yes	197	4	0.13	192	9	0.89	172	20	0.48
No	233	1		221	11		207	19	
Paternal mother									
Yes	115	1	0.74	112	3	0.17	104	9	0.56
No	315	4		301	7		275	30	
Other family members									
Yes	220	2	0.62	212	10	0.91	197	21	0.82
No	210	3		201	10		182	18	
Babysitter									
Yes	11	0	0.72	9	2	**0.03**	9	2	0.31
No	419	5		404	18		370	37	
Servant									
Yes	8	1	**0.005**	8	1	0.35	7	1	0.75
No	422	4		405	19		372	38	
Had stressful life event									
Yes	23	1	0.15	22	2	0.37	22	2	0.86
No	407	23		391	18		357	31	

Chi-square test between 'any breastfeeding' and maternal factors

Table 4.74 and 4.75 shows the maternal factors associated with ‘any breastfeeding’. The only factor that was associated with ‘any breastfeeding’ at one month was ‘receiving help from a servant’. At three months, ‘receiving help from a babysitter’ and ‘maternal smoking status during pregnancy’ were associated with ‘any breastfeeding’. ‘Any breastfeeding’ at six months was associated with ‘maternal smoking status’ and ‘receiving help from the infant’s father’.

Table 4.76 Infant variables associated with 'any breastfeeding'

	One month			**Three months**			**Six months**		
Variable	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**
Gender of the baby									
Male	209	4	0.16	201	12	0.32	183	20	0.72
Female	220	1		212	8		196	19	
Type of delivery									
Vaginal	237	2	0.50	229	9	0.36	213	18	0.23
Caesarean	192	3		184	11		166	21	
Prelacteal feeds (ritual)									
Given	78	1	0.42	77	2	0.26	68	9	0.28
Not given	351	4		336	18		311	30	
Prelacteal feeds (formula)									
Given	19	2	**0.02**	14	7	**<0.001**	13	7	**<0.001**
Not given	410	3		339	13		366	32	
Initiation of breastfeeding									
Within one hour	360	4	0.64	350	14	**0.04**	320	31	**0.04**
1-4 hours	41	1		39	2		38	2	
> 4 hours	28	0		24	4		21	6	
Birth weight (Full term infants)									
<2,500g	22	0	0.81	20	1	0.74	19	1	0.78
2,500-3,900g	394	5		380	19		349	37	
≥4,000g	12	0		12	0		11	1	
Infant boys' weight at one month									
<3,300g (-2 z score)	12	0	0.62	11	1	0.62	9	2	0.32
3,300-5,700g	193	4		187	10		171	17	
>5,700g (+2 z score)	-	-		-	-		-	-	
Infant boys' weight at three months									
<5,000g (-2 z score)	14	0	0.63	14	0	0.38	10	2	0.35
5,000-8,000g	185	3		178	10		167	16	
>8,000 (+2 z score)	-	-		-	-		-	-	

Table 4.77 Infant variables associated with 'any breastfeeding' (cont.)

	One month			**Three months**			**Six months**		
Variable	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**
Infant boys' weight at six months									
<6,300g (-2 z score)	13	0	0.88	13	0	0.67	13	0	**0.004**
6,300-9,800g	179	3		172	10		165	17	
>9,800g (+2 z score)	1	0		-	-		0	1	
Infant boys' length at one month									
<50.5cm (-2 z score)	15	0	0.79	15	0	0.55	13	0	0.08
50.5-58.2 cm	147	4		141	10		131	15	
>58.2cm (+2 z score)	2	0		2	0		1	1	
Infant boys' length at three months									
<57.2 (-2 z score)	27	0	0.47	25	2	0.64	23	2	0.84
57.2 -65.5	152	3		147	8		137	14	
>65.5 (+2 z score)	-	-		-	-		-	-	
Infant boys' length at six months									
<63.2 cm (-2 z score)	33	0	0.70	32	1	0.76	31	2	0.77
63.2-71.8 cm	143	3		137	9		132	14	
>71.8 cm (+2 z score)	1	0		1	0		1	0	
Infant girls' weight at one month									
<3,100g (-2 z score)	6	0	0.98	5	1	0.24	5	1	0.77
3,100-5,400g	206	1		199	7		185	18	
>5,400g (+2 z score)	1	0		1	0		1	0	
Infant girls' weight at three months									
<4,500g (-2 z score)	3	0	0.99	3	0	0.93	3	0	**0.004**
4,500-7,500g	206	1		200	7		188	17	
>7,500 (+2 z score)	1	0		1	0		0	1	
Infant girls' weight at six months									
<5,700g (-2 z score)	6	0	0.98	6	0	0.88	0	6	0.71
5,700-9,300g	203	1		197	7		18	186	
>9,300g (+2 z score)	1	0		1	0		0	1	

Table 4.78 Infant variables associated with 'any breastfeeding' (cont.)

	One month			Three months			Six months		
Variable	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**	**Any BF**	**Not BF**	**p-value**
Infant girls' length at one month									
<49.5cm (-2 z score)	10	0	0.96	10	0	0.79	0	10	0.52
49.5-57.3 cm	166	1		161	6		15	149	
>57.3cm (+2 z score)	3	0		3	0		0	3	
Infant girls' length at three months									
<55.6 (-2 z score)	22	0	0.93	21	1	0.89	1	20	0.73
55.6 -64.0	163	1		159	5		14	149	
>64.0 (+2 z score)	3	0		3	0		0	3	
Infant girls' length at six months									
<61.0 cm (-2 z score)	8	0	0.83	7	0	0.57	0	8	0.39
61.0-70.1 cm	183	1		177	8		16	168	
>70.1 cm (+2 z score)	-	-		-	-		-	-	
Infants who had diarrhoea									
Yes	28	1	0.23	27	2	0.55	22	6	**0.02**
No	401	4		386	18		357	33	
Infants who had ARI									
Yes	129	2	0.63	125	6	0.98	120	11	0.66
No	300	3		288	14		259	28	
Other infant health problems									
Yes	9	0	0.74	7	2	**0.01**	5	3	**0.006**
No	420	5		406	18		374	36	

Chi-square test between 'any breastfeeding and baby health problems

Table 4.76, 4.77 and 4.78 show the infant variables associated with 'any breastfeeding'. Infants who were given any breastmilk at three months were less likely to have 'other health problems' (digestive problems, vomiting and constipation) compared with infants who were not given any breastmilk. Infants (boys) who were 'any breastfed' at six months were more likely to be below two standard deviations on the (World Health Organisation, 2006) growth chart at six months compared with boys who were not breastfed. Infants (girls) who were 'any breastfed' at six months were more likely to be below two standard deviations on the (World Health Organisation, 2006) growth chart at three months compared with girls who were not breastfed. 'Any breastfed' infants were less likely to have 'other health problems' compared with infants who were not breastfed at six months.

Table 4.79 Factors that support 'any breastfeeding' at one month

Factor	Any	None	P-value
Time of decision to breastfeed			
Before I became pregnant	286	1	**0.01**
During my pregnancy	93	1	
After my baby was born	34	2	
Mother's perception of where baby should sleep			
In the same bed with me	240	1	0.39
In the same room, but not in the same bed as me	170	3	
In another room	3	0	
Received information from hospital			
Yes	201	1	0.35
No	212	3	
Sources of information			
Pamphlets or booklets on breastfeeding	35	0	0.51
Lectures or classes on breastfeeding	114	0	
Demonstrations on how to breastfeed	4	0	
Video or TV show on how to breastfeed	2	0	
Individual consultation or discussion	73	1	
Did not receive any information	118	3	
Other forms of information (internet)	67	0	
People who support breastfeeding			
Baby's father: Yes	272	2	0.50
No	141	2	
Maternal mother: Yes	172	2	0.79
No	234	2	
Paternal mother: Yes	22	0	0.64
No	391	4	
Doctors: Yes	21	1	0.08
No	392	3	
Nurses: Yes	26	1	0.13
No	387	3	
Community health workers: Yes	11	0	0.74
No	402	4	
Friends and other family members: Yes	45	0	0.49
No	368	4	
Maternal mother's feeding method			
Breastfeed	397	3	**0.03**
Bottle feed	16	1	
Father's preference of feeding method			
Prefers bottle feeding	1	0	0.76
Prefers breastfeeding	379	4	
Does not mind how the baby is fed	33	1	
Never really discussed the matter with him	16	0	
Maternal mother's preference of feeding method			
Prefers bottle feeding	5	0	0.77
Prefers breastfeeding	349	5	
Does not mind how I feed our baby	27	0	
Never really discussed the matter with her	48	0	

Chi-square test between 'any breastfeeding' and variables which support breastfeeding

Table 4.79 shows that the only significant factors which supported 'any breastfeeding' at one month were, 'deciding to breastfeed before pregnancy' and 'maternal mother's feeding method being breastfeeding'. All other factors were not significant.

Table 4.80 Factors that support 'any breastfeeding' at three months

Factor	Any	None	P-value
Time of decision to breastfeed			
Before I became pregnant	276	11	0.44
During my pregnancy	89	5	
After my baby was born	33	3	
Mother's perception of where baby should sleep			
In the same bed with me	234	7	0.14
In the same room, but not in the same bed as me	161	12	
In another room	3	0	
Received information from hospital			
Yes	189	13	0.07
No	209	6	
Sources of information			
Pamphlets or booklets on breastfeeding	34	1	0.86
Lectures or classes on breastfeeding	107	7	
Demonstrations on how to breastfeed	4	0	
Video or TV show on how to breastfeed	2	0	
Individual consultation or discussion	72	2	
Did not receive any information	114	7	
Other forms of information (internet)	65	2	
People who support breastfeeding			
Baby's father: Yes	261	13	0.80
No	137	6	
Maternal mother: Yes	170	11	0.19
No	228	8	
Paternal mother: Yes	21	1	0.99
No	377	18	
Doctors: Yes	20	2	0.30
No	378	17	
Nurses: Yes	24	3	0.09
No	374	16	
Community health workers: Yes	10	1	0.47
No	388	18	
Friends and other family members: Yes	42	3	0.47
No	356	16	
Maternal mother's feeding method			
Breastfeed	384	16	**0.008**
Bottle feed	14	3	
Father's preference of feeding method			
Prefers bottle feeding	1	0	0.07
Prefers breastfeeding	368	14	
Does not mind how the baby is fed	30	4	
Never really discussed the matter with him	14	2	
Maternal mother's preference of feeding method			
Prefers bottle feeding	4	1	0.1
Prefers breastfeeding	340	13	
Does not mind how I feed our baby	24	3	
Never really discussed the matter with her	45	3	

Chi-square test between 'any breastfeeding' and variables which support breastfeeding

Table 4.80 shows the factors that support 'any breastfeeding' at three months. The only factor that was significant with 'any breastfeeding' was 'maternal mother's feeding method being breastfeeding'.

Table 4.81 Factors that support 'any breastfeeding' at six months

Factor	Any	None	P-value
Time of decision to breastfeed			
Before I became pregnant	261	22	0.17
During my pregnancy	83	10	
After my baby was born	29	6	
Mother's perception of where baby should sleep			
In the same bed with me	217	20	0.67
In the same room, but not in the same bed as me	153	18	
In another room	3	0	
Received information from hospital			
Yes	175	24	**0.04**
No	198	14	
Sources of information			
Pamphlets or booklets on breastfeeding	33	2	0.82
Lectures or classes on breastfeeding	99	13	
Demonstrations on how to breastfeed	3	1	
Video or TV show on how to breastfeed	2	0	
Individual consultation or discussion	67	6	
Did not receive any information	109	11	
Other forms of information (internet)	60	5	
People who support breastfeeding			
Baby's father: Yes	244	25	0.96
No	129	13	
Maternal mother: Yes	157	23	**0.03**
No	216	15	
Paternal mother: Yes	19	3	0.47
No	354	35	
Doctors: Yes	17	5	**0.03**
No	5	33	
Nurses: Yes	22	5	0.09
No	351	33	
Community health workers: Yes	9	2	0.30
No	364	36	
Friends and other family members: Yes	39	5	0.61
No	334	33	
Maternal mother's feeding method			
Breastfeed	359	35	0.22
Bottle feed	14	3	
Father's preference of feeding method			
Prefers bottle feeding	1	0	0.63
Prefers breastfeeding	336	32	
Does not mind how the baby is fed	29	5	
Never really discussed the matter with him	13	2	
Maternal mother's preference of feeding method			
Prefers bottle feeding	3	2	0.06
Prefers breastfeeding	310	30	
Does not mind how I feed our baby	22	4	
Never really discussed the matter with her	44	3	

Chi-square test between 'any breastfeeding' and variables which support breastfeeding

Table 4.81 shows that mothers who received information from their hospitals were less likely to continue ‘any breastfeeding’ at six months. Getting infant feeding support from maternal mothers also was associated with lower rates of ‘any breastfeeding’ at six months. Getting information from doctors is associated with higher rates of ‘any breastfeeding’ at six months.

4.10.2 Multivariate analysis

Multivariate logistic regression was used to further analyse the factors associated with ‘any breastfeeding’. The significant infant variables identified from the cross tabulation were put into the full model. The factors included in the full model were ‘initiation of breastfeeding’, ‘maternal mother’s feeding method’, infant’s weight at three months (girls), infant’s weight at six months (boys),‘baby had health problems’, ‘baby had diarrhoea’ and ‘baby was given prelacteal feeds’. The non-significant factors then were removed using the backward stepwise method. The variables that were in the final model were factors for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.82 Factors associated with ‘any breastfeeding cessation’ before six months

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Initiation of breastfeeding				
< one hour	1		1	
1-4 hours	0.5	(0.13 – 2.36)	0.3	(0.05 – 1.62)
> 4 hours	2.9	(1.11 – 7.85)*	1.3	(0.35 – 4.91)
Maternal mother’s feeding method was breastfeeding				
Yes	1		1	
No	2.1	(0.60 – 8.02)	1.3	(0.28 – 5.50)
Baby had other health problems				
Yes	6.2	(1.43 – 27.16)*	7.4	(1.63 – 33.41)*
No	1		1	
Baby had diarrhoea				
Yes	3.0	(1.11 – 7.89)*	3.6	(1.26 – 9.99)*
No	1		1	
Prelacteal feed (formula)				
Yes	1		1	
No	6.1	(2.30 – 16.53)***	6.0	(1.64 – 21.80)**

-2 Log likelihood (deviance) 230.695 df=2*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.82 shows the factors associated with ‘any breastfeeding cessation’ before six months. Mothers who gave infant formula as a prelacteal feed were six times more likely to stop ‘any breastfeeding’ before six months compared with mothers who did not give infant formula as a prelacteal feed. Infants of mothers who stopped ‘any breastfeeding’ before six months were over three times more likely to have diarrhoea and over seven times more likely to have other health problems (digestive problems, vomiting and constipation) compared with the infants of mothers who did not stop ‘any breastfeeding’.

4.11 Factors associated with introduction of infant formula

4.11.1Cross tabulation

Table 4.83 shows the demographic factors associated with formula feeding. Formula feeding at three months was associated with ‘mother’s age being more than or equal to 24 years’, ‘parity’, ‘mother being employed’ and ‘lower household income’. There were no demographic factors associated with formula feeding at one month and six months.

Table 4.83 Demographic factors associated with formula feeding

	One month			Three months			Six months		
Variable	**Formula Feeding**	**No formula**	**p-value**	**Formula Feeding**	**No formula**	**p-value**	**Formula Feeding**	**No formula**	**p-value**
Mother's age, years									
<24	24	85	0.34	30	79	**0.006**	84	22	
24 - 35	87	217		128	174		243	54	0.84
≥35	7	14		12	9		17	4	
Marital status									
Married	117	312	0.71	168	259	0.97	342	78	0.11
Divorced	1	4		2	3		2	2	
Mother's education									
Primary or lower	20	54	0.97	26	46	0.54	55	16	0.39
Secondary and higher	98	262		144	216		289	64	
Type of accommodation									
Rented	52	136	0.84	80	108	0.23	149	34	0.90
Own place	66	180		90	154		195	46	
Number of people living in a room ≤3	9	264	0.96	140	220	0.76	289	64	0.36
>3	19	52		29	42		54	16	
Parity									
Primiparous	67	169	0.20	92	143	**0.027**	187	42	0.38
Multiparous (2)	35	81		55	61		96	18	
Multiparous (≥3)	16	66		23	58		61	19	
Mother's occupation									
Housewife/self-employed	71	207	0.30	96	180	**0.01**	217	52	0.75
Government/private employment	47	109		74	82		127	28	
Husband's occupation									
Unemployed	4	12	0.68	7	7	0.67	12	3	0.50
Government employment	114	304		162	254		332	77	
Household annual income									
<MVR 90,000 (<A$6,209)	25	81	0.31	33	72	**0.047**	80	22	0.27
MVR 90,000-250,000	76	294		112	167		222	53	
>MVR 250,000 (>A$17, 249)	17	31		25	23		42	5	

Chi-square test between formula feeding and demographic factors

Table 4.84 Maternal factors associated with formula feeding

	One month			Three months			Six months		
Variables	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**
Maternal weight at one month after delivery									
< 50 kg	2	28	**0.047**	6	24	0.08	24	6	0.44
50-65 kg	38	105		60	83		119	23	
> 65 kg	26	66		37	55		71	21	
Maternal weight at three months after delivery									
< 50 kg	5	35	**0.009**	12	28	0.14	34	6	0.82
50-65 kg	41	122		66	97		131	31	
> 65 kg	23	35		29	29		48	10	
Maternal weight at six months after delivery									
< 50 kg	7	42	**0.029**	14	35	0.11	41	8	0.89
50-65 kg	42	123		65	100		135	30	
> 65 kg	22	38		29	31		48	12	
Smoking :									
Before pregnancy									
Yes	3	12	0.52	6	9	0.96	11	4	0.43
No	115	304		164	253		333	76	
During pregnancy									
Yes	0	2	0.39	2	0	0.08	2	0	0.49
No	118	314		168	262		342	80	
Before pregnancy (husband)									
Yes	55	132	0.37	78	108	0.34	150	33	0.70
No	63	184		92	154		194	47	
During pregnancy (husband)									
Yes	51	115	0.19	71	94	0.22	136	26	0.24
No	67	201		99	168		208	54	
Received help in looking after children and in household chores									
Yes	102	278	0.67	148	230	0.82	302	70	0.94
No	16	38		22	32		42	10	

Table 4.85 Maternal factors associated with formula feeding (cont.)

	One month			Three months			Six months		
Variables	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**
People who helped:									
Husband									
Yes	58	142	0.43	79	120	0.89	155	40	0.42
No	60	174		91	142		189	40	
Maternal mother									
Yes	56	145	0.77	83	117	0.40	159	36	0.84
No	62	171		87	145		185	44	
Paternal mother									
Yes	29	89	0.54	43	72	0.62	88	25	0.30
No	89	229		127	190		256	55	
Other family members									
Yes	62	160	0.72	90	132	0.60	178	42	0.90
No	56	156		80	130		155	38	
Babysitter									
Yes	2	9	0.50	5	6	0.68	9	2	0.95
No	9	307		165	256		335	78	
Servant									
Yes	3	6	0.68	7	2	**0.017**	8	1	0.55
No	115	310		163	260		336	79	
Had stressful life event									
Yes	114	296	0.23	6	18	0.14	18	6	0.43
No	4	20		164	244		326	74	

Chi-square test between formula feeding and maternal factors

Table 4.84 and 4.85 show the maternal factors associated with formula feeding. Formula feeding at one month was associated with ‘maternal weight being more than 65 kg’ at one month, three months and six months. Formula feeding at three months was associated with ‘receiving help from a servant’. Formula feeding at six months was not associated with any maternal variables.

