School of Public Health

Breastfeeding in Western Saudi Arabia:
A prospective cohort study

Daifellah A M Al Juaid

This thesis is presented for the Degree of

Doctor of Philosophy

of

Curtin University

May 2016

Declaration

This research work was undertaken solely by the researcher, and is original. The work of literature review, study design, data collection, ethics clearance, data analysis and writing the thesis was under the supervision of Professor Colin W. Binns.

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: ……09..May..2016…...

Acknowledgements

I will be forever thankful to my supervisor, Professor Colin W. Binns of Curtin University for his unlimited support, encouragement and advice during accomplishment of this project. His expertise and support have inspired me to complete the entire research confidently. This thesis reflects the collaborative research environment that exists in the School of Public Health, Curtin University.

I am sincerely grateful to my co-supervisor, Dr. Roslyn Giglia, for her advice, dedication and persistent support throughout the study. I would also like to thank Dr. Yun Zhao, the chairperson of my thesis committee for her previous and ongoing support. Finally, I would like to thank my wife, family and friends for their support and inspiration.

Abstract

Background: Breastfeeding is the best method of infant feeding for optimal growth and short term and life-long health. Therefore, undertaking studies to document and monitor breastfeeding practices are among the most important health research priorities. While research on infant feeding has been undertaken in both developed and developing countries, there is a need for continuing research as social and economic conditions change and improved methodologies are developed. Research on breastfeeding in Saudi Arabia has been usually based on cross-sectional designs which have many limitations and the outcomes have been inconsistent. There have been no published cohort studies of breastfeeding in Saudi Arabia. As the economy continues to expand in this country, there appears to have been a decline in breastfeeding practices and duration. Thus, it is necessary to carry out cohort studies to document the current rates and to examine causes behind such a decrease.

Objectives: The present study aims to document current prevalence rates (initiation and duration) and difficulties of breastfeeding; to analyse its associations with risk factors and maternal chronic illnesses (obesity, type 2 diabetes and postpartum depression); to explore effects of maternal attitudes towards breastfeeding on actual practices and to compare breastfeeding indicators in two cities of Western Saudi Arabia (Taif and Jeddah).

Methods: A prospective cohort study was conducted in Western Saudi Arabia in two of the major three cities: Taif and Jeddah. A consecutive sample of 600 mothers who delivered full-term healthy single babies in two maternity hospitals between December 2013 and January 2014 were invited to participate in the study. Subjects who agreed to participate completed a baseline questionnaire to collect data on socio-demographic variables and initial feeding practices, and were then followed up until the infants were six months old. During follow up, participants were contacted by telephone at 6, 16 and 26 weeks postpartum to collect information on ongoing breastfeeding practices and maternal health status. Data collection instruments and tools were validated and had been used in other studies in the Middle East region. Data was coded and entered into computer for analysis. Appropriate statistical procedures (t-test, Chi-square, logistic regression analysis and Kaplan Meier survival analysis) were used to present objective-related results. The research project was approved by ethics committees at Curtin University and the Saudi health authorities.

Results: A total of 578 of mothers participated in the study (response rate 96.3%). Breastfeeding was initiated by 36.1% within one hour of delivery, and the majority of infants

(76.5%) received breastmilk within the first 24 hours. The rate of 'any breastfeeding' was almost 80% of mothers at discharge, but decreased to 46.6% at six months of age. 'Exclusive breastfeeding' was practiced by 48.6% of mothers at discharge and by only 7.7% at 26 weeks postpartum. The median duration of 'any breastfeeding' was 18 weeks (about four months), which is low compared to other nearby countries. Most mothers (71.3%) introduced some infant formula before six weeks of age and solids were introduced later (at 17 weeks). The high rate of positive attitudes toward breastfeeding was not reflected in actual practices. Obesity and postpartum depression were prevalent at 27% and 16% of the sample, respectively, and these factors had negative associations with breastfeeding.