Table 4.86 Infant variables associated with formula feeding

	One month			Three months			Six months		
Variable	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**
Gender of the baby									
Male	57	156	0.84	83	137	0.48	178	39	0.63
Female	61	160		87	125		166	41	
Type of delivery									
Vaginal	50	189	**0.001**	76	161	**0.001**	175	58	**<0.001**
Caesarean	68	127		94	101		169	22	
Prelacteal feeds (formula)									
Given	21	0	**<0.001**	21	0	**<0.001**	21	0	**0.02**
Not given	100	313		151	260		323	80	
Initiation of breastfeeding									
Within one hour	84	280	**<0.001**	129	234	**<0.001**	282	74	**0.045**
1-4 hours	17	25		21	20		35	5	
> 4 hours	19	9		22	6		27	1	
Birth weight (Full term infants)									
<2,500g	6	16	0.9	10	11	0.68	18	3	0.75
2,500-3,900g	108	291		156	242		317	74	
≥4,000g	4	8		4	8		9	3	
Infant boys' weight at one month									
<3,300g (-2 z score)	5	7	0.18	7	5	0.18	10	2	0.79
3,300-5,700g	48	149		76	120		153	38	
>5,700g (+2 z score)									
Infant boys' weight at three months									
<5,000g (-2 z score)	6	8	0.14	7	7	0.46	11	2	0.69
5,000-8,000g	47	141		75	113		148	37	
>8,000 (+2 z score)									
Infant boys' weight at six months									
<6,300g (-2 z score)	4	9	0.78	6	7	0.64	10	3	0.86
6,300-9,800g	47	135		72	110		145	37	
>9,800g (+2 z score)	0	1		0	1		1	0	

Chi-square test between formula feeding and baby health problems

Table 4.87 Infant variables associated with formula feeding (cont.)

	One month			Three months			Six months		
Variable	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**
Infant boys' length at one month									
<50.5cm v	4	11	0.69	6	9	0.96	11	3	0.76
50.5-58.2 cm	41	110		62	89		122	27	
>58.2cm (+2 z score)	0	2		1	1		2	0	
Infant boys' length at three months									
<57.2 (-2 z score)	8	19	0.78	12	15	0.81	22	4	0.56
57.2 -65.5	42	113		65	90		122	31	
>65.5 (+2 z score)									
Infant boys' length at six months									
<63.2 cm (-2 z score)	7	26	0.56	12	21	0.41	24	9	0.41
63.2-71.8 cm	42	104		61	85		120	26	
>71.8 cm (+2 z score)	0	1		1	0		1	0	
Infant girls' weight at one month									
<3,100g (-2 z score)	2	4	0.25	4	2	0.14	6	0	0.45
3,100-5,400g	56	151		75	131		167	38	
>5,400g (+2 z score)	1	0		1	0		1	0	
Infant girls' weight at three months									
<4,500g (-2 z score)	1	2	0.27	2	1	0.24	3	0	0.64
4,500-7,500g	57	150		75	132		168	38	
>7,500 (+2 z score)	1	0		1	0		1	0	
Infant girls' weight at six months									
<5,700g (-2 z score)	1	5	0.22	3	3	0.34	6	0	0.45
5,700-9,300g	56	148		74	130		166	38	
>9,300g (+2 z score)	1	0		1	0		1	0	
Infant girls' length at one month									
<49.5cm (-2 z score)	3	7	0.38	5	5	0.43	7	3	0.43
49.5-57.3 cm	49	118		62	105		137	29	
>57.3cm (+2 z score)	2	1		2	1		3	0	

Chi-square test between formula feeding and baby health problems

Table 4.88 Infant variables associated with formula feeding (cont.)

	One month			**Three months**			**Six months**		
Variable	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**	**Formula feeding**	**No formula**	**p-value**
Infant girls' length at three months									
<55.6 (-2 z score)	3	19	0.11	7	15	0.36	16	5	0.64
55.6 -64.0	52	112		62	102		135	29	
>64.0 (+2 z score)	0	3		0	3		2	1	
Infant girls' length at six months									
<61.0 cm (-2 z score)	3	5	0.52	5	3	0.11	7	1	0.67
61.0-70.1 cm	50	134		64	120		150	34	
>70.1 cm (+2 z score)	0	0		0	0		0	0	
Infants who had diarrhoea									
Yes	10	19	0.36	14	15	0.30	26	3	0.22
No	108	297		156	247		318	77	
Infants who had ARI									
Yes	35	96	0.88	58	73	0.16	100	31	0.09
No	83	220		112	119		244	49	
Other infant health problems									
Yes	5	4	**0.05**	8	1	**0.002**	7	1	0.64
No	113	312		162	261		337	79	

Chi-square test between formula feeding and baby health problems

Table 4.86, 4.87 and 4.88 show the infant variables associated with formula feeding. Mothers who delivered by caesarean section were more likely to give infant formula to their infants at one month, three months and six months when compared with mothers who delivered by vaginal birth. Formula fed babies were also more likely to have ‘other health problems’ (digestive problems, vomiting and constipation) at one month and three months compared with infants who were not given infant formula.

Table 4.89 Factors that support introduction of formula at one month

Factor	Given	Not given	P-value
Time of decision to breastfeed			
Before I became pregnant	68	219	**<0.001**
During my pregnancy	27	67	
After my baby was born	20	16	
Mother's perception of where baby should sleep			
In the same bed with me	65	176	0.93
In the same room, but not in the same bed as me	49	124	
In another room	1	2	
Received information from hospital			
Yes	59	143	0.47
No	56	159	
Sources of information			
Pamphlets or booklets on breastfeeding	8	27	**0.02**
Lectures or classes on breastfeeding	37	77	
Demonstrations on how to breastfeed	3	1	
Video or TV show on how to breastfeed	1	1	
Individual consultation or discussion	16	58	
Did not receive any information	40	81	
Other forms of information (internet)	10	57	
People who support breastfeeding			
Baby's father: Yes	76	198	0.92
No	39	104	
Maternal mother: Yes	45	136	0.28
No	70	166	
Paternal mother: Yes	5	17	0.60
No	110	285	
Doctors: Yes	8	14	0.34
No	107	288	
Nurses: Yes	9	18	0.49
No	106	284	
Community health workers: Yes	4	7	0.36
No	111	295	
Friends and other family members: Yes	10	35	0.40
No	105	267	
Maternal mother's feeding method			
Breastfeed	109	291	0.47
Bottle feed	6	11	
Father's preference of feeding method			
Prefers bottle feeding	0	1	0.45
Prefers breastfeeding	101	282	
Does not mind how the baby is fed	13	21	
Never really discussed the matter with him	4	12	
Maternal mother's preference of feeding method			
Prefers bottle feeding	1	4	0.64
Prefers breastfeeding	98	256	
Does not mind how I feed our baby	9	18	
Never really discussed the matter with her	10	38	

Chi-square test between 'formula feeding' and variables which support breastfeeding

Table 4.89 shows that the factors that supported formula feeding at one month were 'making the decision about feeding method after the baby was born' and 'the type of information on breastfeeding'. All other factors were not statistically significant.

Table 4.90 Factors that support introduction of formula at three months

Factor	Given	Not given	P-value
Time of decision to breastfeed			
Before I became pregnant	98	189	**<0.001**
During my pregnancy	42	52	
After my baby was born	26	10	
Mother's perception of where baby should sleep			
In the same bed with me	88	153	0.25
In the same room, but not in the same bed as me	77	96	
In another room	1	2	
Received information from hospital			
Yes	91	111	**0.03**
No	75	140	
Sources of information			
Pamphlets or booklets on breastfeeding	12	23	0.15
Lectures or classes on breastfeeding	53	61	
Demonstrations on how to breastfeed	3	1	
Video or TV show on how to breastfeed	1	1	
Individual consultation or discussion	31	43	
Did not receive any information	48	73	
Other forms of information (internet)	18	49	
People who support breastfeeding			
Baby's father: Yes	108	166	0.82
No	58	85	
Maternal mother: Yes	74	107	0.69
No	92	144	
Paternal mother: Yes	10	12	0.58
No	156	239	
Doctors: Yes	13	9	**0.048**
No	153	242	
Nurses: Yes	15	12	0.07
No	151	239	
Community health workers: Yes	6	5	0.31
No	160	246	
Friends and other family members: Yes	18	27	0.98
No	148	224	
Maternal mother's feeding method			
Breastfeed	158	242	0.53
Bottle feed	8	9	
Father's preference of feeding method			
Prefers bottle feeding	0	1	0.08
Prefers breastfeeding	143	238	
Does not mind how the baby is fed	20	14	
Never really discussed the matter with him	7	9	
Maternal mother's preference of feeding method			
Prefers bottle feeding	2	3	0.08
Prefers breastfeeding	134	218	
Does not mind how I feed our baby	17	10	
Never really discussed the matter with her	17	31	

Chi-square test between 'formula feeding' and variables which support breastfeeding

Table 4.90 shows the factors that were associated with 'formula feeding' at three months. Mothers who decided on a feeding method during pregnancy or after their babies were born were more likely to give infant formula to their infants at three months when compared with mothers who decided on a feeding method before pregnancy. Mothers who received breastfeeding information and support from doctors were more likely to give infant formula to their infants.

Table 4.91 Factors that support introduction of formula at six months

Factor	Given	Not given	P-value
Time of decision to breastfeed			
Before I became pregnant	227	58	0.47
During my pregnancy	80	14	
After my baby was born	30	6	
Mother's perception of where baby should sleep			
In the same bed with me	191	48	0.06
In the same room, but not in the same bed as me	145	28	
In another room	1	2	
Received information from hospital			
Yes	168	32	0.16
No	169	46	
Sources of information			
Pamphlets or booklets on breastfeeding	25	10	0.37
Lectures or classes on breastfeeding	97	16	
Demonstrations on how to breastfeed	4	0	
Video or TV show on how to breastfeed	2	0	
Individual consultation or discussion	56	17	
Did not receive any information	100	21	
Other forms of information (internet)	53	14	
People who support breastfeeding			
Baby's father: Yes	220	52	0.82
No	117	26	
Maternal mother: Yes	154	27	**0.048**
No	183	51	
Paternal mother: Yes	19	3	0.52
No	318	75	
Doctors: Yes	20	2	0.18
No	317	76	
Nurses: Yes	25	2	0.09
No	312	76	
Community health workers: Yes	8	3	0.34
No	329	75	
Friends and other family members: Yes	41	4	**0.048**
No	296	74	
Maternal mother's feeding method			
Breastfeed	325	73	0.25
Bottle feed	12	5	
Father's preference of feeding method			
Prefers bottle feeding	1	0	0.69
Prefers breastfeeding	300	73	
Does not mind how the baby is fed	30	4	
Never really discussed the matter with him	13	3	
Maternal mother's preference of feeding method			
Prefers bottle feeding	3	2	0.12
Prefers breastfeeding	279	66	
Does not mind how I feed our baby	25	1	
Never really discussed the matter with her	37	11	

Chi-square test between 'formula feeding' and variables which support breastfeeding

Table 4.91 shows the factors that were associated with giving infant formula at six months. Getting support regarding infant feeding from maternal mothers was associated with higher rates of formula feeding at six months. Getting information from friends and other family members also was associated with higher rates of formula feeding.

4.11.2 Multivariate Analysis

Multivariate logistic regression was used to further analyse the factors associated with the occurrence of 'formula feeding'. The significant infant variables identified from the cross tabulation were put into the full model. Three different models were used to analyse the factors associated with 'formula feeding' at one month, three months and six months. The non-significant factors then were removed using a backward stepwise method. The variables that were in the final model were factors for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.92 Demographic factors associated with formula feeding at three months

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Mother's age (years)				
18- 24	1		1	
24 – 35	1.9	(1.2 – 3.1)**	2.1	(1.3 – 3.6)**
> 35	3.4	(1.3 – 9.1)*	5.2	(1.8 – 14.7)**
Parity				
Primiparous	2.2	(1.2 – 4.1)**	2.1	(1.1 – 4.0)*
Multiparous (2)	1.6	(0.9 – 2.8)	2.6	(1.4 – 5.1)**
Multiparous (≥3)	1		1	
Mother's occupation				
Housewife	1		1	
Employed	1.6	(1.1 – 2.5)*	1.7	(1.1 – 2.6)*

-2 Log likelihood (deviance) 504.027 df=6*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.92 shows the demographic factors that were associated with formula feeding at three months. The factors included in the full model were 'mother's age', 'parity', 'mother's occupation', 'time of decision to breastfeed' and' information sources'. Compared with mothers who were in the age group '18-24', mothers in the age group '24 - 35' (Adjusted OR= 2.1; 95% CI, 1.3 – 3.6) and 'above 35' (adjusted OR= 5.2; 95% CI, 1.8 – 14.7) were more likely to give infant formula at three months. Compared with multiparous (number of children: ≥3) mothers, primiparous mothers (adjusted OR= 2.1; 95% CI, 1.1 – 4.0) and multiparous (number of children: 2) mothers (adjusted OR= 2.6; 95% CI, 1.4 – 5.1) were more likely to give infant formula to their infants at three months. Mothers who were employed in government or private jobs (adjusted OR=1.7; 95% CI, 1.1 – 2.6) were more likely to give infant formula to their infants compared with mothers who were house wives of self-employed.

Table 4.93 Maternal factors and infant variables associated with formula feeding at one month

	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Maternal weight at three months after delivery				
< 50 kg	1		1	
50-65 kg	2.4	(0.9 – 6.4)	2.4	(0.9 – 6.4)
> 65 kg	4.6	(1.6 – 13.5)**	4.4	(1.5 – 13.0)**
Maternal weight at six months after delivery				
< 50 kg	1		1	
50-65 kg	2.0	(0.9 – 4.9)	2.1	(0.9 – 5.2)
> 65 kg	3.4	(1.3 – 9.0)*	3.4	(1.3 – 8.9)*
Type of delivery				
Vaginal	1		1	
Caesarean	1.3	(1.3 – 3.1)**	2.1	(1.2 – 3.6)*
Infants who had diarrhoea				
Yes	1.4	(0.7 – 3.2)	1.1	(0.4 – 3.2)
No	1		1	
Infants who had ARI				
Yes	0.96	(0.6 – 1.5)	1.2	(0.7 – 2.2)
No	1		1	
Other infant health problems				
Yes	3.5	(0.9 – 13.0)	1.6	(0.3 – 9.1)
No	1		1	

-2 Log likelihood (deviance) 280.113 df=6*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.93 shows the multivariate logistic regression analysis on the factors associated with the introduction of infant formula at one month. The factors included in the full model were 'maternal weight at three months' 'maternal weight at six months', type of delivery' 'infants who had diarrhoea', 'infants who had acute respiratory infections', 'other infant problems', 'time of decision to breastfeed', 'getting information on breastfeeding' and 'doctor's support in breastfeeding'. Mothers who introduced formula at one month were more likely to be above 65 kg at three months after delivery (Adjusted OR= 4.4; 95% CI, 1.5 – 13.0) and six months after delivery (Adjusted OR= 2.1; 95% CI, 1.3 – 8.9) compared to mothers who did not introduce infant formula. Mothers who gave birth by caesarean section were more likely to be giving formula at one month (Adjusted OR= 2.1; 95% CI, 1.2 – 3.6) compared with mothers who gave birth by vaginal delivery. Babies having 'acute respiratory infections', 'diarrhoeal episodes' and 'other health problems' did not have any statistical significance with the introduction of infant formula at one month.

Table 4.94 Maternal factors and infant variables associated with formula feeding at three months

Variable	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Type of delivery				
Vaginal	2.0	(1.3 – 2.9)**	1	(1.3 – 3.0)**
Caesarean	1		2.0	
Infants who had diarrhoea				
Yes	1.5	(0.7 – 3.1)	1.4	(0.7 – 3.1)
No	1		1	
Infants who had ARI				
Yes	1.3	(0.8 – 2.0)	1.4	(0.9 – 2.2)
No	1		1	
Other infant health problems				
Yes	12.9	(1.6 – 104.0)*	14.2	(1.7 – 116.7)*
No	1		1	

-2 Log likelihood (deviance) 555.112 df=4*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.94 shows the maternal factors and infant problems associated with 'formula feeding'. Factors included in the full model were 'type of delivery', 'infants who had diarrhoea', 'infants who had acute respiratory infections' 'maternal mother's support in breastfeeding', 'friends' support in breastfeeding' and 'other infant health problems'. Multivariate logistic regression on the factors associated with formula feeding showed that the mothers who gave birth by caesarean section were more likely to give infant formula at three months (Adjusted OR= 2.0; 95% CI, 1.3 – 3.0) compared with mothers who gave birth by vaginal delivery. Infants who were formula fed were also more likely to have 'other health problems' (digestive problems, vomiting and constipation) at three months (Adjusted OR= 14.2; 95% CI, 1.7 – 116.7) compared with the infants of mothers who did not give infant formula at three months. Babies having acute respiratory infections and diarrhoea did not have any statistical significance with the introduction of infant formula at three months.

4.12 Factors associated with infant growth

4.12.1 Cross tabulation

Table 4.95 Demographic factors that affect infant weight at one month (boys)

Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Mother's age (years)				
<30	8	159	-	0.24
≥30	4	38	-	
Marital status				
Married	12	196	-	0.81
Divorced	0	1	-	
Mother's education				
Primary and below	4	23	-	**0.03**
Secondary and above	8	174	-	
Type of accommodation				
Rented	4	90	-	0.40
Own home	8	107	-	
Number of people living in a room				
<3	7	170	-	**0.009**
≥3	5	27	-	
Parity				
Primiparous	5	107	-	0.54
Multiparous (2)	4	62	-	
Multiparous (≥3)	3	28	-	
Mother's occupation				
Housewife/self-employed	9	117	-	0.66
Government employment	3	65	-	
Private employment	0	13	-	
Studying	0	2	-	
Husband's occupation				
Unemployed	0	6	-	0.81
Government employment	7	90	-	
Private employment	5	99	-	
Studying	0	1	-	
Household annual income				
<MVR 90,000	2	42	-	**0.03**
MVR 90,000-250,000	5	129	-	
>MVR 250,000	5	26	-	

Chi-square test between boys' weights and demographic factors

Table 4.95 shows the demographic factors that were associated with infants' weights at one month. 'Mothers education level being primary or lower', 'number of people living in a room being more than three' and 'a household annual income less than MVR 90,000' were associated with the infant being below two standard deviations on the (World Health Organisation, 2006) weight for age z-score (boys) growth charts. 'Number of people living in a room being more than three' reflects lower socio-economic status. 'Maternal age', 'type of accommodation', 'parity' or 'maternal and husband's occupations' were not associated with infant weight.