Mothers with middle education (diploma or high school) and those with a higher depression score were less likely to initiate breastfeeding early (adjusted odds ratio [aOR]=0.51 and 0.49, 95%CI = (0.32-0.82) and (0.30-0.80), respectively). Obese mothers and those of high socio-economic status were more likely to breastfeed for a shorter period (aOR=2.79 and 4.56), 95%CI = (1.41-5.56) and (1.89-10.97), respectively). Primi-parity, young maternal age, previous child feeding method, lack of antenatal education, prelacteal feeds, exposure to advertisement of and early introduction of infant formula were associated with late initiation, shorter duration and early cessation of breastfeeding. "Insufficient breastmilk" and "sore or painful nipples" were the most common breastfeeding difficulties whereas mastitis was less prevalent (1.2%). Overall, mothers from Taif City had better infant feeding practices, but had higher prevalence of obesity, type 2 diabetes and postpartum depression.

Conclusion: The prevalence of 'exclusive and any breastfeeding' decreased as the infant's age increased. The rate of early initiation was very low, and average duration of 'any breastfeeding' is decreasing over time. Maternal obesity and postpartum depression had negative associations with breastfeeding outcomes. Although the effect of maternal type 2 diabetes on breastfeeding was not clear, it may have the same adverse effect as obesity. Maternal attitudes toward breastfeeding were not consistent with actual practices, and thus had little effect on breastfeeding indicators. Mothers of younger ages, those who are primiparous or of higher socio-economic status are less likely to initiate and maintain breastfeeding. Future research should consider these factors when investigating breastfeeding practices. Findings from this study and other studies may inform breastfeeding promotional programs implemented in this population by health professionals and authorities.

Table of Contents

List of Tables

List of Figures

Abbreviations

aHR:	Adjusted hazard ratio
aOR:	Adjusted odds ratio
AU$:	Australian dollars
BFHI:	Baby Friendly Hospital Initiative
BMI:	Body mass index
CDSI:	Central Department of Statistics and Information in Saudi Arabia
CI:	Confidence interval
DHA:	Docosahexaenoic acid
DM:	Diabetes mellitus
EMRO:	Eastern Mediterranean Regional Office of WHO
EPDS:	Edinburgh Postnatal Depression Scale
GDM:	Gestational diabetes mellitus
GDP:	gross domestic product
HR:	Hazard ratio
HREC:	Human Research Ethics Committee, Curtin University
IDF:	International Diabetes Federation
IIFAS:	Iowa Infant Feeding Attitudinal Scale
IQ:	Intelligence quotient
IQR:	Interquartile range
KSA:	the Kingdom of Saudi Arabia
MENA:	Middle East and North Africa
MOH:	Ministry of Health in Saudi Arabia

NHMRC:	National Health and Medical Research Council of Australia
OC:	Oral contraceptive
OR:	Odds ratio
ORS:	Oral rehydration solution
PHC:	Primary healthcare centre
UNFPA:	United Nations Populations Fund
UNICEF:	United Nations Children's Fund
US$:	United States dollars
USA:	the United States of America
WHO:	World Health Organisation

Chapter 1

1.0 Introduction

1.1 Overview

This chapter briefly introduces the study, presents its significance and objectives and defines some important concepts.

1.2 Importance of breastfeeding

Among all suggested methods of infant feeding, breastfeeding has been shown to be the optimal and the most effective in promoting health (Binns and Graham 2005, James and Lessen 2009). In their recent review of 22 systematic reviews and meta-analyses, Victora et al. (2016) project that increasing breastfeeding rates to the international level would prevent 823000 deaths of children under five years and 20000 maternal deaths annually. There are many reasons for this benefit (Chantry, Howard, and Auinger 2006, Dòrea 2009, Victora et al. 2016). Breastfeeding has benefits for the mother, environment, economy and society as a whole (Ip et al. 2007, Li, Fein, and Grummer-Strawn 2010, Orshan 2008, Rollins et al. 2016). Many professional health organisations, including the United Nations Children's fund (UNICEF) and the World Health Organisation (WHO), have strongly endorsed practicing breastfeeding exclusively for the first six months of life (WHO 2011, WHO and UNICEF 2007). Then, it is recommended that breastfeeding should proceed up until two years as well as beyond, alongside with appropriate, nutritionally adequate supplemental foods (James and Lessen 2009, WHO and UNICEF 2007).