Table 4.96 Demographic factors that affect infant weight at three months (boys)

Variable	-2 z-score	Normal	+2 z-score	P-value
Mother's age (years)				
<30	10	151	-	0.43
≥30	4	37	-	
Marital status				
Married	14	187	-	0.78
Divorced	0	1	-	
Mother's education				
Primary and below	6	20	-	**0.001**
Secondary and above	8	168	-	
Type of accommodation				
Rented	5	88	-	0.42
Own home	9	100	-	
Number of people living in a room				
<3	9	161	-	**0.035**
≥3	5	27	-	
Parity				
Primiparous	7	100	-	0.81
Multiparous (2)	4	60	-	
Multiparous (≥3)	3	28	-	
Mother's occupation				
Housewife/self-employed	11	110	-	0.46
Government employment	3	63	-	
Private employment	0	13	-	
Studying	0	10	-	
Husband's occupation				
Unemployed	0	84	-	0.90
Government employment	7	96	-	
Private employment	7	6	-	
Studying	0	1	-	
Household annual income				
<MVR 90,000	4	39	-	0.53
MVR 90,000-250,000	7	122	-	
>MVR 250,000	3	27	-	

Chi-square test between boys' weights and demographic factors

Table 4.96 shows the demographic factors that were associated with infants' weights at three months. 'Mothers education level being primary or lower' and 'number of people living in a room being more than three' were associated with the infant being below two standard deviations on the (World Health Organisation, 2006) weight for age z-score (boys) growth charts. 'Maternal age', 'type of accommodation', 'parity', 'maternal / husband's occupation' or 'a household annual income less than MVR 90,000' were not associated with infant weight.

Table 4.97 Demographic factors that affect infant weight at six months (boys)

Variable	-2 z-score	Normal	+2 z-score	P-value
Mother's age (years)				
<30	9	147	1	0.53
≥30	4	35	0	
Marital status				
Married	13	182	2	-
Divorced	-	-	-	
Mother's education				
Primary and below	5	20	0	**0.02**
Secondary and above	8	162	1	
Type of accommodation				
Rented	7	82	0	0.55
Own home	6	100	1	
Number of people living in a room				
<3	10	156	1	0.63
≥3	3	26	0	
Parity				
Primiparous	6	99	0	0.62
Multiparous (2)	5	55	1	
Multiparous (≥3)	2	28	0	
Mother's occupation				
Housewife/self -employed	9	107	0	0.83
Government employment	3	61	1	
Private employment	1	12	0	
Studying	0	2	0	
Husband's occupation				
Unemployed	0	5	0	0.91
Government employment	5	86	1	
Private employment	8	90	0	
Studying	0	1	0	
Household annual income				
<MVR 90,000	3	40	0	0.18
MVR 90,000-250,000	9	115	0	
>MVR 250,000	1	27	1	

Chi-square test between boys' weights and demographic factors

Table 4.97 shows the demographic factors that were associated with infants' weights at six months. 'Mothers education level being primary or lower' was the only factor associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts. 'Maternal age', 'type of accommodation', 'parity', 'maternal / husband's occupation', 'a household annual income less than MVR 90,000' or 'number of people living in a room being more than three' were not associated with infant weight.

Table 4.98 Demographic factors that affect infant length at one month (boys)

Variable	-2 z-score	Normal	+2 z-score	P-value
Mother's age (years)				
<30	11	122	2	0.61
≥30	4	29	0	
Marital status				
Married	15	150	2	0.95
Divorced	0	1	0	
Mother's education				
Primary and below	5	18	1	**0.03**
Secondary and above	10	133	1	
District of residence				
Malé	7	113	2	**0.045**
Atolls	8	38	0	
Type of accommodation				
Rented	6	69	0	0.40
Own home	9	82	2	
Number of people living in a room				
<3	11	133	1	0.09
≥3	4	18	1	
Parity				
Primiparous	5	82	1	0.47
Multiparous (2)	6	49	1	
Multiparous (≥3)	4	20	0	
Mother's occupation				
Housewife/self-employed	12	94	1	0.84
Government employment	2	47	1	
Private employment	1	9	0	
Studying	0	1	0	
Husband's occupation				
Unemployed	0	6	0	0.44
Government employment	4	72	1	
Private employment	11	72	1	
Studying	-	-	-	
Household annual income				
<MVR 90,000	3	35	0	0.79
MVR 90,000-250,000	11	97	2	
>MVR 250,000	1	19	0	

Chi-square test between boys' lengths and demographic factors

Table 4.98 shows the demographic factors that were associated with infants' lengths at one month. 'Mothers education level being primary or lower' and 'the district being the islands' were associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts. 'Maternal age', ‘type of accommodation’, ‘parity’, ‘maternal / husband’s occupation’, ‘a household annual income less than MVR 90,000’ or ‘number of people living in a room being more than three’ were not associated with infant weight.

Table 4.99 Demographic factors that affect infant length at three months (boys)

Variable	-2 z-score	Normal	+2 z-score	P-value
Mother’s age (years)				
<30	20	125	-	0.43
≥30	7	30	-	
Marital status				
Married	27	154	-	0.85
Divorced	0	1	-	
Mother’s education				
Primary and below	7	19	-	0.06
Secondary and above	20	136	-	
District of residence				
Malé	19	116	-	0.62
Atolls	8	39	-	
Type of accommodation				
Rented	14	69	-	0.48
Own home	13	86	-	
Number of people living in a room				
<3	21	134	-	0.24
≥3	6	21	-	
Parity				
Primiparous	13	83	-	0.85
Multiparous (2)	10	49	-	
Multiparous (≥3)	4	23	-	
Mother’s occupation				
Housewife/self-employed	20	93	-	0.55
Government employment	6	50	-	
Private employment	1	10	-	
Studying	0	2	-	
Husband’s occupation				
Unemployed	0	6	-	0.49
Government employment	14	68	-	
Private employment	13	80	-	
Studying	-	-	-	
Household annual income				
<MVR 90,000	4	36	-	0.25
MVR 90,000-250,000	21	95	-	
> 250,000	2	24	-	

Chi-square test between boys’ length and demographic factors

Table 4.99 shows the demographic factors that were associated with infant boys’ lengths at three months. ‘Mother’s education level being primary or lower’, ‘the district in which mothers live’, ‘maternal age’, ‘type of accommodation’, ‘parity’, ‘maternal / husband’s occupation’, ‘a household annual income less than MVR 90,000’ and ‘number of people living in a room being more than three’ were not associated with infant length.

Table 4.100 Demographic factors that affect infant length at six months (boys)

Variable	-2 z-score	Normal	+2 z-score	P-value
Mother’s age (years)				
<30	25	118	1	0.71
≥30	8	28	0	
Marital status				
Married	33	146	1	-
Divorced	-	-	-	
Mother’s education				
Primary and below	9	16	0	**0.046**
Secondary and above	24	130	1	
District of residence				
Malé	26	107	1	0.68
Atolls	7	39	0	
Type of accommodation				
Rented	16	61	1	0.41
Own home	17	85	0	
Number of people living in a room				
<3	27	126	1	0.74
≥3	6	20	0	
Parity				
Primiparous	15	81	1	0.62
Multiparous (2)	11	46	0	
Multiparous (≥3)	7	19	0	
Mother’s occupation				
Housewife/self-employed	22	87	0	0.62
Government employment	8	49	1	
Private employment	2	9	0	
Studying	1	1	0	
Husband’s occupation				
Unemployed	0	5	0	0.57
Government employment	14	71	1	
Private employment	19	70	0	
Studying	-	-	-	
Household annual income				
<MVR 90,000 (<A$6,209)	8	31	0	0.95
MVR 90,000-250,000	20	93	1	
>MVR 250,000 (>A$17, 249)	5	22	0	

Chi-square test between boys’ lengths and demographic factors

Table 4.100 shows the demographic factors that were associated with infant boys’ lengths at six months. ‘Mothers education level being primary or lower’ and ‘the district of residence being the islands’ were associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts.

‘Maternal age’, ‘type of accommodation’, ‘parity’, ‘maternal/husband’s occupation’, ‘a household annual income less than MVR 90,000’ or ‘number of people living in a room being more than three’ were not associated with infant length.

Table 4.101 Maternal factors and infant variables that affect infant weight (boys)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Maternal weight at one month after delivery												
< 50 kg	1	15	-	0.23	2	14	-	0.37	2	14	-	0.59
50-65 kg	5	71	-		3	73	-		4	70	-	
> 65 kg	0	43	-		2	41	-		3	40	-	
Maternal weight at three months after delivery												
< 50 kg	2	17	-	0.26	2	17	-	0.38	2	17	-	0.38
50-65 kg	4	81	-		3	83	-		4	80	-	
> 65 kg	0	25	-		2	21	-		3	22	-	
Maternal weight at six months after delivery												
< 50 kg	2	22	-	0.32	2	20	-	0.45	2	20	-	0.38
50-65 kg	4	82	-		3	84	-		4	83	-	
> 65 kg	0	25	-		2	23	-		3	22	-	
Smoking before pregnancy												
Yes	0	5	-	0.57	0	5	-	0.70	0	4	0	0.86
No	12	192	-		14	183	-		13	178	1	
Smoking during pregnancy												
Yes	0	2	-	0.73	0	2	-	0.87	0	1	0	0.96
No	12	195	-		14	186	-		13	181	1	
Smoking before pregnancy (husband)												
Yes	7	80	-	0.23	9	75	-	0.07	8	73	0	0.22
No	5	117	-		5	113	-		5	109	1	
Smoking during pregnancy (husband)												
Yes	7	66		0.08	9	61	-	**0.016**	8	59	0	0.08
No	5	131			5	127	-		5	123	1	
Received help in looking after children and in household chores												
Yes	10	176	-	0.39	14	168	-	0.22	12	163	1	0.90
No	2	21	-		0	20	-		1	19	0	
Had stressful life event												
Yes	0	5	-	0.58	0	5	-	0.70	0	5	0	0.82
No	12	192	-		14	183	-		13	177	1	

Chi-square test between boys' weights and demographic factors

Table 4.102 Maternal factors and infant variables that affect infant weight (boys) (cont.)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Birth weight (Full term infants)												
<2,500g	5	1	-		4	2	-	**<0.001**	3	10	0	**<0.001**
2,500-3,900g	7	189	-	**<0.001**	10	179	-		2	173	7	
≥4,000g	0	7	-		0	7	-		0	1	0	
Infants who had diarrhoea												
Yes	1	10	-	0.62	2	10	-	0.17	2	9	0	0.28
No	11	187	-		12	178	-		11	173	1	
Infants who had ARI												
Yes	4	62	-	0.89	5	60	-	0.77	6	57	1	0.19
No	8	135	-		9	128	-		7	125	0	
Other infant health problems												
Yes	1	6		0.32	0	7	-	0.60	1	5	0	0.59
No	11	191			14	181	-		12	177	1	

Chi-square test between boys' weights and demographic factors

Table 4.101 and 4.102 show the maternal and infant variables associated with infants' weights. The factor which was associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts at one month, three months and six months was 'having low birth weight'. 'Husband smoking during pregnancy' also was associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts at three months.

Table 4.103 Maternal factors and infant variables that affect infant length (boys)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Maternal weight at one month after delivery												
< 50 kg	2	12	-	0.74	2	14	-	0.80	2	14	0	0.56
50-65 kg	5	59	-		12	57	-		16	53	1	
> 65 kg	3	33	-		5	33	-		5	34	0	
Maternal weight at three months after delivery												
< 50 kg	2	15	-	0.90	4	15	-	0.76	5	14	0	0.76
50-65 kg	6	66	-		12	67	-		15	62	1	
> 65 kg	2	19	-		3	20	-		3	21	0	
Maternal weight at six months after delivery												
< 50 kg	2	17	-	0.93	4	18	-	0.75	6	16	0	0.64
50-65 kg	6	68	-		10	68	-		13	67	1	
> 65 kg	2	18	-		4	19	-		3	21	0	
Smoking before pregnancy												
Yes	0	1	1	**<0.001**	0	3	-	0.61	0	2	0	0.79
No	15	150	1		27	152	-		33	144	1	
Smoking during pregnancy												
Yes	0	0	1	**<0.001**	0	2	-	0.73	0	1	0	0.89
No	15	151	1		27	153	-		33	145	1	
Smoking before pregnancy (husband)												
Yes	11	55	2	**0.005**	14	58	-	0.16	17	55	0	0.24
No	4	96	0		13	97	-		16	91	1	
Smoking during pregnancy (husband)												
Yes	10	44	2	**0.002**	12	47	-	0.15	15	44	0	0.19
No	5	107	0		15	108	-		18	102	1	
Received help in looking after children and in household chores												
Yes	14	135	2	0.80	23	141	-	0.35	29	133	0	**0.009**
No	1	16	0		4	14	-		4	13	1	

Chi-square test between boys' lengths, maternal factors and infant variables

Table 4.104 Maternal factors and infant variables that affect infant length (boys) (cont.)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Had stressful life event												
Yes	0	4	0	0.79	1	4	-	0.74	2	3	0	0.44
No	15	147	2		26	151	-		31	143	1	
Birth weight (Full term infants)												
<2,500g	5	0	0	**<0.001**	6	0	-	**<0.001**	5	0	0	**<0.001**
2,500-3,900g	10	144	2		20	150	-		27	141	1	
≥4,000g	0	2	0		1	5	-		1	5	0	
Infants who had diarrhoea												
Yes	2	7	0	0.34	4	7	-	**0.038**	2	8	0	0.96
No	13	144	2		23	148	-		31	138	1	
Infants who had ARI												
Yes	7	44	1	0.32	11	47	-	0.28	14	42	1	0.11
No	8	107	1		16	108	-		19	104	0	
Other infant health problems												
Yes	0	5	0	0.75	1	6	-	0.97	0	6	0	0.49
No	15	146	2		26	149	-		33	140	1	

Chi-square test between boys' lengths, maternal factors and infant variables

Table 4.103 and 4.104 show the maternal and infant variables associated with infants' lengths (boys). The factor which was associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts at one month, three months and six months was 'having low birth weight'. 'Smoking by the mother and husband before and during pregnancy' also were associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts at one month. Infants who had diarrhoeal episodes were more likely to be below two standard deviations on the (World Health Organisation, 2006) length for age growth chart.

Table 4.105 Demographic factors that affect infant weight (girls)

	One month				**Three months**				**Six months**			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Mother's age (years)												
<30	6	154	1	0.30	2	155	1	0.80	3	155	1	0.29
≥30	0	53	0		1	52	0		3	49	0	
Marital status												
Married	6	204	1	0.95	3	204	1	0.97	6	201	1	0.95
Divorced	0	3	0		0	3	0		0	3	0	
Mother's education												
Primary and below	0	45	0	0.38	1	42	1	0.13	1	43	0	0.81
Secondary and above	6	162	1		2	165	0		5	161	1	
District of residence												
Malé	5	144	1	0.62	0	148	0	**0.008**	1	46	1	**0.01**
Atolls	1	63	0		3	59	1		5	58	0	
Type of accommodation												
Rented	4	84	0	0.31	0	86	0	0.25	0	86	0	0.08
Own home	2	123	1		3	121	1		6	118	1	
Number of people living in a room												
<3	6	169	1	0.47	3	168	1	0.64	5	166	1	0.89
≥3	0	37	0		0	38	0		1	37	0	
Parity												
Primiparous	6	109	1	0.19	3	109	1	0.47	4	109	1	0.59
Multiparous (2)	0	48	0		0	49	0		0	49	0	
Multiparous (≥3)	0	50	0		0	49	0		2	46	0	

Chi-square test between girls' weights and demographic factors

Table 4.106 Demographic factors that affect infant weight (girls) (cont.)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Mother's occupation												
Housewife/self-employed	2	139	0	0.42	2	136	1	0.99	2	137	0	0.18
Government employment	3	50	1		1	51	0		4	48	1	
Private employment	1	17	0		0	19	0		0	18	0	
Studying	0	1	0		0	1	0		0	1	0	
Husband's occupation												
Unemployed	0	4	0	0.43	0	4	0	0.82	0	4	0	0.40
Government employment	5	99	1		1	103	0		1	102	1	
Private employment	1	101	0		2	97	1		5	95	0	
Studying	-	-	-		-	-	-		-	-	-	
Household annual income												
<MVR 90,000	0	58	0	0.53	2	55	0	0.56	2	54	0	0.88
MVR 90,000-250,000	5	133	1		1	135	1		4	133	1	
>MVR 250,000	1	16	0		0	17	0		0	17	0	

Chi-square test between girls' weights and demographic factors

Table 4.105 and 4.106 show the demographic factors associated with infant girls' weights. The only factor which was associated the infant being below two standard deviations on the (World Health Organisation, 2006) weight for age growth charts at three months and six months was 'living on islands'. No other factors were associated with infants' weights.

Table 4.107 Demographic factors that affect infant length (girls)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Mother's age (years)												
<30	6	124	2	0.59	14	123	3	0.31	4	139	-	0.11
≥30	4	43	1		8	41	0		4	45	-	
Marital status												
Married	10	164	3	0.88	21	162	3	0.49	4	36	-	**0.038**
Divorced	0	3	0		1	2	0		4	148	-	
Mother's education												
Primary and below	5	32	1	0.06	5	36	1	0.89	7	182	-	**0.01**
Secondary and above	5	135	2		17	138	2		1	2	-	
District of residence												
Malé	5	120	2	0.33	14	118	2	0.71	3	130	-	**0.047**
Atolls	5	47	1		8	46	1		5	54	-	
Type of accommodation												
Rented	3	71	0	0.25	8	68	0	0.32	3	71	-	0.95
Own home	7	96	0		14	96	3		5	113	-	
Number of people living in a room												
<3	10	134	2	0.25	21	130	2	0.17	6	152	-	0.55
≥3	0	32	0		1	33	1		2	31	-	
Parity												
Primiparous	4	91	2	0.79	14	84	2	0.46	6	99	-	0.29
Multiparous (2)	3	38	0		2	40	1		0	42	-	
Multiparous (≥3)	3	38	1		6	40	0		2	43	-	

Chi-square test between girls' lengths and demographic factors

Table 4.108 Demographic factors that affect infant length (girls) (cont.)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Mother's Occupation												
Housewife/self-employed	8	109	1	0.41	13	111	1	**0.007**	7	120	-	0.40
Government employment	2	43	2		7	41	0		1	47	-	
Private employment	0	15	0		2	12	2		0	17	-	
Studying	-	-	-									
Husband's occupation												
Unemployed	0	3	0	0.08	1	2	0	0.33	0	3	-	0.89
Government employment	1	88	1		10	82	0		4	91	-	
Private employment	9	73	2		10	78	3		3	88	-	
Studying	-	-	-		-	-	-		-	-	-	
Household annual income												
<MVR 90,000	4	44	1	0.85	7	46	0	0.74	4	48	-	0.29
MVR 90,000-250,000	5	110	2		14	106	3		4	123	-	
>MVR 250,000	1	13	0		1	12	0		0	13	-	

Chi-square test between girls' lengths and demographic factors

Table 4.107 and 4.109 show the demographic factors associated with infant girls' lengths. There were no factors associated with length of the infant at one month. At three months, 'mother being a housewife' was associated with the infant being below two standard deviations on the (World Health Organisation, 2006) length for age growth charts. At six months, infant length was associated with 'being divorced', 'education level being primary or below', and 'living on an island'. No other factors were associated with infants' lengths.