Breastfeeding is the main, most important source of all nutrients required during infancy period (WHO 2009). If the infant is exclusively breastfed for the first six months and also receives the proper complementary nutrition, and then breastfeeding continues thereafter up to two years or beyond, this will promote optimal growth, development and well health for the rest of life (WHO and UNICEF 2007). The anti- infective, immunising properties of breastmilk may protect infants against infectious illnesses when their immune systems are immature and not well-developed (Goldman 2007). In addition, a variety of chronic illnesses including diabetes, cardiovascular diseases, obesity, as well as intellectual impairment may be prevented through adoption of breastfeeding practices (Allen and Hector 2005). Other benefits of breastfeeding for infants include allergy prevention, eyesight and speech development (National Health and Medical Research Council of Australia [NHMRC] 2012).

In terms of maternal health, breastfeeding is useful in delaying the next pregnancy after childbirth, and thus reducing maternal fertility and helping in family planning (Labbok 2001). Also, breastfeeding can be protective against breast and ovarian cancers, rheumatoid arthritis, osteoporosis and maternal depression (Allen and Hector 2005, Labbok 2001, Victora et al. 2016). In weight control, lactation can play a role as it helps to metabolise 500-640 calories per day (Allen and Hector 2005).

Although there is limited research regarding the costs and economic benefits of breastfeeding, the illnesses which breastfeeding prevents are considered major health issues in Australia and worldwide (Allen and Hector 2005). These diseases contribute considerably to the health burden on the society. Breastfeeding infants means fewer ill cases, and thereby less expenditure on child and mother health (NHMRC 2012). Furthermore, the impact on the

environment and natural resources attributable to breastfeeding is far lower than any other feeding method since breastfeeding saves food resources, fuel, raw materials and energy (Smith and Ingham 2001). A novel study estimated the economic benefits of breastfeeding to be AU$3 billion per year in Australia (Smith 2013).

1.3 Study location

The Kingdom of Saudi Arabia (KSA) is a country within the region of the Middle East, and has a population of about 31 million, of whom, just over 20 million are Saudi Arabian citizens (Central Department of Statistics and Information in the KSA [CDSI] 2014). The KSA constitutes approximately four fifths of the entire Arabian peninsula, and spans around two million square kilometres (CDSI 2014). The population density was estimated in 2013 as 15 persons/square kilometre whilst the growth rate is estimated as 2.9% per annum (CDSI 2014).

The Kingdom of Saudi Arabia has achieved rapid development in education and literacy for both males and females. According the United Nations Educational, Scientific and Cultural Organization (UNESCO), the youth (15-24 years old) literacy rate is 99.35% while the female youth literacy rate is 99.31% (UNESCO, 2016). The total adult (15 years and above) literacy rate has improved from 70.82% in 1992 to reach 94.84% in 2015(UNESCO, 2016). In 2015, more than 1.3 million students (52% female) were enrolled in bachelor degrees in 32 universities, five of these institutions are in Makkah region (Ministry of Education in Saudi Arabia 2016).

The cultural and religious settings of Saudi Arabia are Arab and Islam, and society itself is in general deeply religious, conservative, traditional, and family oriented (Lacey 2011). However, its culture has also been affected by rapid changes, as the country was transformed from an impoverished nomadic society into a rich oil producer in just a few years in the 1970s (Lacey 2011).

The gross domestic product (GDP) per capita in 2013 was reported as US$24,454 annually; indicating a high level of wealth for the Saudi people (CDSI 2014). The Ministry of Health in the KSA (MOH) stated that the KSA puts in over 6% of its national income into health, spending approximately US$345 on health annually per person (MOH 2014). The crude birth rate in the KSA was 23.3 per 1000 population in 2013 and the rate for infant mortality was 16.9 per 1000 Saudi live births in the same year (MOH 2014).

The western province of Saudi Arabia (Makkah region) is inhabited by 25.5% of the whole population and is concentrated in three major cities: Jeddah, Makkah and Taif (CDSI 2014). Jeddah is a major city on the Red Sea, with a population of 3,734,000 and is characterised by a modern, urban culture (CDSI 2014). It has a rapid rate of developmental growth as many people have been moving to the city for a better standard of living. Taif, by contrast, is a medium-sized city, lying on high mountains of 1000 metres above the sea level at a distance of about 200 kilometres east of Jeddah (CDSI 2014). It is inhabited by around 1,100,000 people and has a rural, more conservative culture (CDSI 2014). Figure 1.1 below shows the map of the Kingdom of Saudi Arabia; with its provinces being bordered and coloured (Saudi Geographic Survey 2015). Makkah Province appears in the western region of the country in dark green colour, with its major cities: Makkah, Jeddah and Taif (Figure 1.1).

Figure 1.1: Map of the Kingdom of Saudi Arabia, along with provinces identified. Source: (Saudi Geographic Survey 2015)

Asides from a chain of mountains that expands out parallel to the Red Sea with progressively declining altitudes as the mountain range moves northwards, the landscape of KSA is primarily characterised by arid desert (Saudi Geographic Survey 2015).

Similarly, except for colder conditions that mark the southern highlands, the KSA experiences periods of intense heat in most parts. The intense heat is the result of the KSA being located quite close to the equator. During July 2014, some Saudi cities recorded maximum temperatures of 50 degrees, (Presidency of Meteorology and Environmental Protection in the KSA 2015).

Climate in the western region (Makkah Province) of Saudi Arabia is not different from the rest of the KSA. Jeddah and Makkah cities are characterised by very hot, humid weather in summer season (June to September) while they have moderate, slightly warm weather in winter (Presidency of Meteorology and Environmental Protection in the KSA 2015). As situated on high lands, Taif City has a cold and dry climate during winter; moderate one in summer (Presidency of Meteorology and Environmental Protection in the KSA 2015).

1.4 Study design

This study is designed as a cohort study whereby the researcher followed subjects from birth up to six months. At selected time points during this period, information such as infant feeding practices and patterns, socio-demographic characteristics, type 2 diabetes status, maternal obesity, postnatal depression, breastfeeding initiation, duration and intensity, and attitudes towards breastfeeding were collected. Specifically, data was collected four times: in hospital, at 6, 16, and 26 weeks after birth. In hospital, the female research team contacted eligible mothers personally to obtain informed consent and if they agreed to participate they completed a baseline questionnaire. After discharge, mothers have been followed up by telephone interview, or when needed when visiting primary health care centres to undertake periodic vaccinations. Data on type 2 diabetes was generally available from the patients' records at the hospitals, and patients' agreement to obtain this data was included in the consent form. Questions on pre-pregnancy maternal weight, height and type 2 diabetes status were included in the baseline questionnaire. Mothers' weight and height at six months after birth were measured by research personnel at primary health care centres during vaccination visits. The collected data has been entered to the computer for processing and analysis.

1.5 Aim and objectives

1.5.1 Aim

The aim of this study is to document how infant feeding is practiced in the KSA's western region, and to analyse associations with demographic factors and maternal chronic illnesses, such as type 2 diabetes, obesity and postpartum depression.

1.5.2 Objectives

1- To document the current rates of initiation and breastfeeding duration in Western Saudi Arabia.

2- To identify risk factors connected to infant feeding practices in this population.

3- To assess any associations between maternal obesity, postpartum depression, and type 2 diabetes, and outcomes of breastfeeding practices (initiation and duration) in this region.

4- To investigate the impact of mothers' attitudes in influencing which approach they will choose in regards to infant feeding.

5- To compare breastfeeding practices between two cities in Western Saudi Arabia: Taif and Jeddah.

6- To document the rates of maternal difficulties with infant feeding, including the incidence of mastitis.

1.6 Significance of the study

The present study represents the first cohort in the KSA which aims to investigate infant feeding outcomes using prospective follow-up data. While previous studies (mainly cross sectional in nature) on breastfeeding in Saudi Arabia have examined a variety of factors and conditions that may affect infant feeding methods, other important factors that largely exist in the Saudi female society such as diabetes, obesity and postpartum depression are being examined for the first time. Also, valid, reliable measurement tools like the Iowa Infant Feeding Attitude Scale (IIFAS) and the Edinburgh Postnatal Depression Scale (EPDS) were innovative instruments used by this research project (Cox, Holden, and Sagovsky 1987, De La Mora et al. 1999).

Previous studies were marked by poor sample selections and study designs, and this is reflected in the discrepancies between the breastfeeding rates reported, particularly in the 'exclusive breastfeeding' category, which showed great variation. Hence, it was important that breastfeeding practices and patterns are to be re-examined in the KSA using better research tools. The cohort study design is preferred as it is more suited for the analysis of follow-up data, presenting more valid and reliable results. It is hoped that this study will provide an appropriate model for other researchers in the KSA. The data on breastfeeding will contribute to the health policy of Western Saudi Arabia and to the design of a regional strategy for promotion, surveillance and recording of breastfeeding rates.