Table 4.109 Maternal factors and infant variables that affect infant weight (girls)

	One month				**Three months**				**Six months**			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Maternal weight at one month after delivery												
< 50 kg	0	14	-	0.73	0	14	0	0.84	0	14	-	0.26
50-65 kg	3	64	-		2	64	1		1	66	-	
> 65 kg	2	46	-		1	47	0		3	44	-	
Maternal weight at three months after delivery												
< 50 kg	0	21	-	0.23	0	21	0	0.71	0	21	-	0.22
50-65 kg	4	72	-		2	74	1		1	76	-	
> 65 kg	0	33	-		0	33	0		2	30	-	
Maternal weight at six months after delivery												
< 50 kg	0	27	-	0.12	1	26	0	0.74	0	27	-	0.48
50-65 kg	5	72	-		2	75	1		3	75	-	
> 65 kg	0	35	-		0	35	0		2	33	-	
Smoking before pregnancy												
Yes	0	9	0	0.85	0	9	0	0.91	1	9	0	0.37
No	6	19	1		3	198	1		5	195	1	
Smoking during pregnancy												
Yes	-	-	-	-	-	-	-	-	-	-	-	-
No	6	207	1		3	207	1		6	204	1	
Smoking before pregnancy (husband)												
Yes	3	90	0	0.65	2	90	1	0.38	4	89	0	0.36
No	3	117	1		1	117	0		2	115	1	
Smoking during pregnancy (husband)												
Yes	3	83	0	0.63	2	83	1	0.31	4	82	0	0.30
No	3	124	1		1	124	0		2	122	1	
Received help in looking after children and in household chores												
Yes	6	179	1	0.58	3	179	1	0.73	5	178	1	0.89
No	0	28	0		0	28	0		1	26	0	

Chi-square test between girls' weights, maternal factors and infant variables

Table 4.110 Maternal factors and infant variables that affect infant weight (girls) (cont.)

	One month				**Three months**				**Six months**			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Had stressful life event												
Yes	0	17	0	0.73	0	17	0	0.84	0	17	0	0.73
No	6	190	1		3	190	1		6	187	1	
Birth weight (Full term infants)												
<2,500g	4	12	0		1	13	0	0.46	1	13	0	**<0.001**
2,500-3,900g	2	191	0	**<0.001**	2	189	1		5	187	0	
≥4,000g	0	4	1		0	5	0		0	4	1	
Infants who had diarrhoea												
Yes	0	17	0	0.73	0	17	0	0.84	0	17	0	0.73
No	6	190	1		3	190	1		6	187	1	
Infants who had ARI												
Yes	5	60	0	**0.01**	2	62	0	0.31	4	60	0	0.12
No	1	47	1		1	45	1		2	144	1	
Other infant health problems												
Yes	0	2	0	0.97	0	2	0	0.98	0	2	0	0.97
No	6	205	1		3	205	1		6	202	1	

Chi-square test between girls' weights, maternal factors and infant variables

Table 4.109 and 4.110 show the maternal and infant variables associated with infant girls' weights. The factor which was associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts at one month and six months was 'having low birth weight'. Having acute respiratory tract infection also was associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts at one month. No other factors were associated with infant girls' weights.

Table 4.111 Maternal factors and infant variables that affect infant length (girls)

	One month				Three months				Six months			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Maternal weight at one month after delivery												
< 50 kg	5	4	1	**0.001**	2	11	0	0.97	1	11	-	0.56
50-65 kg	8	52	42		10	48	1		4	56	-	
> 65 kg	0	0	1		6	37	1		1	41	-	
Maternal weight at three months after delivery												
< 50 kg	3	16	0	0.24	2	17	1	0.73	1	18	-	0.90
50-65 kg	4	58	0		10	56	2		4	65	-	
> 65 kg	1	28	1		3	28	0		1	27	-	
Maternal weight at six months after delivery												
< 50 kg	4	19	0	0.14	3	19	1	0.85	1	22	-	0.87
50-65 kg	4	61	0		10	58	2		4	67	-	
> 65 kg	1	30	1		4	29	0		1	30	-	
Smoking before pregnancy												
Yes	1	6	1	**0.032**	1	7	1	0.06	1	9	-	0.34
No	9	161	2		21	157	2		7	175	-	
Smoking during pregnancy												
Yes	-	-	-	-	-	-	-	-	-	-	-	-
No	10	167	3		22	164	3		8	184	-	
Smoking before pregnancy (husband)												
Yes	4	73	2	0.71	10	68	2	0.65	5	76	-	0.24
No	6	94	1		12	96	1		3	108	-	
Smoking during pregnancy (husband)												
Yes	4	66	2	0.64	10	63	1	0.80	5	69	-	0.15
No	6	101	1		12	101	2		3	115	-	
Received help in looking after children and in household chores												
Yes	8	145	3	0.65	20	139	3	0.56	7	159	-	0.93
No	2	22	0		2	25	0		1	25	-	
Had stressful life event												
Yes	0	14	1	0.19	2	15	0	0.86	1	15	-	0.51
No	10	153	2		20	149	3		7	169	-	

Table 4.112 Maternal factors and infant variables that affect infant length (girls) (cont.)

	One month				**Three months**				**Six months**			
Variable	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**	**-2 z-score**	**Normal**	**+2 z-score**	**P-value**
Birth weight (Full term infants)												
<2,500g	4	8	0	**<0.001**	3	10	0	0.62	1	13	-	0.77
2,500-3,900g	6	155	2		19	49	3		7	166	-	
≥4,000g	0	4	1		0	5	0		0	5	-	
Infants who had diarrhoea												
Yes	1	12	0	0.84	0	16	0	0.26	0	16	-	0.49
No	9	155	3		22	148	3		8	168	-	
Infants who had ARI												
Yes	5	51	1	0.44	9	48	1	0.54	2	58	-	0.52
No	5	116	2		13	116	2		6	126	-	
Other infant health problems												
Yes	0	2	0	0.92	0	2	0	0.86	0	2	-	0.91
No	10	165	3		22	162	3		8	182	-	

Chi-square test between girls' lengths, maternal factors and infant variables

Table 4.111 and 4.112 show the maternal and infant variables associated with infant girls' lengths. The factors which were associated with the infant being below two standard deviations on the (World Health Organisation, 2006) growth charts at one month were 'having a maternal weight less than 50 kg at one month', 'maternal smoking before pregnancy' and 'birth weight less than 2,500 grams'. There were no maternal and infant variables associated with infants' lengths at three months and six months.

4.12.2 Multivariate Analysis

The factors associated with infant growth were further explored using a multivariate model. All the significant variables derived from the results of cross tabulation and identified by the literature were put into the full model. The non-significant factors were then removed using backward step wise method. The variables that were in the final model were factors which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom. The factors included in the full model were household annual income', 'birth weight', 'maternal education' and 'socioeconomic factors' (number of people living in a room).

Table 4.113 Factors associated with infant's weight for age at one month (boys)

	Crude Odds Ratio	**95% CI**	**Adjusted Odds Ratio**	**95% CI**
Household annual income				
<MVR 90,000	4.0	(0.7 – 22.4)	21.4	(1.4 – 334.5)*
MVR 90,000-250,000	4.9	(1.3 – 18.4)*	12.5	(1.8 – 85.3)*
>MVR 250,000	1		1	
Low birth weight (grams)				
<2,500	0.01	(0.001 – 0.7)***	0.01	(0.001 – 0.1)***
≥2,500	1		1	
Maternal education				
Primary or lower	1		1	
Secondary or higher	3.7	(1.1 – 13.6)*	3.8	(0.6 – 21.6)
Number of people in room				
≤3	1		1	
>3	0.2	(0.07 – 0.7)*	0.1	(0.02 – 0.7)*

-2 Log likelihood (deviance) 53.249 df=4*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.113, above, shows the factors associated with infant weight at one month. After adjustment for confounding factors, maternal education was not significant. , 'Household annual income', 'birth weight', and 'socioeconomic factors' (number of people living in a room) were all significant factors associated with the infant's weight for age on the (World Health Organisation, 2006) z-score growth charts for boys at one month. 'Maternal education' was not significant in the adjusted model.

Note that the confidence intervals for 'household annual income' and 'birth weight' are very wide in the adjusted multivariate model. Hence the results might not be significant even if a statistical significance of P<0.05 - P<0.001 is shown.

Table 4.114 Factors associated with infant's weight for age at three months (boys)

	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Husband's smoking status				
Yes	1		1	
No	3.7	(1.2 – 11.7)*	3.2	(0.9 – 11.6)
Low birth weight (grams)				
<2,500	0.3	(0.004 – 0.2)***	0.3	(0.003 – 0.2)**
≥2,500	1		1	
Maternal education				
Primary or lower	1		1	
Secondary or higher	6.3	(2.0 – 20.0)**	4.6	(1.1 – 17.9)*
Number of people in room				
≤3	1		1	
>3	0.3	(0.09 – 0.97)*	0.5	(0.1 – 2.0)

-2 Log likelihood (deviance) 75.481 df=3*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.114 shows the factors associated with infant's weight being normal at three months. The factors included in the full model were 'father's smoking status', 'birth weight', 'maternal education' and 'number of people living in the room' were associated with infant boys' weights at three months. After adjustment for confounding factors, 'father's smoking status' and 'number of people who were living in the room' were not associated with the infant's weight for age at three months. Infants who had birth weights of less than 2,500 grams were less likely to be in the normal weight range on the WHO weight for age z-score growth chart (OR=0.3) compared with infants who had a birth weight equal to or above 2,500 grams. Infants of mothers whose education levels were above or equal to secondary schooling were more likely to be on the normal weight range on the (World Health Organisation, 2006) growth chart.

Table 4.115 Factors associated with infant's weight for age at six months (boys)

	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Low birth weight (grams)				
<2,500	0.04	(0.006 – 0.2)**	0.05	(0.006 – 0.3)**
≥2,500	1		1	
Maternal education				
Primary or lower	1		1	
Secondary or higher	5.1	(1.5 – 17.1)**	4.3	(1.1 – 15.9)*
Full breastfeeding				
Yes	0.7	(0.2 – 2.7)	0.5	(0.1 – 2.3)
No	1		1	

-2 Log likelihood (deviance) 80.258 df=2*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.115 shows that the factors associated with normal weight for age at six months in boys were 'maternal education' and 'birth weight'. The factors included in the full multivariate model were 'maternal education', 'birth weight' and 'full breastfeeding'. Compared with infants whose birth weight was equal to or above 2,500 grams, infants whose birth weights were less than 2,500 grams were less likely to be at normal weight for age in the (World Health Organisation, 2006) weight for age z-score growth chart for boys at six months. Infants of mothers whose education levels were above or equal to secondary were more likely to be in the normal weight for age. 'Full breastfeeding' was not associated with the weight of the infant.

Table 4.116 Factors associated with infant's length for age at one month (boys)

	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Full breastfeeding				
Yes	1	(0.3 – 3.1)	1.5	(0.4 – 5.2)
No	1		1	
Maternal education				
Primary or lower	1		1	
Secondary or higher	3.5	(1.1 – 11.4)*	2.5	(0.7 – 8.6)
Paternal smoking before pregnancy				
Yes	1		1	
No	4.6	(1.4 – 15.2)*	4.7	(1.4 – 16.3)*
District of residence				
Malé	1		1	
Other	0.3	(0.1 – 0.9)*	0.2	(0.09 – 0.9)*

-2 Log likelihood (deviance) 85.812 df=6*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.116 shows the factors associated with normal length at one month in boys. The factors included in the full multivariate model were 'full breastfeeding', 'maternal education being secondary or above', 'infant's father not smoking before pregnancy' and 'the district in which mothers live being Malé '. After adjusting for confounding factors and co-variates, the factors associated with normal length at one month were, ‘infant’s father not smoking before pregnancy’ and ‘the district in which mothers live being Malé. Infants of fathers who did not smoke were about five times more likely to have normal length for age on the (World Health Organisation, 2006) z-score growth charts compared with infants of fathers who smoked. Infants who were living on islands were less likely to be in the normal length for age range (OR=0.2).

Table 4.117 Factors associated with infant’s length for age at three months (boys)

	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Full breastfeeding				
Yes	0.97	(0.4 – 2.2)	0.8	(0.4 – 2.0)
No	1		1	
Infant had diarrhoea				
Yes	0.3	(0.07 – 1.0)	0.3	(0.10 - 0.96)*
No	1		1	
Paternal smoking during pregnancy				
Yes	1		1	
No	1.8	(0.8 – 4.2)	1.8	(0.8 – 4.4)
District of residence				
Malé	1		1	
Other	0.8	(0.3 – 2.0)	0.8	(0.3 – 2.0)

-2 Log likelihood (deviance) 146.981 df=3*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.117 shows the factors associated with length for age in boys compared with the (World Health Organisation, 2006) length for age z-score growth chart at three months. The factors included in the full model were ‘full breastfeeding’, ‘infant had diarrhoea’, ‘paternal smoking before pregnancy and ‘district of residence’. Infants who had a history of episodes of diarrhoea were about three times less likely to be in the normal length for age at three months compared with infants who did not have a history of episodes of diarrhoea. ‘Paternal smoking during pregnancy’ and the ‘district in which mothers live’ were not associated with the normal length of the infant boys at three months.

Table 4.118 Factors associated with infant's length for age at six months (boys)

	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Full breastfeeding				
Yes	1.4	(0.6 – 3.30	0.8	(0.4 – 1.7)
No	1		1	
Infant had diarrhoea				
Yes	0.9	(0.2 – 4.4)	0.8	(0.2 - 4.2)
No	1		1	
Maternal education				
Primary or lower	1		1	
Secondary or higher	3.1	(1.2 – 7.7)*	3.1	(1.2 – 7.7)*

-2 Log likelihood (deviance) 150.070 df=3*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

As shown in Table 4.118, the only factor associated with infants' lengths at six month was 'maternal education'. The factors included in the full model were 'full breastfeeding', 'infants had a history of episodes of diarrhoea' and 'maternal education'. Infants of mothers whose education levels were secondary or above were over three times more likely to be within the healthy length range on the (World Health Organisation, 2006) length for age z-score growth chart when compared with infants of mothers whose education levels were primary or below. 'Full breastfeeding' and 'infants having a history of episodes of diarrhoea' were not associated with boys' length for age at six months.

Table 4.119 Factors associated with infant's weight for age at one month (girls)

	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Had ARI				
Yes	0.08	(0.01 – 0.71)*	0.1	(0.01 – 0.97)*
No	1		1	
Low birth weight (grams)				
<2,500	0.03	(0.01 – 0.18)***	0.4	(0.01 – 0.27)**
≥2,500	1		1	
EPDS				
≥13	1.7	(0.19 – 14.60)	2.1	(0.1 – 24.0)
<13	1		1	

-2 Log likelihood (deviance) 34.821 df=3*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.119 shows the factors associated with infant girls' weights at one month. The factors in the full multivariate model were 'had acute respiratory infections', 'low birth weight' and 'EPDS'. Compared with infants who did not have acute respiratory infections, infants who did have acute respiratory infections were 10 times less likely to be in the healthy weight range on the (World Health Organisation, 2006) weight for age z-score growth chart at one month. Infants who had birth weights below 2500 grams also were less likely to be within the normal weight range compared with infants who had birth weights equal to or above 2500 grams. There was no association between infant weight at one month and postnatal depression at one month.

Table 4.120 Factors associated with infant's weight for age at six months (girls)

	Crude Odds Ratio	**95% CI**	**Adjusted Odds Ratio**	**95% CI**
Low birth weight (grams)				
<2,500	0.3	(0.04 – 3.1)	0.8	(0.08 – 6.6)
≥2,500	1		1	
Maternal education				
Primary or lower	1		1	
Secondary or higher	0.7	(0.08 – 6.62)	0.5	(0.05 – 4.3)
District of residence				
Malé	1		1	
Other	0.08	(0.01 – 0.69)*	0.07	(0.01 – 0.67)*

-2 Log likelihood (deviance) 46.106 df=4*P<0.05 **P<0.01 ***P<0.001
All variables in the final model were variables for which the change in deviance was significant compared with the corresponding χ^2 on the relevant degrees of freedom.

Table 4.120 shows the factors associated with infant girls' weights for age at six months. Factors included in the full model were 'low birth weight', maternal education' and 'district of residence'. Infants of mothers who were living on islands other than Malé were over ten times less likely to be within the normal weight range on the (World Health Organisation, 2006) weight for age z-score growth charts for girls when compared with mothers who were living in Malé. 'Low birth weight' and 'maternal education' were not associated with infant girls' weights. No associations were found regarding infant length for age at one month, three months or six months.

4.4 Conclusion

The incidence of antenatal depression using an EPDS cut-off score ≥13 was 23.8%. At one month, three months and six months postnatal, the percentage of mothers with depression was at 26.7 11.9% and 2.6% respectively. The risk factors for antenatal and postnatal depression in this study included 'not receiving help in looking after the children and household chores' (adjusted OR=2.3; 95% CI, 1.2–4.3), 'having stressful life events' (adjusted OR=6.7.0; 95% CI, 2.5–17.5) and 'having a household annual income less than MVR 90,000 (A$6,209)' (adjusted OR=4.1; 95% CI, 1.3–12.8). Antenatal depression in this study also was significantly associated with 'late initiation of breastfeeding' (adjusted OR= 3.0; 95% CI, 1.3–6.8). Postnatal depression at three months was associated with shorter duration of 'exclusive breastfeeding' (log rank chi-square 64.4, df 1, p<0.001), 'full breastfeeding' (log rank chi-square 120.6, df 1, p<0.001) and 'any breastfeeding' (log rank chi-square 133.0, df 1, p<0.001). Depression was also associated with infants being below two standard deviations on the (World Health Organisation, 2006) z-score weight-for-age growth chart at six months had stopped 'exclusive breastfeeding' earlier (log rank chi-square 11.8, df 2, p<0.03).

All of the mothers initiated breastfeeding and 'any breastfeeding' rates stayed high at six months. However, 'full breastfeeding' and 'exclusive breastfeeding' rates dropped to 29.7% and 7.5%, respectively by six months. Factors associated with 'exclusive breastfeeding' were 'initiation of breastfeeding less than four hours after giving birth' (adjusted OR= 0.08; 95% CI, 0.01–0.6), 'receiving help from a family member' (adjusted OR= 2.2; 95% CI, 1.0–4.8) 'receiving help from a baby sitter' (adjusted OR= 0.3; 95% CI, 0.01–1.2) and 'health workers supporting breastfeeding' (adjusted OR= 0.2; 95% CI, 0.04–0.7). Factors associated with full breastfeeding include, 'had decided on a feeding method after the baby was born ' (adjusted OR= 0.1; 95% CI, 0.05–0.32), 'had a caesarean section delivery' (adjusted OR= 0.6; 95% CI, 0.4–0.9) 'had maternal mothers who did not breastfeed' (adjusted OR= 0.1; 95% CI, 0.1–0.3), 'were older than 24 years of age' (adjusted OR= 0.3; 95% CI, 0.1–0.9), or 'had initiated breastfeeding four hours or more after delivery'(adjusted OR= 0.2; 95% CI, 0.07–0.5). Mothers who were 'fully breastfeeding' were less likely to have infants with acute respiratory infections and respiratory problems (adjusted OR= 0.6; 95% CI, 0.4–0.9), compared with mothers who did not 'fully breastfeed'.