1.7 Definitions

'Any breastfeeding': 'Any breastfeeding' means providing breastmilk (including expressed and wet nurses' milk), plus anything else: liquids including animal milk and artificial formulas and/or foods (World Health Organisation [WHO] 2008).

Body mass index (BMI): is an indicator of weight-for-height used to measure overweight and obesity in adults, and is calculated as an individual's weight in kilograms divided by the square of their height in meters (kg/squared metres). Its categories are: (BMI<25 normal, 25≤BMI<30 overweight, and BMI≥30 obese (World Health Organisation [WHO] 2015a).

Bottle-feeding: Bottle-feeding means that the infant will receive any liquids (including breastmilk) or any semi-solid foods that come from a bottle that has a teat or nipple, and permits the infant to have any other things like any liquid or food including formula and non-human milk (WHO 2008).

Breastfeeding cessation: a complete stop of breastfeeding.

Early breastfeeding initiation: proportion of mothers who put their infants on breasts within one hour of birth (WHO 2008).

Edinburgh Postnatal Depression Scale (EPDS): This scale consists of ten-items, all self-reported. It has been constructed so that women can be screened for signs of emotional distress both during and post pregnancy (Cox, Holden, and Sagovsky 1987).

‘Exclusive breastfeeding’: In ‘exclusive breastfeeding’, the infant is required to receive breastmilk (including milk expressed or from a wet nurse); the infant is allowed to receive oral rehydration solution (ORS), drops, syrups (vitamins, minerals, medicines); but nothing else (WHO 2008).

Full breastfeeding: Full breastfeeding necessitates that the infant receives breastmilk (including any expressed from a wet-nurse) as the primary nourishment source, permitting infants to receive certain liquids (water-based drinks, water, fruit juice), ritual fluids and ORS, syrups or drops (medicines, minerals, vitamins) (WHO 2008).

IOWA scale: The Iowa Infant Feeding Attitude Scale, which is also often shortened simply to ‘the Iowa scale’ is a validated tool, utilising a Likert scale with a set of 17 items, which was developed in the 1990s at the Iowa State University as a method to measure mothers' and fathers' attitudes in regards to feeding practices for infants (De La Mora et al. 1999).

Time point of measurement: The time point of measurements denotes one of the four time points in which the data was repeatedly collected throughout the course of the study. These time points are: at birth, 6, 16, and 26 weeks after birth.

Chapter 2

2.0 Literature review

2.1 Overview

In this chapter, the literature on breastfeeding including its benefits for mothers, infants, the environment, and the whole society will be reviewed. In accordance with the study objectives, the chapter also documents published papers on Saudi Arabian infant feeding practices and highlights the most notable changes in breastfeeding outcomes over the last three decades. Risk factors (including maternal diseases such as obesity, type 2 diabetes and postpartum depression) that may be associated with breastfeeding and infant feeding practices are discussed. In addition, the literature review includes the role of maternal attitudes in determining the method of infant feeding. Breastfeeding practices, specifically in Taif and Jeddah Cities, will be compared. The chapter concludes with reviews of the literature on the underlying causes of breastfeeding cessation and breastfeeding difficulties.

2.2 Advantages of breastfeeding

2.2.1 Introduction

Both infants and mothers gain many short and long term benefits from breastfeeding. Breastfeeding is the easiest and most inexpensive way for the mother to feed and take care of her infant. Based on a review of 86 primary research studies and 29 systematic reviews and meta-analyses that include nearly 400 studies, breastfeeding has been found to be protective for infants and mothers against many diseases (Ip et al. 2007). Furthermore, according to Walker (2010), breastmilk is the best nutritional source for neonates, offering immunologic benefits in addition to the nutritional benefits which are not provided by breastmilk substitutes (artificial formulas). The composition of breastmilk includes ‘disease-fighting’

antibodies and other vital immune properties (Van de Perre 2003). The resultant beneficial effect on the growth and development of the infant, as well as the reduction of infant morbidity and mortality is widely acknowledged in literature (Oddy 2001, Victora et al. 2016). Also, the benefits of breastfeeding extend to be useful and protective for the mother as well (Fairbank et al. 2001, Victora et al. 2016). Breastfeeding has been found to be economical and reduces post-delivery stress and depression among nursing mothers through the production of hormones that have been found to reduce these conditions (Groer, Davis, and Hemphill 2002, Kendall-Tackett 2007).

Breastfeeding provides multifaceted protection for mothers against many diseases. It provides some contraception benefits during the first six months as it delays resumption of menstruation periods (Queenan 2004). Breastfeeding also reduces risk of some maternal diseases including cancers, reduces rates of asthma, respiratory disease, and the risk of type 2 diabetes (Labbok 2001, Schack-Nielsen, Larnkjær, and Michaelsen 2005). It also has emotional benefits as the interaction brings the mother closer to her infant. It was found that breastfeeding reduces the mother's obesity due to the adipose tissue, which usually accumulates during pregnancy, being utilised (Labbok 2001). Furthermore, gains that are made by breastfeeding extend both unto the environment and the wider society as a whole. It provides numerous economic benefits to the family by saving on the cost of artificial (infant) formulas, and to governments by enhancing children's health and reducing expenditure on health care (Hausman 2003). Breastfeeding also does not require the consumption of natural resources unlike the production of breastmilk substitutes (Li, Fein, and Grummer-Strawn 2010).

Based on reviews of the scientific evidence, multiple recognised health consulting bodies, including the World Health Organisation (WHO), United Nations Children's Fund (UNICEF), National Health and Medical Research Council of Australia (NHMRC) as well as the American Dietetic Association have recommended that infants be exclusively breastfed by mothers who do not have any medical issues, in the first six month's following an infant's birth, with continuing breastfeeding along with complementary foods after six months of age up until two years or more (James and Lessen 2009, UNICEF 2014, WHO 2011, NHMRC 2012). Therefore, standard definitions of breastfeeding indicators to document and monitor breastfeeding practices around the world have been established, as well as a global strategy to promote, support and protect the ideal feeding styles of newborns and young children (Binns et al. 2009, WHO 2009, WHO and UNICEF 2007). Breastfeeding is the best option to feed an infant because of the number of benefits it provides to the mother, the infant, the environment, as well as the whole society.

2.2.2 Benefits for the infant

It is widely recognised that breastfeeding offers numerous health advantages over breastmilk substitutes. The advantages for the infant include protection against infectious diseases, nutritional superiority, less obesity, and less allergic diseases (Picciano 2001, Binns, Lee, and Low 2016, Victora et al. 2016). With reference to nutritional superiority, human milk has a balance of nutrients that changes over time depending on the development and growth requirements of the infant; a quality that is hardly available in milk from other sources (Nascimento and Issler 2003, Picciano 2001). Ballard and Morrow (2013) explained that human milk contains thousands of biochemical and cellular constituents-proteins, carbohydrates, vitamins, fats, minerals, growth hormones and factors, trace metals, antibodies and white blood cells in ideal proportions to one another. The biochemical balance of these

nutrient components and ingredients in human milk is virtually impossible to be artificially duplicated. A comparison of human milk with milk from cows demonstrates that breastmilk has relatively less total protein, making it more easily digestible and not as stressful on the infant's immature kidneys (Saarinen et al. 2002). Recent research also highlights the importance of lower protein levels in reducing obesity (Koletzko et al. 2009). Lönnerdal (2003) concluded that lipids present in human milk enhance efficient digestion as well as utilisation of nutrients. The composition of human milk represents the necessary nutrients which play multiple vital roles in promoting the health as well as development of infants.

Human milk contains immune-proteins and proteins to provide amino acids for growth. The fats in the milk are the major source of energy for the infants and are important to the developing nervous system(Picciano 2001). Breastmilk contains lipase which is a fat-digesting enzyme that assists in digestion of fats by infants and has a role in its anti-microbiological activity (Landberg et al. 2000). Unsaturated and poly-unsaturated fatty acids are also found in human milk, particularly docosahexaenoic acid (DHA), an imperative omega-3 fatty acid (Marszalek and Lodish 2005). DHA is essential in proper eye and brain development and may not be present in milk substitutes and formulas (Aliyu, Alio, and Salihu 2010). Lactose is the predominant carbohydrate in milk (Bode 2006). It promotes absorption of minerals such as calcium, in addition to providing calories. Lactose also encourages growth of intestinal bacteria that are harmless and which create an acidic environment that helps in protecting against the proliferation of diarrhoea-causing bacteria among infants (Bode 2006, Lönnerdal 2003).