'Mothers who gave infant formula as a prelacteal feed' were six times more likely to stop 'any breastfeeding' before six months (adjusted OR= 6.0; 95% CI, 1.6–21.8) when compared with mothers who did not give infant formula as a prelacteal feed. Infants of mothers who stopped 'any breastfeeding' before six months were over three times more likely to have diarrhoea (adjusted OR= 7.41; 95% CI, 1.6–33.4) and over seven times more likely to have other health problems (digestive problems, vomiting and constipation) (adjusted OR= 3.6; 95% CI, 1.3–9.9), compared with infants of mothers who 'any breastfed' their infants. Some mothers reported several problems they had with breastfeeding, the main one being 'not having enough breastmilk'. Also some mothers reported that their infants were not growing with breastmilk alone, so they had to introduce infant formula. The other reasons mothers reported were ‘pain while breastfeeding’, ‘mastitis’, ‘mother or infant being sick’, ‘suckling problems’, ‘infant refused to breastfeed’, ‘it is the age to start other food’ and ‘infant crying and not sleeping well’

At one month, the proportion of mothers who had given fruits (dates) and honey were high, (40.5% and 15.7%, respectively) because very small amounts of both of these foods are commonly rubbed onto the infant’s upper palate as a ritual before breastmilk is commenced or in the first week. The proportion of mothers who gave water was high, increasing from 20.5% at one month to 46.5% at four months. Many mothers (17.2%) had given pomegranate juice by four months. About 30% of the mothers introduced solid food at five months and a small percentage (7.7%) at four months.

Factors associated with the introduction of infant formula included, ‘the mother being older than 24 years of age’ (adjusted OR= 2.1; 95% CI, 1.3–3.6), ‘having number of children equal to or less than two’ (adjusted OR= 2.1; 95% CI, 1.1–4.0), ‘being employed’(adjusted OR=1.7; 95% CI, 1.1 –2.6) and ‘having a caesarean section delivery’ (adjusted OR= 2.1; 95% CI, 1.2–3.6). Mothers who started giving infant formula at one month were more likely to have a weight above 65kg at six months after delivery (adjusted OR= 4.4; 95% CI, 1.5–13.0). Infants who were formula fed also were more likely to have ‘other health problems’ (digestive problems, vomiting and constipation) (adjusted OR= 2.1; 95% CI, 1.2–3.6) at three months when compared with infants of mothers who did not give infant formula at three months.

There were few infants with low birthweight in this study. Only 5.1% of the infants had a birthweight less than 2,500 grams. The percentage of infants who were short for their age was highest at three months for girls (11.6%) and at six months for boys (18.3%). An infant being normal weight in this study was inversely associated with ‘living on an island other than Male'’ (adjusted OR= 0.07; 95% CI, 0.01–0.67, ‘birthweight less than 2,500 grams’(adjusted OR= 0.2; 95% CI, 0.09–0.9), ‘socioeconomic factors’ [the infant sleeping in a room with more than three people] (adjusted OR= 0.1; 95% CI, 0.02–0.7), ‘the infant ‘having diarrhoeal episodes’ (adjusted OR= 0.3; 95% CI, 0.1–0.9) and the infant ‘having acute respiratory infections’ (adjusted OR= 0.1; 95% CI, 0.01–0.9).

‘Maternal education level being secondary or higher’ (adjusted OR= 4.6; 95% CI, 1.1 – 17.9) and ‘paternal non-smoking’ (adjusted OR= 4.7; 95% CI, 1.4–17.3) were positively associated with an infant being normal weight.

Chapter 5 Discussion and Recommendations

In this chapter the results will be discussed in detail and compared with other studies. The chapter will also give recommendations to the problems identified. The sections of this chapter are derived from the main objectives of this project, which are to:

- Assess the incidence of, and the risk factors for, antenatal and postnatal depression in the Maldives.
- Determine the breastfeeding rates, factors and the incidence of breastfeeding problems in the Maldives.
- Describe the types of complementary foods used and the age at which they are introduced to infants in the Maldives.
- Evaluate the factors associated with the introduction of complementary feeding.
- Identify the risk factors for the use of pre-lacteal foods.
- Describe the risk factors associated with growth faltering of infants in the Maldives.
- Evaluate the effects of antenatal depression and postnatal depression on infant feeding practices in the Maldives.
- Measure the association between postnatal depression and both the use of complementary foods and growth faltering of infants in the Maldives.

5.1 Incidence and risk factors for postnatal depression

5.1.1 Prevalence of antenatal and postnatal depression

In this study, the incidence of antenatal depression with an EPDS cut-off score ≥13 was 23.8%. At one month postnatal, the percentage of mothers with depression was not statistically different at 26.7%. These rates are similar to many other similar countries such as Jordan (22.1%), United Arab Emirates (16.8%) and Iran (21.5%) (Mohammad et al., 2011, Mazhari and Nakhaee, 2007, Hamdan and Tamim, 2011). However, in the study from the United Arab Emirates, an EPDS score of ten or above was used whereas in this study an EPDS score of 13 or above was used for the cut-off score. After one month postnatal, there was a gradual decrease in the prevalence of depression. At three months, the prevalence of postnatal depression was 11.9%. At six months the percentage of mothers with postnatal depression was very low at 2.6% (n=11). Similarly low rates of postnatal depression have been obtained by some studies in Australia (6.2%), United States (6.3%), Canada (4.5%) and England (4.8%) (Deave et al., 2008, Dunn et al., 2006, Nelson et al., 2013, Eastwood et al., 2011). However, most of these studies have not measured the trend of postnatal depression rates from 36 weeks of pregnancy to six months postnatal. Normally postnatal depression reduces over time but there could be other reasons why the depression rate was so low at six months. These include the 'Hawthorn effect' where the subjects improve the responses that are being experimentally measured, due to the fact that they know they are being studied (McCarney et al., 2007). There were also other factors associated with the subjects' depression that may have assisted in their recovery. These factors will be discussed in more detail.

5.1.2 Risk factors for antenatal depression

After adjustment for confounding factors, the risk factors for antenatal depression in this study were 'not receiving help in looking after children and other household chores', 'having a household annual income less than MVR 90,000 (A$6,209)', and 'having a stressful life event (death of a family member, sickness and conflict with husband or other family members)'.

In the study conducted in the United Arab Emirates, similar and additional risk factors existed for antenatal depression (Hamdan and Tamim, 2011). These included 'number of children', 'religion', 'use of formula for feeding', 'educational level of mother', 'lack of breastfeeding', 'personal stressful life events', 'employment status following delivery', 'not breastfeeding', 'giving birth to the first child', 'poor body self-image', 'poor relationship with mother-in-law' and 'an older age at marriage' (Hamdan and Tamim, 2011). Unlike the study in the United Arab Emirates, this study found that 'maternal age', 'marital status', 'smoking status' and 'parity' were only significant factors in the unadjusted multivariate model. Antenatal depression was associated with infant feeding outcomes, which will be discussed in the section, 'Effect of antenatal depression and postnatal depression on infant feeding outcomes'. In developed countries, similar antenatal depression risk factors existed, with small variations. In Australia, the risk factors for antenatal depression were 'emotional-abuse', 'physical- abuse', 'depression in pregnancy' and 'unemployment in early pregnancy' (Yelland et al., 2010). In Singapore, 'high risk pregnancies' also were associated with antenatal depression (Thiagayson et al., 2012).

5.1.3 Risk factors for postnatal depression

In this study, the risk factors for postnatal depression at one month, in the adjusted multivariate model, were ‘depression during pregnancy’ and ‘stressful life events’. Mothers who had depression during pregnancy were more likely to be depressed at one month postnatal. Mothers who experienced stressful life events (death of a family member, conflict with husband or family members) were more likely to be depressed at one month. At three months postnatal, the only factor that was associated with depression was ‘having stressful life events’. At six months, there were no factors associated with postnatal depression. Contrary to this study, most of the studies in other developing countries have found many significant risk factors for postnatal depression. A study in India found that the risk factors for postnatal depression were ‘high maternal age’, ‘low asset ownership’, ‘health problems in the antepartum, delivery and/or postpartum periods’, ‘caesarean section’, ‘an unwanted pregnancy for the mother’, ‘small perceived infant size’ and ‘stillbirth or neonatal death’ (Prost et al., 2012). Similar risk factors for depression were found in China; ‘attitude of acceptance toward violence’ ‘unexpected pregnancy’, ‘psychological violence during pregnancy’, ‘husband's occupation’, ‘excessive alcohol use’ and ‘concern about the infant's health’ (Zhang et al., 2012b). Many studies have found associations between perinatal depression and infant feeding methods. The association found by this study between postnatal depression and infant feeding outcomes and infant growth will be discussed in the following sections. In summary, the risk factors for antenatal and postnatal depression in this study include ‘not receiving help in looking after the children and household chores’, ‘having stressful life events’ and ‘having a household annual income less than MVR 90,000 (A$6,209)’.

Living in Malé is very expensive for mothers who do not own their home. Mothers reported that the price of the rent for one room was MVR 7,000 (AUD520) per month. Hence, it is impossible to financially manage a family when receiving less than MVR 7,500 per month (equal to MVR 90,000 annually). The percentage of families who were living in a rented home was 42.6%. Due to the high cost of renting in Malé, mothers could not afford day-care and other services so this makes ‘not receiving help in looking after children and other household chores’ an unavoidable risk factor for depression. The main conflict between the husband and mother was reported to be the husband having affairs during pregnancy and when the baby was young. Mothers also reported the difficulties and conflicts that arise when big families have to live together due to the lack of space in Malé.

Antenatal clinics and postnatal clinics should disseminate the available information on perinatal depression. At the moment antenatal and postnatal clinics do not have any facilities to screen for postnatal depression, nor do they have a referral system for counselling to manage depression, both of which are highly necessary. Strategies need to be developed to screen for depression in antenatal and postnatal clinics. Further studies need to be carried out to develop interventions to manage depression. Programs need to be planned to help mothers with day-care facilities for working mothers. In addition, the government authorities needs to implement strategies to minimise the cost of living for islanders who had to move to Male' for better opportunities in education and health care. The government also need to plan and mobilise resources in way so that the islanders get more access to health care and education which in turn will prevent Malé getting over populated.

5.2 Effects of antenatal depression and postnatal depression on infant feeding outcomes

5.2.1 Effect of antenatal depression on infant feeding outcomes

Antenatal depression in this study was significantly associated with 'late initiation of breastfeeding'. Compared with mothers who initiated breastfeeding within an hour of birth, mothers who initiated breastfeeding after four hours or more were more likely to be the mothers who had been depressed at 36 weeks of pregnancy. Antenatal depression did not affect infant feeding methods directly but it affected infant feeding methods via late initiation of breastfeeding. Late initiation of breastfeeding has a major impact on feeding patterns of the infant. Compared with mothers who initiated breastfeeding within an hour, mothers who initiated breastfeeding after four hours were less likely to be 'exclusively breastfeeding' up to one month. Mothers who initiated breastfeeding later than four hours also were less likely to 'fully breastfeed' their infants up to six months. Late initiation of breastfeeding also was associated with 'any breastfeeding' cessation before six months. Similar results were found in the longitudinal study conducted in the United Kingdom, where antenatal depressive symptoms were associated with lower rates of initiation and higher rates of discontinuation of breastfeeding (Green and Murray, 1994). Another study in Sweden also indicated that antenatal depressive symptoms were associated with lower rates of initiation of breastfeeding (Seimyr et al., 2004).

5.2.2 Effect of postnatal depression on infant feeding outcomes

Similar to the study in Turkey (Annagur et al., 2013), this study found no associations between postnatal depression and 'any breastfeeding'. However, research in the United Arab Emirates showed that women who were 'any breastfeeding' at two and four months had lower EPDS scores and were less likely to be diagnosed with postpartum depression than mothers who did not breastfeed. (Hamdan and Tamim, 2012). A similar study in Brazil showed that mothers who stopped breastfeeding experienced symptoms of maternal depression (Feldens et al., 2012). This study showed that mothers who were 'fully breastfeeding' at three months were less likely to be depressed at six months. Hence, the drop in the prevalence of depression at six months could be due to 'full breastfeeding' at three months.

In addition, findings from this study also indicated that depressed mothers were more likely to introduce water, fruits, vegetables and rice before six months. Similar foods were introduced by mothers with postnatal depression in other countries. The study in the United States showed that mothers with postnatal depression were more likely to give cereal, water and juice between two to four months and less likely to continue breastfeeding (McLearn et al., 2006) A more recent study also indicated that mothers with postnatal depression were more likely to add cereal to infant formula at two months (Gaffney et al., 2012).

Depressed mothers in this study also were less likely to believe that 'breastmilk is cheaper', 'breastmilk helps mothers to lose weight', 'breastmilk is natural' and 'breastfeeding is more convenient'. The associations between depression and negative breastfeeding attitudes were found in studies conducted in other countries too. A study in Barbados showed that mothers who had depression also had negative attitudes towards breastfeeding, although the attitude items were different to those used in this study. In the Barbados study, depressed mothers were less likely to believe that breastfeeding was better for their infants at seven weeks and more likely to be superstitious about breastfeeding and to have no confidence that breastfeeding leads to improved mother-infant bonding (Galler et al., 2006). The same study showed that mothers with symptoms of depression and anxiety also were more likely to report that breastfeeding was restrictive and to believe that breastfeeding made them look unfashionable (Galler et al., 2006).

In the current study, the survival analysis of breastfeeding up to six months showed that a higher proportion of mothers who were depressed at three months stopped 'exclusive breastfeeding' earlier when compared with non-depressed mothers. The same trend was seen in 'full breastfeeding' and 'any breastfeeding'. That is, a higher proportion of mothers who were depressed at three months stopped 'full breastfeeding' and 'any breastfeeding' earlier, compared with non-depressed mothers. The sudden drops in the curves for 'exclusive breastfeeding' and 'full breastfeeding' on the first day were due to the introduction of prelacteal feeds. In support of this study, many other studies also have confirmed that there were positive associations between postnatal depression and early breastfeeding cessation. In a Canadian study, mothers who were depressed discontinued breastfeeding earlier (Dennis and McQueen, 2007). A review article, by the same authors, of 75 studies also revealed that postnatal depression was associated with decreased breastfeeding duration (Dennis and McQueen, 2009). The reasons why mothers with postnatal depression may stop breastfeeding earlier could be that they are more likely to experience difficulties in breastfeeding and have low breastfeeding self-efficacy. Some studies have shown that postnatal depression was associated with shorter duration of breastfeeding, together with breastfeeding difficulties and low breastfeeding self-efficacy (Dennis and McQueen, 2009). Another study has shown that breastfeeding difficulties and low breastfeeding self-efficacy in the first week were associated with depression at two months (Watkins et al., 2011). The same study also showed that breastfeeding help is a protective factor for depression (Watkins et al., 2011).

In summary, Antenatal depression in this study was significantly associated with 'late initiation of breastfeeding'. Compared with mothers who initiated breastfeeding within an hour, mothers who initiated breastfeeding after four hours were more likely to be the mothers who were depressed at 36 weeks of pregnancy. A higher proportion of depressed mothers at three months stopped 'exclusive breastfeeding' earlier when compared with non- depressed mothers. The same trend was seen in 'full breastfeeding' and 'any breastfeeding'. A higher proportion of mothers who were depressed at three months stopped 'full breastfeeding' and 'any breastfeeding' earlier when compared with non-depressed mothers. Mothers who initiated breastfeeding later than four hours also were less likely to 'fully breastfeed' their infants up to six months. Late initiation of breastfeeding also was associated with 'any breastfeeding' cessation before six months. In addition, findings from this study also indicated that depressed mothers were more likely to introduce water, fruits, vegetables and rice before six months. Depressed mothers in this study also were less likely to believe that 'breastmilk is cheaper', 'breastmilk helps mothers to lose weight', 'breastmilk is natural' and 'breastfeeding is more convenient'.

Further studies need to be developed to determine how and the reasons why postnatal depression affects breastfeeding cessation. As there are many adverse health consequences for breastfeeding cessation, there is a great need to manage postnatal depression in mothers in order to assist mothers to breastfeed for longer durations.

5.3 Effect of postnatal depression on infant growth

In this study, there was a significant association between depression and infant growth exemplified by mothers who were depressed at one month and their infants' weights at six months in the univariate analysis. Infants of mothers who were depressed at one month were more likely to be below two standard deviations at six months. This is similar to the results found in South Africa, Nigeria and Brazil (Adewuya et al., 2008, Avan et al., 2010, Santos et al., 2010). In the Nigerian study, infants of depressed mothers were more likely to be below the fifth percentile (weight-for-age) than those of non-depressed mothers at three and six months (Avan et al., 2010). However, unlike the Nigerian study, the current research did not find an immediate effect of depression on infant growth. The effect of being depressed at one month was only evident at six months. In the South African study, postnatal depression at six months was associated with the child being stunted at two years (Adewuya et al., 2008). In the current study, when adjustments were made for confounding factors, no direct association was found between postnatal depression and infant growth faltering. The same results were seen in the Brazilian study, in which no association was found between depression and infant growth when other factors were adjusted (Santos et al., 2010). No direct associations between depression and infant growth faltering have been found in most developing countries (Husain et al., 2012). Findings from developed countries also indicated that postnatal depression did not have a direct effect on infant growth faltering but, rather, the effect was due to infant feeding practices (Stewart, 2007).

Only a few infants in this study were above two standard deviations on the weight-for-age and length-for-age (World Health Organisation, 2006) growth charts. Hence, the effect of depression on high weight reported by studies conducted in Brazil and the United States (Surkan et al., 2008a, Gaffney et al., 2012) was not supported.
In summary, there was a significant association between depression and infant growth only in the mothers who were depressed at one month and their infants' weights at six months in the univariate analysis. Multivariate analyses showed that there was no direct effect of postnatal depression on infant growth in this study. The relationship of postnatal depression on infant growth is via infant feeding.

Future research is needed to determine why there was no direct association with postnatal depression and infant growth in this study while studies in some other developing countries have shown an association. Programs need to be planned to promote exclusive breastfeeding up to six months and timely complementary feeding since the relationship of postnatal depression on infant growth is via infant feeding.

5.4 Relationship between postnatal depression, infant feeding outcomes and infant growth

In the survival analysis, when depression at one month was chosen as a status for the duration of 'exclusive breastfeeding' and the factor was infant's weight range at six months, there was a significant association between depression and both 'exclusive breastfeeding' and infant growth. Compared with mothers of infants who were in the normal weight range, a higher proportion of mothers whose infants were below two standard deviations stopped 'exclusive breastfeeding' earlier. As all the Maldivian infants were small, there weren't any infants who were above two standard deviations on the (World Health Organisation, 2006) weight-for-age growth chart. The mother being depressed and the infant being below two standard deviations on the (World Health Organisation, 2006) weight–for-age z-score chart contribute to the introduction of other foods, which makes the 'exclusive breastfeeding' rates low as well. Some mothers reported that health workers suggested infant formula when infants were below two standard deviations on the growth chart. In the United States study, multivariate regression models revealed that, in the group of mothers with postpartum depression, low breastfeeding intensity at two months significantly increased weight gain by six months (Gaffney et al., 2012). The same study showed that, in the group of mothers with postpartum depression, adding cereal to the baby's bottle at two months also increased weight gain by the age of six months (Gaffney et al., 2012). The authors also showed that early introduction to solid food significantly predicted higher average weight gain among babies of mothers without postpartum depression, but that breastfeeding intensity and adding cereal to the baby's bottle did not (Gaffney et al., 2012). However, the study analysed feeding methods and weight gain in two separate models for depressed and non-depressed mothers. Hence the statistical differences between depressed and non-depressed mothers cannot be known. Nevertheless, the results of the current study, and the literature before it, support that a larger proportion of mothers with depression stop breastfeeding earlier when compared with non-depressed mothers, and that breastfeeding affects infant growth and infant health. So, there is a need to treat mothers for their postnatal depression. The literature has suggested many interventions to manage postnatal depression which have been shown to be effective. These include cognitive-behavioural depression prevention interventions (Mendelson et al., 2013) and person-centred approaches for mothers with depression (Morrell et al., 2009).

The results, in addition to the literature support, shows that a larger proportion of mothers with depression stop breastfeeding earlier, when compared with non-depressed mothers, and that breastfeeding affects infant growth and infant health. Even though postnatal depression had no direct effect on infant growth, it is a matter of concern because postnatal depression affects feeding methods which in turn affects infant growth. Further studies needs to be carried out in order to identify all the factors that are associated with postnatal depression in the Maldives. By having a better understanding of these factors, interventions can be developed to minimise postnatal depression and consequently its effects on infant feeding practices and infant growth. The literature has shown that cognitive-behavioural interventions for depression prevention was effective in managing depression (Mendelson et al., 2013). Future studies can be targeted to check the effectiveness of these interventions and their appropriateness in the Maldivian context.

5.5 Breastfeeding rates, factors and the incidence of breastfeeding problems in the Maldives

5.5.1 Breastfeeding rates

Although prelacteal feeds were given to many infants, 100% of the mothers initiated breastfeeding. The majority of the mothers (83.9%) initiated breastfeeding within one hour after birth. The percentages of mothers who initiated breastfeeding within and after four hours after delivery were 9.7% and 6.5%, respectively. ‘Any breastfeeding’ rates were very high up to six months later in this study, being98.8% at one month, 95.4% at three months and 90.7% at six months. This is because breastfeeding is ingrained in the Maldivian culture. The Maldives is an Islamic country and Islam instructs mothers to breastfeed through the Quran. Verse number 233 from *Surah Al-Baqarah* states:

Mothers shall suckle their children for two whole years; (that is) for those who wish to complete the suckling. The duty of feeding and clothing nursing mothers in a seemly manner is upon the father of the child. No one should be charged beyond his capacity. A mother should not be made to suffer because of her child, nor should he to whom the child is born (be made to suffer) because of his child. And on the (father's) heir is incumbent the like of that (which was incumbent on the father). If they desire to wean the child by mutual consent and (after) consultation, it is no sin for them; and if ye wish to give your children out to nurse, it is no sin for you, provided that ye pay what is due from you in kindness. Observe your duty to Allah, and know that Allah is Seer of what ye do (2011).

The same trend is seen in other Islamic countries, although the initiation rate is lower than the present study. A sample of 373 women in Kuwait found that 92.5% initiated breastfeeding (Dashti et al., 2010). A cross-sectional study of 906 neonates in Al-Hassa province, Saudi Arabia, showed that 91.9% of the neonates studied were breastfed (El-Gilany et al., 2012).

Although ‘any breastfeeding’ rates were high, the ‘exclusive breastfeeding’ rate was very low at one month in this study. The reason for this was the introduction of prelacteal feeds as a ritual feed, which will be discussed in detail in a later section. So, ‘full breastfeeding’ and ‘exclusive breastfeeding’ rates dropped down to 29.7% and 7.5%, respectively, due to the early introduction of other foods. The ‘exclusive breastfeeding’ rate in this study was found to be very different to that of the National Micronutrient Survey which was conducted in the Maldives in 2007. The National Micronutrient Survey 2007 showed that 51.9% of the boys and 50.8% of the girls were exclusively breastfed up to six months. The National Micronutrient Survey was a cross-sectional survey of mothers with children under five years of age, which is an inaccurate method of measuring exclusive breastfeeding. A prospective cohort study collects data closer to the time of the event (Dawson). Additionally, the National Micronutrient Survey involved a larger sample size from other islands which might have affected the breastfeeding rates. However the results from this study’s survival analysis showed that a higher proportion of mothers living in the islands ceased ‘full breastfeeding’ earlier when compared with mothers living in Malé. Hence it is very unlikely that ‘exclusive breastfeeding’ rates in the Maldives were above 50% up to six months after birth. Similar to this study, a previous cohort study of 561 infants in Malawi demonstrated that rates of ‘full breastfeeding were 13% at four months, 6.3% at five months and 1.5% at six months (Kalanda et al., 2006).

‘Exclusive breastfeeding’ and ‘full breastfeeding’ were 0% at six months because all of the mothers had started to give either infant formula or solid food at six months (approximately 180 days). Within the first week of birth, 19.6% of the infants received infant formula and the rate increased to 39.8% by three months. The introduction of formula is high in other studies too. A cohort study in Italy reported that, at the time of discharge, 9% (n=836) of mothers introduced infant formula to their infants (Zanardo et al., 2013).

5.5.2 Factors associated with infant feeding methods

Univariate analysis showed that infants who were ‘exclusively breastfed’ for a duration of three or more months were less likely to have acute respiratory infections. Multivariate logistic regression of this study indicated that the factors associated with ‘exclusive breastfeeding’ at one month were ‘initiation of breastfeeding before four hours’, ‘receiving help from a servant’ and ‘health workers supported breastfeeding’. At three months, no factors were significantly associated with ‘exclusive breastfeeding’ in the adjusted model. At six months ‘exclusive breastfeeding' was associated with 'receiving help from a servant' and 'receiving help from a family member'. After adjustments were made for confounding factors, only 'receiving help from a family member' was significant. Similar risk factors were found in other studies. Data from the Infant Feeding Practices Survey II found that there was a positive association between longer breastfeeding duration and receiving breastfeeding education from classes/support groups (Chen et al., 2012). However, there were different risk factors for 'exclusive breastfeeding' in other studies. In a Tanzanian study, 'non-exclusive breastfeeding' during the first six months was associated with 'lack of professional assistance at birth' and 'residence in urban areas' (Victor et al., 2013). The New Zealand Asthma and Allergy Cohort Study, consisting of 1,105 children born in Christchurch and Wellington between 1997 and 2001, found that, in children who were atopic, exclusive breastfeeding for three months or longer was associated with reduced asthma at ages 4, 5 and 6 years (62%, 55% and 59%, respectively) (Oddy, 2013).

After adjustments were made for confounding factors, analysis showed that 'mothers who decided on a feeding method after the baby was born', 'mothers who had a caesarean section' and 'mothers who had maternal mothers who did not breastfeed' were less likely to 'fully breastfeed' at one month. At three months in the unadjusted model, 'mothers who were older than 24 years of age', 'mothers who decided to breastfeed after the baby was born' and 'mothers who initiated breastfeeding four hours after delivery' also were less likely to 'fully breastfeed' up to three months. Mothers who were 'fully breastfeeding' were less likely to have infants with acute respiratory infections and respiratory problems compared with mothers who did not 'fully breastfeed'. However, the association was not significant after adjustment for confounding factors. At six months, the factors associated with 'full breastfeeding' were 'initiation of breastfeeding within one hour', 'deciding to breastfeed before pregnancy' and 'not having stressful life events'. Contrary to this study, most other studies have shown that younger mothers are more likely to discontinue breastfeeding (Scott et al., 2006, Hwang et al., 2006). The reason why younger mothers were more likely to 'fully breastfeed' in this study could be because the younger mothers were better educated. A lower rate of 'full breastfeeding' was associated with caesarean sections because mothers who had caesarean sections introduced infant formula to their infants within the first week. The association between caesarean sections and lower rates of 'full breastfeeding' has been found in other studies (Zanardo et al., 2013, Sallam et al., 2013). This is mostly due to the introduction of prelacteal feeds which will be discussed under that section. Another similarity between this study and others is that maternal grandmothers have an influence on the chosen feeding method. A prospective cohort study involving 463 mothers in Vietnam has shown that the maternal grandmother's preference for breastfeeding was associated with exclusive breastfeeding upon hospital discharge (adjusted OR= 3.52; 95% CI,1.21-10.28) (Duong et al., 2004b).

Similar to the findings of the current study, the National Health and Nutrition Examination Survey III in America has shown that 'full breastfeeding' is associated with lower risks of acute respiratory infections (Chantry et al., 2006). Mothers who reported respiratory infections also reported respiratory difficulties which might be due to asthma. Other studies have shown that duration of 'full breastfeeding' reduces the likelihood of mothers reporting breathing difficulties for their infants. A cross-sectional study of 622 children in Riyadh, Saudi Arabia, found that increasing the duration of full breastfeeding was associated with a reduced likelihood of maternal reporting of her child having 'ever wheezed', 'wheezed in the last 12 months', and 'ever having asthma', with an adjusted odds ratio for full breastfeeding ≥12 months versus never breastfed of 0.51 (95% confidence interval 0.29-0.90), 0.48 (0.26-0.88) (Al-Makoshi et al., 2012). Similarly, the data from the Pregnancy Risk Assessment and Monitoring System (PRAMS) in 11 states and New York City showed that breastfeeding initiated within the first hour after birth was positively associated with breastfeeding duration (Ahluwalia et al., 2012). Unlike this study, most studies discussed the intention of breastfeeding rather than the time at which the decision was made to breastfeed. Such studies showed that having an intention to follow breastfeeding recommendations is positively associated with the 'initiation of breastfeeding' (Wen et al., 2012). In this study, the mothers who said they were not going to breastfeed were very small, so the results had no significant association with breastfeeding method or duration. Similar to this study, prenatal stress has been found to be associated with breastfeeding (Insaf et al., 2011).

In this study, mothers who gave infant formula as a prelacteal feed were six times more likely to stop 'any breastfeeding' before six months when compared with mothers who did not give infant formula as a prelacteal feed. Similarly, the study of prelacateal feeds in Hangzhou, China, found that mothers who gave prelacteal feeds were less likely to 'any breastfeed' their infants (Qiu et al., 2007). In this study, infants of mothers who stopped 'any breastfeeding' before six months were over three times more likely to have diarrhoea and over seven times more likely to have other health problems (digestive problems, vomiting and constipation) when compared with infants of mothers who 'any breastfed'. This is similar to the case-control study in England which also demonstrated that infants who were never breastfed were more likely to have diarrhoeal disease when compared with infants who were breastfed (Quigley et al., 2006).

In summary, 'mothers who decided on a feeding method after the baby was born ', 'caesarean section delivery', 'mothers who had maternal mothers who did not breastfeed' 'mothers who were older than 24 years of age', 'mothers who initiated breastfeeding four hours or more after delivery' and 'mothers who had stressful life events' were less likely to 'fully breastfeed'. Mothers who were 'fully breastfeeding' were also less likely to have infants with acute respiratory infections and respiratory problems, compared with mothers who did not 'fully breastfeed'. 'Mothers who gave infant formula as a prelacteal feed' were six times more likely to stop 'any breastfeeding' before six months compared with mothers who did not give infant formula as a prelacteal feed. Also, infants of mothers who stopped 'any breastfeeding' before six months were more likely to have diarrhoea and other health problems (digestive problems, vomiting and constipation), compared with the infants of mothers who 'any breastfed' their infants.

5.5.3 Breastfeeding problems

Mothers reported several problems they had with breastfeeding, the main one being: 'not having enough breastmilk'. Mothers also reported that their infants were not growing with breastmilk alone, so they had to introduce infant formula. The other reasons mothers reported were 'pain while breastfeeding', 'mastitis', 'mother or infant being sick', 'suckling problems', 'infant refused to breastfeed', 'it is the age to start other food' and 'infant crying and not sleeping well'.

The study of 593 mothers in United Arab Emirates indicated that the most common reasons perceived by mothers for terminating breastfeeding were 'new pregnancy' and ‘insufficient milk supply’ (Radwan, 2013). Similarly, the most common reason given in this study was ‘insufficient milk supply’. The results from a prospective study of 946 women conducted in the United States showed that mastitis was associated with cessation of breastfeeding (Schwartz et al., 2002). Insufficient milk supply also has been shown to be associated with feeding for longer durations for each feed. A case-control study in Western Australia showed that lower milk productions were associated with longer feed durations in each feed for mothers experiencing pain (McClellan et al., 2012). Although the IOWA infant feeding attitudinal scale scores were high in this study, many mothers reported that they introduced the bottle because the infants were not growing well, and/or the infants were crying and not sleeping well.

Like this study, other studies also have confirmed that maternal and infant health affect breastfeeding. A cohort study of 1,177 mothers in the US found that the major reasons why mothers stop breastfeeding before they desire include concerns about maternal or child health (Odom et al., 2013).

Mothers’ understanding of why other women bottle feed was interesting. The reasons mothers gave for other mothers ceasing breastfeeding or starting bottle feeding were ‘afraid that breasts will sag or they may look ugly’, ‘having flat nipples’, ‘baby or mother being too sick’, ‘lazy’, ‘baby crying too much’, ‘baby not growing’, ‘baby refusing to breastfeed’, ‘food age’, ‘mother too busy’, ‘baby can’t sleep’ and ‘too difficult to breastfeed’.

In short, all the mothers initiated breastfeeding in this study and ‘any breastfeeding’ rates were very high up to six months. Due to the introduction of prelacteal feeds as a ritual feed, ‘full breastfeeding’ and exclusive breastfeeding rates were low at one month. ‘Full breastfeeding’ and ‘exclusive breastfeeding’ rates dropped down to 29.7% and 7.5%, respectively at six months, due to the early introduction of other foods. Mothers reported several problems they experienced with breastfeeding. The main problem mothers reported was ‘not having enough breastmilk’. Mothers also reported that their infants were not growing with breastmilk alone, so they had to introduce infant formula. The other reasons for introducing formula that mothers reported were ‘pain while breastfeeding’, ‘mastitis’, ‘mother or infant being sick’, ‘suckling problems’, ‘infant refusing to breastfeed’, ‘it is the age to start other food’ and ‘infant crying and not sleeping well’.

There is a need to educate and support mothers about breastfeeding problems to make breastfeeding more successful. This is because the results of this study and the literature have confirmed that low levels of breastfeeding are associated with infants having a history of episodes of diarrhoea, acute respiratory infections, breathing difficulties, digestive problems, constipation and vomiting. There is also a need to explore the reasons for so many caesarean sections (44.9% of deliveries were by caesarean section) and to initiate breastfeeding within one hour of all births, as these factors affect breastfeeding rates.

5.6 The types of complementary foods used and their age of introduction to infants in the Maldives

5.6.1 Types of complementary feeds

The percentages of mothers who had given fruits (dates) and honey at one month was high, (40.5% and 15.7%,) respectively), because very small amounts of both foods made into a paste are commonly rubbed onto the infant’s upper palate as a ritual before breastmilk is commenced or in the first week. Some mothers introduced other types of fruit by four months. The percentage of mothers who gave water was high, increasing from 20.5% at one month to 46.5% at four months. Giving small amounts of pomegranate juice also was a common Maldivian cultural practice (to cleanse the tongue of the infant). Many mothers (17.2%) had given pomegranate juice by four months. In this study, the majority of the mothers (60.8%) introduced solid food at the age of six months. About 30% of the mothers introduced food at five months and a small percentage (7.7%) at four months. In an earlier study in the Maldives, the median age for the introduction of solid foods was four and a half months (Abdulraheem and Binns, 2007).

Similar results were shown in studies conducted in other countries too. A cohort study of 561 in Malawi also showed that the mean age for introduction of water was 2.5 months (range 0-11.8), of complementary foods was 3.4 months (range, 1.0-10.7) and of solids was 4.5 months (range 1.2-13.8) (Kalanda et al., 2006). Similar to the factors associated with 'not exclusively breastfeeding' or 'not fully breastfeeding' in this study, the Malawi study found that early complementary feeding was significantly associated with increased risk for respiratory infection and marginally increased risk for eye infection and episodes of malaria (Kalanda et al., 2006).

5.6.2 Factors associated with complementary feeding

Although 'any breastfeeding' rates were high, almost half of the mothers in this study had introduced infant formula by four months. At six months, a very high percentage of mothers (81.1%) had introduced infant formula to their infants. There were several factors associated with introduction of formula in this study. Multivariate logistic regression showed that mothers who introduced formula at one month were more likely to be above 65 kg at three months and six months after giving birth when compared to mothers who did not introduce infant formula. Data from the Active Mothers Postpartum (AMP) study of overweight and obese postpartum women (n = 450), also demonstrated that weight loss was associated with breastfeeding (Ostbye et al., 2012).

Mothers who gave birth by caesarean section also were more likely to be giving formula at one month, compared with mothers who gave birth by vaginal delivery. An exploratory cross-sectional study in Swansea, Wales, similarly found that mothers who had caesarean sections were more likely to introduce complementary feeds and discontinue breastfeeding before six months postpartum (Brown and Jordan, 2013).

At three months, compared with mothers who were in the age group '18-24', mothers in the age groups '24 - 35' and 'above 35' were more likely to give infant formula at three months. Compared with multiparous (number of children: 3) mothers, primiparous mothers and multiparous (number of children: 2) mothers were more likely to give infant formula to their infants at three months. Conversely, in the Generation R Study, in Rotterdam, the Netherlands, higher maternal age was negatively associated with early introduction of complementary food (Tromp et al., 2013). However, similar to this study, 'multiple parity' was positively associated with early introduction of complementary food (Tromp et al., 2013). Mothers who were employed in government or private jobs also were more likely to give infant formula to their infants when compared with mothers who were housewives or self-employed. This is because of the inconveniences faced by working mothers. However, in the Maldives, the duration of maternity leave is 60 days and, upon return to work after completion of maternity leave, the employee is entitled to two daily breaks of thirty minutes each to attend to the needs of the child (Maldives Civil Services Comission, 2008). A similar association between maternal occupation outside the home and low 'exclusive breastfeeding' rate has been noted by other studies too. A national cross-sectional study conducted in Canada, consisting of 5,615 women whose infants were aged six months or more, indicated that women who were unemployed were more likely to 'exclusively breastfeed' their infants for six months, compared with women who were employed (Al-Sahab et al., 2010). A longitudinal study in Beirut also showed that non-working mothers were more likely to breastfeed, compared with working mothers (Hamade et al., 2013).