Breastfeeding has also been found to reduce rates of obesity among infants. According to scientific evidence, infants who are breastfed tend to put on lower amounts of weight as well as be less heavy at the age of one when compared to babies who have been fed by formula, even as normal healthy activity levels as well as development is maintained (Dewey 1998). During infancy, this pattern may affect the later patterns of growth of the infant; leading to lower obese as well as overweight individuals amongst children who are breastfed. In accordance with one study, bottle-fed infants have higher chances of feeding more in later infancy stages than those who were breastfed (Li, Fein, and Grummer-Strawn 2010). This is attributed to the fact that during bottle feeding, parents urge the infant to finish the contents even when it is not necessary while during breastfeeding, infants naturally develop a self-regulation mechanism with regard to milk intake. Studies also show that formula-fed infants have six times more chances of becoming obese at three years of age as compared to those who are breastfed in addition to being given solid foods (Armstrong and Reilly 2002, Binns, Lee, and Low 2016). The mechanism of risk reduction of childhood obesity by breastfeeding has been explored by Koletzko et al. (2009). Indeed, breastfeeding could reduce obesity rates among infants and young children.

Research findings demonstrate that breastfeeding is associated with developing an effective immune system. Breastfed infants have been found to have high immunity which is mainly attributed to the antibodies found in colostrum milk created for new-borns (Dòrea 2009). Colostrum, the yellowish and thin milk excreted in the first days after delivery, contains proteins, minerals and antibodies that sustain the infant's health and consolidate immunity with a surge of antibodies; protecting the infant from first time exposure to many pathogens (Guxens et al. 2011, Wheeler et al. 2007). Breastfed infants have shown to produce better immune responses to tetanus, Haemophilus influenza, diphtheria, and polio immunisations, as

well as to respiratory syncytial infection which is a common viral respiratory infection among infants (Jackson and Nazar 2006). Human milk has bioactive and anti-inflammatory factors as well as other factors that help in regulating the immune system's response against infection (Labbok, Clark, and Goldman 2004, Oddy 2001). Evidence also demonstrates that breastfeeding leads to earlier immune system development for the infant (Jackson and Nazar 2006).

Breastmilk has many anti-infective factors, contributing to infant protection from several diseases and conditions. These include lactoferrin, a substance that inhibits pathogenic intestinal bacteria from growing, probably by sequestrating iron and immunoglobulin A which provides protection from microorganisms, and lipase which is bile-stimulated and offers protection against infections caused by organisms that are amoebic (Leung et al. 2006). Leung et al. (2006) showed that infection protection is most tenacious in the first few months for an infant who is exclusively breastfed. Studies indicated that these benefits continue even after cessation of breastfeeding (Cattaneo 2008, Schack-Nielsen, Larnkjær, and Michaelsen 2005). Jackson and Nazar (2006) suggested that infants who are breastfed for longer periods may develop an even stronger protective system. Children who are exclusively breastfed have also been found to develop fewer illnesses than those who are bottle-fed (Oddy 2001).

Evidence in the literature has shown that breastfeeding decreases the prevalence of a variety of infectious diseases among infants. A pooled analysis of six studies including 1223 subjects concluded that babies who are not breastfed have higher risk of infectious diseases than breastfed ones (pooled odds ratios [OR] = 5·8, 95% confidence interval [CI] = 3·4 - 9·8) (World Health Organisation [WHO] 2000). Several studies revealed that breastfeeding is

protective against otitis media, bacteraemia, diarrhoea, and urinary tract infection, among others (Labbok, Clark, and Goldman 2004, Oddy 2001, Walker 2010). According to Leung et al. (2006), these benefits are attributed to maternal macrophages as well as immunoglobulin A antibodies which protect the infant. It has been established that breastfeeding significantly reduces infant mortality rates in developed and under-developed countries. One study noted that 'exclusive breastfeeding' is associated with less morbidity and mortality from infectious diseases (Bai et al., 2009). Chen and Rogan (2004) found that it reduced mortality rate by 21% in the United States of America (USA). Bai et al. (2009) concluded that the termination of breastfeeding before two months increased prevalence of urinary tract infection particularly among female neonates than its termination after six months. Breastfeeding has been found to increase vaccine response among infants. Antibody levels of infants who underwent immunisation are significantly higher in breastfed infants than those who were formula-fed (Labbok, Clark, and Goldman 2004). Therefore, breastfeeding promotes the immunological function among infants.