At three months, mothers who gave birth by caesarean section were more likely to continue to give infant formula, compared with mothers who gave birth by vaginal delivery. Infants who were formula-fed also were more likely to have 'other health problems' (digestive problems, vomiting and constipation) at three months, compared with the infants of mothers who did not give infant formula at three months. Digestive problems, vomiting and constipation could have been due to gastroenteritis, although no history of episodes of diarrhoea was reported. Results from a prospective birth cohort study of 1,901 infants in Germany also showed that 'exclusive breastfeeding' for six months or longer significantly reduced the risk for gastrointestinal tract infection, compared with breastfeeding for less than four months (Rebhan et al., 2009). In the current study, having acute respiratory infections and a history of episodes of diarrhoea did not have any statistically significant association with the introduction of infant formula at three months. However, 'having a history of episodes of diarrhoea' was a significant factor in infants who were not breastfed at all up to six months. Many mothers who gave infant formula were still partially breastfeeding and the association between introduction of infant formula and a history of episodes of diarrhoea was not seen for this group. The association was seen in the mothers who did not breastfeed at all up to six months, having introduced formula as a complete substitute, suggesting the importance of giving at least some breastmilk compared with not giving any breastmilk. Acute respiratory infections and respiratory difficulties were significant in the infants of mothers who were not fully breastfeeding. Studies have suggested that predominant breastfeeding for four to six months can reduce the risk of allergies and diarrhoea (Morales et al., 2012).

Early introduction of complementary feeds were high among working mothers and older mothers. This might be because mothers who are working seem to face some difficulties in ‘full breastfeeding’. Lengthening of maternity leave to six months could help mothers to ‘fully breastfeed’ their infants. Hence, there is a need to educate all mothers about the adverse effects of introducing formula and other early complementary feeds. In addition, this study and the literature has shown that mothers who introduce formula are more likely to be over 65 kg in weight and that infants of mothers who are fed infant formula are more likely to have health problems. Breastfeeding education should include individual adverse effects of formula feeding which includes maternal weight retainment, infant health problems and also the advantages of breastfeeding.

5.7 The risk factors for the use of prelacteal feeds

5.7.1 Types of prelacteal feeds used in the Maldives

The majority of the infants were given breastmilk as the first feed. However, 23.1% of the infants were given prelacteal feeds, including infant formula (4.1%), honey (10.6%), dates (7.4%), glucose (0.7%) and Zam Zam water (0.2%). Within the first week of birth, 38.0 %, 15.0 % and 19.6% of the infants received honey, dates and infant formula, respectively. Many other studies also have shown that breastmilk was not the first feed an infant received. A study in Kuwait, found that 76.4% of the babies received infant formula and 4.6% received glucose water as prelacteal feeds (Dashti et al., 2010). A review of prelacteal feeds in China found that the practice was common, with the highest reported rate in the Shandong Province in Eastern China, where 72% of the infants received prelacteal feeds before breastfeeding was initiated (Tang et al., 2012).

5.7.2 Factors associated with prelacteal feeding

The boys were more likely to receive a ritual feed as their first feed. Mothers who agreed with the practice were more likely to give honey or dates as the first feed. The maternal age being between 24 and 35 decreased the likelihood of introducing prelacteal feeds (ritual feeds) compared with mothers in the age group of 18- 24 years. Employed mothers also were more likely to introduce ritual feeds as prelacteal feeds. Introduction of prelacteal feeds (ritual feeds) was not associated with the IIFAS score, type of infant delivery or depression score at 36 weeks of pregnancy.

The use of prelacteal feeds is very common in Muslim cultures and seems to be increasing in the Maldives with renewed interest in religious practices (Abdulraheem and Binns, 2007, Shaikh and Ahmed, 2006). Knowledge and attitudes about the choice of the first feed affects breastfeeding practice. It is a ritual practiced in many Muslim communities to give something sweet as the first feed (Tahneek). According to the Sunnah of the Prophet Mohammed, the prelacteal feeds given were dates. Hadith number 5347 in the book on general behaviour states, “A'isha, wife of Prophet Muhammad (May peace be upon him), reported that the new-born infants were brought to Allah's Messenger. He blessed them and rubbed their palates with dates” (al Hajjaj, 2009). It is believed that the piece of date is given only for the sweet flavour, not for ingestion (Shaikh and Ahmed, 2006). Some Islamic scholars believe that the sugar from the small amount of date made into a paste and put on the upper palate has medicinal value. A recent randomised, double blind, placebo-controlled trial also has shown that a small amount of dextrose applied inside newborn’s mouth prevents neonatal hypoglycaemia (Harris et al., 2013). The use of prelacteal feeds, including honey or water supplements, in many Muslim communities is a cultural practice rather than a religious practice (Shaikh and Ahmed, 2006). Giving honey under one year of age carries a risk of Clostridium infection (King et al., 2010) and the resultant low rate of exclusive breastfeeding may change the nature of the human microbiome, which is an important factor in determining obesity and chronic disease later in life (Thompson, 2012). Similar cultural practices have been seen in less developed areas of Pakistan, where a concoction of honey and sometimes saliva, animal milk, water, ‘desi’ ghee and/or tea with herbs were given to infants within the first three days (Khadduri et al., 2008).

Compared with mothers who had vaginal delivery, mothers who had undergone caesarean sections were significantly more likely to give their babies infant formula as the prelacteal feed. This is because infant formula is more likely to be given as the prelacteal feed at the hospital and giving birth by caesarean section delays the initiation of breastfeeding (Dewey et al., 2003). The percentage of births by caesarean section in this study is slightly higher than the 41.11% reported in 2011 for the whole Maldives (Ministry of Health and Family, 2012). The WHO recommended upper limit for caesarean section rate is 15% (World Health Organisation, 1985) because medically unnecessary caesarean sections can have significant negative health implications for health equity within and across countries (Gibbons et al., 2010).

Maternal grandmother's breastfeeding practice was inversely associated with the introduction of infant formula as the infant's prelacteal feed. Introduction of infant formula was not associated with IIFAS score or maternal experiences of stressful life events.

Health professionals need to distinguish between religious and cultural practices in order to develop appropriate health education programs to reduce the unnecessary use of early additional feeds. Antenatal education programs need to include more information on the importance of exclusive breastfeeding and employ better targeting at parents and health care workers. These programs should include information about what religious practices are and what cultural practices are. A religious practice in an Islamic community is practice which comes from Quran or the "sunnah' ways of Prophet Muhammad (peace be upon him). Although a culture is based on religion, any practice which has been practiced over time but which does not come from Quran or the 'sunnah' of Prophet Muhammad, would be regarded just as a cultural practice. Hence, religious educators and health care workers should work together to educate the public on such matters to improve breastfeeding rates and minimise introduction of unnecessary feeds such as honey.

In addition, future research needs to identify factors associated with the increasing number of caesarean sections, as well as the barriers to initiation of breastfeeding after undergoing a caesarean section. Such information can be used to increase breastfeeding rates, particularly the exclusive breastfeeding rates within the first six months after delivery. It is important, also, to include maternal grandmothers in antenatal education programs because they have an influence on the infant feeding practices.

5.8 The risk factors associated with growth faltering of infants in the Maldives

Infants with low birthweight were very few in this study. Only 5.1% of the infants had a birthweight less than 2,500 grams. This is very low compared to the percentage of low birthweight babies in the Maldives in the year of data collection. The percentage of infants with low birthweight in the Maldives in the year 2011 was 10.2% (Ministry of Health and Family, 2012). This might be because, in this study, only full-term babies were included.

The percentages of girls below and above two standard deviations in weight at three months were 1.4% and 0.5 %, respectively. At six months, the percentage of girls who were two standard deviations below the WHO standard increased to 2.8%.

The percentage of girls and boys who were below two standard deviations on the (World Health Organisation, 2006) weight and height growth charts was very high. At one month, 5.7% of boys and 2.6% girls were below (-2 Z scores) and 1.4% of girls were above (+2 Z scores) two standard deviations on the WHO growth standards, z-score charts. The percentage of boys below two standard deviations at three months was 6.9%. The percentage of babies who were short for age was highest at three months for girls (11.6%) and at six months for boys (18.3%). This is a public health concern as the survival analysis results have shown that a higher proportion of mothers of infants who were below two standard deviations on the (World Health Organisation, 2006) growth chart stopped 'exclusive breastfeeding' earlier when compared with mothers of infants who had normal weight. This is because the exclusively breastfed infants were classified as having poor growth when compared with the (World Health Organisation, 2006) growth chart, which led to the introduction of additional feeds before six months (Binns and Lee, 2012).

In the adjusted multivariate model of this study, 'lower household annual income', 'birth weight lower than 2,500 grams', and 'lower socioeconomic status' (infant sleeping in a room with three or more people) were all significant factors associated with the infant's weight being below two standard deviations on the (World Health Organisation, 2006) weight-for-age z-score growth charts for boys at one month.

After adjustment for confounding factors, low maternal education level was not significant. The confidence intervals for ‘low household annual income’ and ‘low birth weight’ were very wide in the adjusted multivariate model. Hence, the results might not be significant even if a statistical significance of $P<0.05$ was shown. The infant sleeping in a room with more than three people was significantly associated with the infant being below two standard deviations on the weight–for-age (World Health Organisation, 2006) z-score growth chart. The infant sleeping in a room with more than three people is a reflection of low socioeconomic status. This is a serious concern because close to 50% of the mothers reported that more than three people slept in the same room as the mother and infant. This is unavoidable in the current situation within the Maldives because many people have moved from the islands to the capital, Malé, to obtain better education, health care and other services. Of the total population of the Maldives (which was 298,968 in 2006), 103,693 people were on the island of Malé which covers an area of only 5.8 square kilometres (Ministry of Planning and National Development, 2006). The government of the Maldives has started new programs to minimise the number of people living in Malé by providing more facilities on the other islands as well.

In the unadjusted multivariate model, ‘Father’s smoking status’, ‘birthweight’, ‘maternal education level’ and ‘number of people living in the room’ were associated with infant boy’s weight at three months. After adjustment for confounding factors, ‘father’s smoking status’ and ‘number of people living in the room’ were not associated with infant’s weight-for-age at three months. Infants who had a birthweight less than 2,500 grams were less likely to be within the normal weight range on the (World Health Organisation, 2006) weight–for-age z-score growth chart (OR=0.3) compared with infants who had a birthweight equal to or above 2,500 grams. Infants of mothers whose education levels were above or equal to secondary schooling were more likely to be within the normal weight range on the (World Health Organisation, 2006) growth chart. The same factors, birthweight and maternal education level, were associated with infants being underweight at six month as well. Compared with infants whose birthweight was equal to or above 2500 grams, infants whose birthweight was less than 2500 grams were less likely to be in the normal weight-for-age in the (World Health Organisation, 2006) weight-for-age z-score growth chart for boys at six months. Infants of mothers whose education levels were above or equal to secondary school were more likely to be in the normal weight-for–age range. 'Full breastfeeding' was not associated with the weight of the infant.

Some studies have shown that maternal smoking status is associated with growth faltering in infants (Weng et al., 2012). Due to the small number of mothers in this study who smoked, no significant effects of maternal smoking on infant growth faltering were seen. However, in the univariate analysis and multivariate unadjusted model, paternal smoking was positively associated with the infant being underweight. 'Low household income', 'maternal education level' and 'infections' were shown to be risk factors for being undernourished in The Bangladesh Demographic and Health Survey 2004, consisting of 6,005 children (Das and Rahman, 2011), and several other studies have shown that birthweight is associated with growth faltering. However, unlike this study, most studies have shown that high birthweight is associated with children being overweight (Barroso et al., 2012).

Similar factors existed for infants being short when compared with the (World Health Organisation, 2006) growth chart values. In the unadjusted model, the factors associated with normal length at one month were 'maternal education being secondary or above', 'infant's father not smoking before pregnancy' and 'the district in which mothers live being Malé. After adjusting for confounding factors and co-variates, the factors associated with normal length at one month were 'infant's father not smoking before pregnancy' and 'the district in which mothers live being Malé. Infants of fathers who did not smoke were about five times more likely to have normal length–for-age on the (World Health Organisation, 2006) z-score growth charts, compared with infants of fathers who smoked. Infants who were living in the islands were less likely to be in the normal length-for-age. Paternal smoking being related to the infant being short is a grave public health concern because 43% of the fathers were smokers. Legislations have been enacted by the Ministry of Health to reduce the percentage of people who smoke but with poor results. The fact that infants who were living in the islands were less likely to be in the normal length-for-age compared with those living in Malé might be due to the comparative lack of access to good health care services. The lack of good health care services and good education opportunities in the islands are the main reasons why the capital city, Malé, is so heavily populated. Similar associations of 'residence in a certain region' and growth faltering were seen in other studies too. For the Women and Children

National Demography and Health Survey 2006 in Brazil, 'residence in Midwestern region' was a factor for growth faltering (Cocetti et al., 2012).

The other factor for growth faltering is having a history of episodes of diarrhoea. Infants who had a history of episodes of diarrhoea were about three times less likely to be the normal length-for-age at three months, compared with infants who did not have a history of episodes of diarrhoea. The Bangladesh Demographic and Health Survey 2004 also showed that having 'diarrhoeal episodes' and 'acute respiratory infections' were associated with growth faltering (Das and Rahman, 2011).

The only factor associated with infant's length at six months was 'maternal education level'. Mothers whose education levels were secondary or above were over three times more likely to have infants within the healthy length range on the (World Health Organisation, 2006) length-for-age z-score growth chart when compared with mothers whose education level was primary or below. 'Full breastfeeding' and 'infants having a history of episodes of diarrhoea' was not associated with length–for-age at six months (boys). Similar to the factors associated with weight of the infant, 'maternal education level' affected length of the infant too. The fact that the maternal education level being above or equal to secondary reduces the risk of the infant being short for age is a good sign because, in the Maldives, female education is given a high importance. In this study itself, 82.3% of the mothers had an educational level of secondary or above.

The risk factors for growth faltering in girls are slightly different than those for boys. More factors associated with growth faltering were found for boys, possibly because of the difference in the cut-off values in the plus or minus two standard deviations for normal weight and length. However, the factors 'living in an island other than Malé and 'birthweight being less than 2,500 grams' appeared in the multivariate logistic regression analysis for girls as well. Compared with infants who did not have acute respiratory infections, infants who did have acute respiratory infections were ten times less likely to be within the healthy weight range on the (World Health Organisation, 2006) weight–for-age z-score growth chart at one month for girls. Infants who had a birthweight below 2,500 grams also were less likely to be within the normal weight range when compared with infants who had a birthweight equal to or above 2, 500 grams. There was no association between infant's weight at one month and postnatal depression at one month. No associations were found with growth faltering at three months.

Infants of mothers who were living in islands other than Malé were ten times less likely to be within the normal weight range on the (World Health Organisation, 2006) weight-for-age z-score growth charts for girls compared with infants of mothers who were living in Malé at six months. 'Low birthweight' and 'maternal education level' were not associated with girl infants' weights. No associations were found for girl infant's length-for-age at one month, three months or six months.

In summary, the factors that were positively associated with infant's normal weight in this study included 'maternal education level' (adjusted OR= 4.6; 95% CI, 1.1 – 17.9) and 'paternal non-smoking' (adjusted OR= 4.7; 95% CI, 1.4 – 17.3). Factors that were inversely associated with infant's normal weight were 'living in an island other than Malé, 'birthweight less than 2,500 grams' (adjusted OR= 0.2; 95% CI, 0.09 – 0.9), the infant 'sleeping in a room with more than three people'(adjusted OR= 0.1; 95% CI, 0.02 – 0.7), the infant 'having a history of episodes of diarrhoeal' (adjusted OR= 0.3; 95% CI, 0.1 – 0.9) and 'having acute respiratory infections' (adjusted OR= 0.1; 95% CI, 0.01 – 0.9).

The percentage of babies who were short for age was high in the Maldives. This is a public health concern because the survival analysis results have shown that a higher proportion of mothers of infants who were below two standard deviations on the (World Health Organisation, 2006) growth chart stopped 'exclusive breastfeeding' earlier when compared with mothers of infants who had normal weight. The factors associated with infant growth faltering in this study included 'living in an island other than Malé', 'birthweight less than 2,500 grams', 'socioeconomic factors' (the infant 'sleeping in a room with more than three people), 'lower maternal education level', 'paternal smoking', the infant 'having a history of episodes of diarrhoeal' or 'having acute respiratory infections' and 'lower household income'.

Strategies need to be planned to minimise the gap between the services provided in Malé and in the islands. In fact, the government of the Maldives has started new programs to better distribute the number of people living in Malé by providing more facilities on the other islands.

Paternal smoking being related to the infant being short is a grave public health concern as 43% of the fathers were smokers. Legislations have to be re-enacted reduce the percentage of people who smoke. Further research is also needed to explore the factors associated with high smoking rates.

The fact that the maternal education level being above or equal to secondary reduces the risk of an infant being short for its age is a good sign because, in the Maldives, female education is given high importance. In this study itself, 82.3% of the mothers had an educational level of secondary or above. An effort should be made to maintain the high level of female education in the Maldives.

Chapter 6 Conclusions

This chapter summarizes the key findings of the study and recommendations for promotion of good health. It also gives suggestions for further study directions.

6.2 Conclusions

This study has shown that the prevalence of antenatal depression and postnatal depression in the Maldives was similar to other countries. The 'any breastfeeding' rates in the Maldives were high, although 'full breastfeeding' and 'exclusive breastfeeding' rates were low due to the early introduction of complementary feeds. The percentage of infants with measurements below the new WHO weight/length-for-age growth charts was high in the Maldives. The results, have demonstrated that a proportion of mothers with depression stopped breastfeeding earlier, compared with non-depressed mothers. Infants of the few mothers who stopped breastfeeding were more likely to have health problems (a history of episodes of diarrhoea, acute respiratory infections, breathing difficulties, digestive problems, vomiting and constipation) and growth faltering. Hence there is a great need to treat mothers with postnatal depression and to minimise the risk factors for depression. Further studies need to be carried out on interventions to manage depression. Good child health facilities are needed because an infant being unwell also contributes to the mother's depression. There is also a need to minimise the gap in maternal and child health services between the islands so that the island of Malé does not become so over-populated and to improve breastfeeding rates and infant growth of the infants living in the islands. The need for caesarean sections should be explored as caesarean sections affect the initiation of breastfeeding, which in turn affects breastfeeding rates. Finally, health professionals and families need to be able to distinguish between cultural and religious practices in order to reduce the use of early, unnecessary complementary feeding.

Chapter 7 References

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Chapter 8 Appendix

Appendix A: The letters of ethics approval

Curtin University

Memorandum

To	Professor Colin Binns, School of Public Health
From	A/Prof Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 146/2010**
Date	18 May 2011
Copy	Dr Kay Sauer School of Public Health Ms Raheema Abdul Raheem, School of Public Health Graduate Studies Officer, Faculty of Health Sciences

Office of Research and Development

Human Research Ethics Committee

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Thank you for providing the additional information for the project titled "*A cohort study of postnatal depression, infant feeding practices and infant growth in Malé, the Republic of Maldives*". The information you have provided has satisfactorily addressed the queries raised by the Committee. Your application is now **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 146/2010.** *Please quote this number in any future correspondence.*
- Approval of this project is for a period of twelve months **16-05-2011** to **16-05-2012**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **16-05-2012**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Faculty Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:
  This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 146/2010). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:
When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Regards,

Associate Professor Stephan Millett
Chair Human Research Ethics Committee

بسم الله الرحمن الرحيم

National Health Research Committee
Ministry of Health and Family
Male'
Republic Of Maldives

16th January 2011

Ms. Raheema Abdul Raheem
Ma. Dhathurunaage
Male,
Republic of Maldives,

Approval of Research Proposal

Title of Study Proposal:	"A Cohort Study of Postnatal Depression, Infant Feeding Practices and Infant Growth in Male', the Republic of Maldives"
Researcher:	Ms. Raheema Abdul Raheem

Dear Ms. Raheema,

The members of the Health Research Committee have reviewed your revised research proposal "A Cohort Study of Postnatal Depression, Infant Feeding Practices and Infant Growth in Male', the Republic of Maldives".

The members of the committee after reviewing have approved the proposed study.

It is requested that the final report of the research be forwarded to the Ministry of Health and Family for future local reference and use.

MINISTRY OF HEALTH AND FAMILY
Male' Republic of Maldives

Decision Support Division
Ministry of Health and Family
(Secretariat of the National Health Research Committee)

Tel: (960) 3328425, Fax: (960) 3330699, Email: moh@dhivehinet.net.mv

Appendix B: The information letter to mother

Curtin University of Technology

School of Public Health

Participant Information Sheet

My name is Raheema Abdul Raheem. I am currently conducting research for my Doctorate Degree of Public Health at Curtin University of Technology.

I am investigating the problems mothers have after having a baby, the difficulties in feeding their babies and how their babies grow in Male' the Republic of Maldives.

I am interested in finding out how you feel in the last days of your pregnancy and after you give birth to your infant. I would also like to find out about any problems you have in feeding your baby and the growth of your baby. I am asking for your help by participating in this study. The findings from this research will help us to plan and provide better health programs for the mothers and their babies in the Maldives. You can help by completing a questionnaire at 36 weeks (now), at 1 month, 3 months and 6 months postpartum. An interviewer will be available to help you should there be any problem in answering the questions. Each questionnaire will take approximately 20 minutes to complete.

Your involvement in the research is entirely voluntary. You have the right to withdraw at any stage without it affecting your rights or my responsibilities. When you have signed the consent form I will assume that you have agreed to participate and allow me to use your data in this research.

The information you provide will be kept separate from your personal details, and I will only have access to this. All questionnaires will be stored securely for seven years at Curtin University. The data files and other electronic work will also be stored for seven years with secure password protection.

This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee and the National Research Committee of Maldives. If you would like further information about the study, please feel free to contact me on 7864597 or by email: raheema.abdulraheem@postgrad.curtin.edu.au. Alternatively, you can contact my supervisor, Professor Colin Binns on +61 8 9266 2952 or c.binns@curtin.edu.au.

Thank you very much for your involvement in this research, your participation is greatly appreciated

Appendix C: The consent form

Curtin University of Technology

A Cohort Study of Postnatal Depression, Infant Feeding Practices and Infant Growth in Male' the Republic of Maldives

I________________________________ have read the information on the attached letter. Any questions I have asked have been answered to my satisfaction. I agree to participate in this research but understand that I can change my mind or stop at any time.

I understand that all information provided is treated as confidential.

I agree that research gathered for this study may be published provided names or any other

Information that may identify me is not used.

Name _______________________________ Signature ____________________

Date ______________________________

Investigators Raheema Abdul Raheem Signature ______________________

Professor Colin Binns Signature _____________________

Dr Kay Sauer Signature ______________________

CONSENT FORM

• I understand the purpose and procedures of the study.

• I have been provided with the participant information sheet.

• I understand that the procedure itself may not benefit me.

• I understand that my involvement is voluntary and I can withdraw at any time without problem.

• I understand that no personal identifying information like my name and address will be used and that all information will be securely stored for 7 years before being destroyed.

• I have been given the opportunity to ask questions.

• I agree to participate in the study outlined to me.

Signature ___________________________ Date __________________________

Witness Signature____________________ Date __________________________

Appendix D: Questionnaires used in the study

The health and nutrition of mothers, infants and children is a major priority around the world. We are interested in understanding how you feel in the last days of your pregnancy and after you give birth to your infant. We would also like to find out about any problems you have in feeding your baby and growth of your baby. Your help in completing this short questionnaire will assist us in planning better health promotion and nutrition education programs. It will take only about 20 minutes to fill in the questionnaire.

Prof Colin Binns {Supervisor: MBBS (University of Western Australia) MPH (Harvard) PhD (Hon, Inje) FRACGP FAFOM FAFPHM)}

Dr. Kay Sauer PhD {Co Supervisor}

Raheema Abdul Raheem (12587171) {BHlthSc (Flinders University), MPH (Curtin University) PHD candidate (Curtin University)}

Telephone:+9607561187
Email: raheema.abdulraheem@.postgrad.curtin.edu.au

Name: ________________________________ Address: _____________________________

Your Date of Birth: _____________________ _____________________________

Baby's Date of Birth: ____________________ Phone: ___________________________

As you are pregnant or have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt **IN THE PAST 7 DAYS**, not just how you feel today.

Here is an example, already completed.
I have felt happy:

- ☐ Yes, all the time
- ☐ Yes, most of the time
- ☐ No, not very often
- ☐ No, not at all

This would mean: "I have felt happy most of the time" during the past week. Please complete the other questions in the same way.

1. I have been able to laugh and see the funny side of things
   - ☐ As much as I always could
   - ☐ Not quite so much now
   - ☐ Definitely not so much now
   - ☐ Not at all

2. I have looked forward with enjoyment to things
   - ☐ As much as I ever did
   - ☐ Rather less than I used to
   - ☐ Definitely less than I used to
   - ☐ Hardly at all

3. I have blamed myself unnecessarily when things went wrong
   - ☐ Yes, most of the time

6. Things have been getting on top of me
   - ☐ Yes, most of the time I haven't been able to cope at all
   - ☐ Yes, sometimes I haven't been coping as well as usual
   - ☐ No, most of the time I have coped quite well
   - ☐ No, I have been coping as well as ever

7. I have been so unhappy that I have had difficulty sleeping
   - ☐ Yes, most of the time
   - ☐ Yes, sometimes
   - ☐ Not very often
   - ☐ No, not at all

8. I have felt sad or miserable

- Yes, some of the time
- Not very often
- No, never

- Yes, most of the time
- Yes, quite often
- Not very often
- No, not at all

4. I have been anxious or worried for no good reason
- No, not at all
- Hardly ever
- Yes, sometimes
- Yes, very often

5. I have felt scared or panicky for no very good reason
- Yes, quite a lot
- Yes, sometimes
- No, not much
- No, not at all

9. I have been so unhappy that I have been crying
- Yes, most of the time
- Yes, quite often
- Only occasionally
- No, never

10. The thought of harming myself has occurred to me
- Yes, quite often
- Sometimes
- Hardly ever
- Never

For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion. The number '1' indicates strong disagreement, whereas '5' indicates strong agreement.

Strongly agree

Strongly disagree

a)	Honey should be the first food given to the infants when they are born	1	2	3	4	5
b)	Water should be given to new born babies with breastmilk in a hot country like Maldives	1	2	3	4	5
c)	Fruit juice should be given with breastmilk before six months	1	2	3	4	5
d)	Formula should be fed to all newborn infants until their mother's milk comes in.	1	2	3	4	5
e)	Infants do equally well regardless of whether they are breastfed or formula-fed	1	2	3	4	5
f)	The nutritional benefits of breastmilk last only until the baby is weaned from breastmilk	1	2	3	4	5
g)	Formula-feeding is more convenient than breastfeeding	1	2	3	4	5
h)	Breastfeeding increases mother-infant bonding	1	2	3	4	5
i)	Breastmilk is lacking in iron	1	2	3	4	5
j)	Formula-fed babies are more likely to be overfed than breastfed babies	1	2	3	4	5
k)	Formula-feeding is the better choice if the mother	1	2	3	4	5

	works outside the home					
l)	Mothers who formula-feed miss one of the great joys of motherhood	1	2	3	4	5
m)	Women should not breastfeed in public places such as restaurants	1	2	3	4	5
n)	Babies who are fed breastmilk are healthier than babies who are fed formula	1	2	3	4	5
o)	Breastfed babies are more likely to be overfed than formula-fed babies	1	2	3	4	5
p)	Fathers feel left out if a mother breastfeeds	1	2	3	4	5
q)	Breastmilk is the ideal food for babies	1	2	3	4	5
r)	Breastmilk is more easily digested than formula	1	2	3	4	5
s)	Formula is as healthy for an infant as breastmilk	1	2	3	4	5
t)	Breastfeeding is more convenient than formula-feeding	1	2	3	4	5
u)	Mothers who breastfeed should avoid taking any traditional medicines.	1	2	3	4	5
v)	Mothers who breastfeed should avoid taking any western medicines.	1	2	3	4	5
w)	Breastmilk is less expensive than formula	1	2	3	4	5
x)	Mothers who smoke should formula feed their babies	1	2	3	4	5
y)	I do not like breastfeeding.	1	2	3	4	5
z)	Breastfeeding will make my breast sag	1	2	3	4	5
aa)	The baby’s father can help with bottle-feeding	1	2	3	4	5
bb)	Breastfeeding is too embarrassing	1	2	3	4	5
cc)	Breast-feeding helps mothers regain their figures faster than formula feeding	1	2	3	4	5
dd)	I would be embarrassed if a mother breastfed her infant in front of me.	1	2	3	4	5
ee)	In general, I do not care to breastfeed in front of other people.	1	2	3	4	5
ff)	Mothers who breastfeed are likely to be more tired than mothers who bottle-feed	1	2	3	4	5
gg)	Mothers in Male’ generally bottle-feed their babies	1	2	3	4	5

Breastfeeding and Demographic Information

1. In the first few days a mother makes colostrum; this early secretion (watery) which comes in breastmilk is;

    i. Harmful to the baby
    ii. Important for the baby
    iii. Should be discarded
    iv. Do not know

2. The best time to introduce a breastfed infant to the formula is:
    i. Within 24 hours of birth
    ii. 3-4 weeks
    iii. 3 months
    iv. 4-6 months
    v. 1 year
    vi. Does not matter which time
    vii. Never

3. How are you going to feed your baby? Please give your reason(s) for your choice; you can give more than one answer. Number them from most important to the least important, with the most important reason starting from 1

    i. Bottle feed with infant formula:

        a) do not have breastmilk
        b) go back to work or study
        c) baby's father disapproves
        d) Breastfeeding is restrictive
        e) infant formula is better
        f) formula makes the child grow bigger
        g) want to continue smoking
        h) play a lot of sport
        i) my mother or mother-in-law suggested bottle feeding
        j) friends or relative suggested bottle-feeding
        k) health professionals (doctors, nurses) suggested bottle-feeding
        l) it is the way babies feed in Maldives
        m) Other ____________________________

    ii. Breastfeed:
        a) the baby's father wants me to breastfeed
        b) breastmilk is better for the baby
        c) Islam recommends breastfeeding
        d) breastfeeding is cheaper
        e) breastfed babies are more intelligent
        f) breastfeeding helps you lose weight
        g) my mother or mother-in-law advises me to breast feed
        h) other people advise me to breastfeed
        i) breastfeeding is more convenient
        j) breastfed infants have fewer infections
        k) breastfeeding is natural
        l) breastfeeding promotes mother-infant bonding
        m) many public places have rooms for mothers to breastfeeding
        n) other (please specify)__________________________________

4. Why do you think mothers stop breastfeeding before their baby is 6 months old: You can give more than one answer. Number them from most important to the least important, with the most important reason starting from1

    i. Mothers' do not have enough milk
    ii. Mothers go back to work or study
    iii. Baby's father disapproves
    iv. Infant formula is better
    v. Mothers want to continue smoking
    vi. Mothers play a lot of sport
    vii. Grandmother suggested bottle feeding
    viii. Friends or relative suggested bottle-feeding
    ix. Health workers (doctors, nurses) suggested bottle-feeding
    x. Mother finds breastfeeding too painful
    xi. Other (please specify)____

In this section we are interested in finding out about the baby's health and how you are feeding your baby.

What is the sex of the baby?

Male

Female

What was the type of birth delivery?

Vaginal

Caesarean

What was the birth weight of the baby (kg)?_____________________________________

What was the birth length of the baby (cm)?_____________________________________

How are you feeding your baby today?(choose only one)

Breastmilk only

Formula only – name?

Formula and breastmilk

Water

Cow's milk

Juice

Fruits (type)

Vegetables (type)

Rice

Wheat

Bottled food

Cow's milk only

Infant formula & cow's milk

Breast-feeding & cow's milk

Solids & breast-feeding with or without cow's milk

Infant formula with or without cow's milk

Other ________________________________

Weight of the baby in (kg) today_____________________________

Height of the baby (cm) _________________________

Weight of the mother (kg) _____________________

Number of diarrhoeal episodes the baby had since we last spoke (passing watery tools more than three times a day and each episode lasting for more than 2 days) ______________________

How many times has your baby been hospitalised due to an acute respiratory infection since we last spoke? ________________

Why did you decide to breastfeed? You can give more than one answer. Number them from most important to the least important

i. The baby's father wanted me to breastfeed
ii. Islam recommends breastfeeding
iii. Breastmilk is better for the baby
iv. Breastfeeding is cheaper
v. Breastfed babies are more intelligent
vi. Breastfeeding helps you lose weight
vii. My mother advised me to breast feed
viii. other people advised me to breastfeed
ix. breastfeeding is more convenient
x. breastfed infants have fewer infections
xi. breastfeeding is natural
xii. breastfeeding promotes mother-infant bonding

5. Why did you use bottle feeding? You can give more than one answer. Number them from most important to the least important
   i. did not have enough breastmilk
   ii. needed to go back to work or study
   iii. baby's father disapproved of breastfeeding
   iv. Breastfeeding is restrictive.
   v. infant formula is better
   vi. formula makes the baby grow big

vii. wanted to continue smoking
viii. I played a lot of sport
ix. my mother or mother-in-law suggested bottle feeding
x. friends or relative suggested bottle-feeding
xi. health professionals (doctors, nurses) suggested bottle-feeding
xii. other (please specify)________________________________

For how long did you breastfeed your baby?
(WEEKS)____________________________________

How long after the birth it was before you put your new baby to the breast?

Immediately after birth (< 1 hour)

Within 4 hours

4-24

The next day

Other (please specify) _____________________________

What was the first feed given to the baby? _________________________

What was the first solid food given to your baby?___________________________

How old was the baby when you first gave her/him water? ___________________________

How old was the baby when you first gave him/ her juice?
____

How old was your baby when you first gave your baby solid food?
____

What kind of methods did you use to help produce more milk?

None

Coconut milk

Traditional medicine

Nutritional food

Others (please specify) ________________________________

Has your baby received any of the following foods or drinks since his/her birth or since we last spoke? If yes, how old was he/she when he/she first received the food or drink?

	Yes	No	Age started (month)
Honey			
Infant formula/ cow’s milk			
Glucose water			
Pomegranate or any other fruit juice			
Ribena			
Fruits(type)			
Vegetable (type)			
Any kind of cereal			
Bottled food			
Mashed food with water			
Other food (please specify)			

Other questions about feeding your baby

When did you **first** decide how you were going to feed your last baby?

Before I became pregnant

Early in my pregnancy

Late in my pregnancy

During labour

After my baby was born

Where do you think a new born baby should sleep?

In the same bed with me

In the same room but not in the same bed with me

In another room

In general, do you think you had enough help and information about feeding your baby from hospital staff?

Yes

No

Before you had your baby, did you receive any of the following on how to feed your new baby?

Pamphlets or booklets on breastfeeding

i. lectures or classes on breastfeeding
ii. demonstrations on how to breastfeed
iii. video or TV show on how to breastfeed
iv. individual consultation or discussion
v. None
vi. Other____________________________

6. Did any of the following people support or encourage you with breastfeeding?
   i. The baby's father
   ii. Your mother
   iii. Your mother-in-law
   iv. Your doctor
   v. Nurse
   vi. Other ____________________________

7. Did your mother breastfeed any of her children?
   i. Yes
   ii. No
   iii. Do not know

8. Did the baby's father have any preference for how you fed your baby?
   i. Yes, he prefers bottle-feeding
   ii. Yes, he prefers breastfeeding
   iii. He does not mind how I feed our baby
   iv. Never really discussed the matter with him

9. Did your mother have any preference for how you fed your baby?
   i. Yes, she prefers bottle-feeding
   ii. Yes, she prefers breastfeeding
   iii. She does not mind how I feed my baby

iv. Never really discussed the matter with her

10. Before you became pregnant, did you smoke cigarettes?
    i. Yes
    ii. No (go to q36)

11. How many cigarettes did you smoke a day before you became pregnant? ______________________________

12. While you were pregnant, did you smoke cigarettes?
    i. Yes
    ii. No (go to q38)

13. How many cigarettes did you smoke a day when you were pregnant? ________________________

14. Did the baby's father smoke before you were pregnant?
    i. Yes
    ii. No

15. Did the baby's father smoke while you were pregnant?
    i. Yes
    ii. No

Demographic information

16. In which district do you live in? __________________________

17. What is your age (years)? _____________________________

18. What is the highest level of education you have completed?
    i. Primary school
    ii. Senior high school
    iii. Bachelor degree
    iv. Postgraduate diploma
    v. Masters
    vi. PHD
    vii. Other _________________________________

19. What is your marital status?
    i. Never married
    ii. Married
    iii. Divorced
    iv. Separated
    v. Widowed

20. Stressful life events ____

21. What is the number of children you have? ____________________________

22. Do you live in;
    i) A rented place? (rent amount)_______________________________
    ii) Your own place?

23. Do you live in
    i) A nuclear family?

ii) An extended family?

24. No of people living in your apartment____________
25. No of people living in your room _______________
26. Do you get any help in doing housework and looking after your child/ children
    i) Yes (do to q50)
    ii) No

27. People who help to look after your child/ children include;
    iii) Child's / children's father
    iv) Child's / children's grandmother (mother's side)
    v) Child's / children's grandmother (father's side)
    vi) Another member of the family (which member)______________________
    vii) Baby sitter
    viii) Maid
    ix) Child care services
    x) Others__________________________

28. What is your occupation? __________________________

29. What is your partner's occupation? _____________________________

30. Approximately, what was your total family income in Maldivian Rufiyaa for the past 12 months?
    i. Less than MRF 25,000
    ii. 25,001- 35,000
    iii. 35,001- 60,000
    iv. 60,001- 90,000
    v. 90,001- 120,000
    vi. 120,000- 150,000
    vii. 150, 000- 180,000
    viii. 180, 000- 250,000
    ix. 250,000- 300,000
    x. 300,000- 350,000
    xi. More than MRF 350, 000

Thank you