Breastfeeding also provides protection against numerous chronic illnesses in addition to the infectious diseases. A systematic review of 60 studies published between 2007 and 2012 revealed substantial evidence that breastfeeding provides long-term benefits regarding total cholesterol, blood pressure, type 2 diabetes, obesity and overweight (Horta, Victora, and World Health Organisation [WHO] 2013). It reduces the likelihood of the development of type 1 and type 2 diabetes (Owen et al. 2006, Sadauskaitė-Kuehne et al. 2004). This might be attributed to the fact that it reduces weight gain among infants (Singhal and Lanigan 2007). Owen et al. (2006) postulated the early introduction of solid foods and the cow-milk increases the likelihood of developing future type 2 diabetes through effects on the child's weight. In the review by Binns et al. (2009), breastfeeding was found to reduce the risk of

childhood diseases including celiac disease, lymphoma, inflammatory bowel disease, leukaemia, and Hodgkin disease. Hence, breastfeeding protects the infant from both communicable and non-communicable diseases in both childhood and adulthood.

Another breastfeeding benefit is the protection it provides from developing allergies, in particular atopy, although this has become more controversial in recent years. Greer, Sicherer, and Burks (2008) demonstrated that it is possible to prevent or delay atopic dermatitis (eczema), wheeze and cow diary allergy by breastfeeding for at least four months. The authors however illustrated that there was a lack of sufficient proof that breastfeeding offered protective effects against atopic diseases beyond four to six months. Whilst breastfeeding duration is insignificant in this context, the age at which foods other than breastmilk are introduced is very critical. In KSA, a large (n=622) cross-sectional study posted that for mothers who fully breastfed their infants for longer durations, there was less likelihood of them reporting that their children had ever wheezed, had asthma, or wheezed over the last 12 months (Al-Makoshi et al. 2013). Allergic rhinitis can also be reduced if the infant is exclusively breastfed for the first three months for families that have atopy in their history (Bloch et al. 2002). A recent review also found that breastfeeding reduced development of asthma among infants (Dogaru et al. 2014). Chantry, Howard, and Auinger (2006) established that discontinuing ‘exclusive breastfeeding’ between four and six months increased chances of developing pneumonia as compared to continuing breastfeeding exclusively up until six months.

Breastfeeding carries many benefits for mental as well as physical development of the infant. Some studies were conducted to establish the influence of breastfeeding on the infant’s

cognitive development. According to the findings, there exists a significant and positive correlation between cognitive development and breastfeeding duration among children between one and two years (Foroushani et al. 2010). According to Hamosh and Salem (1998), breastmilk comprises of long-chains of poly-unsaturated fatty acids that are essential for development and growth of the infant's brain. Observational studies regarding cognitive and neurological results have enticed researchers to hypothesise that the visual acuity and early cognitive functioning of breastfed children is greater than in children who were not breastfed (Jensen 1999). However, Jacobson, Chiodo, and Jacobson (1999) argue that this hypothesis is yet to be conclusively proven.

It has been shown that breastfeeding could promote cognitive development in breastfed children. Several studies assessed the relationship between breastfeeding and intelligence quotient. Most implied that children who had been breastfed for six months tend to have higher intelligence quotients when compared to children who had never been breastfed, or to children who had been breastfed for periods of less than four months (Horwood, Darlow, and Mogridge 2001, Isaacs et al. 2010). The systematic review by (Horta, Victora, and World Health Organisation [WHO] 2013) concluded that breastfeeding contributes to an increase of 3.5 points in normalised tests of intelligence quotient (IQ). These findings support the earlier argument that breastmilk has long-term benefits with regard to the cognitive development of the child. A large randomised trial of 13889 infants who were followed up until 6.5 years gave conclusive proof regarding the positive effects of breastfeeding on the children's intellectual growth (Kramer et al. 2008). At a population level, these modest increases in IQ could be important in the information age.

Many long-term health benefits are also shown to come from breastfeeding. For example, breastfeeding has been posited as being able to lower the likelihood of sudden infant death syndrome by 50% among infants (Chen and Rogan 2004). By reducing obesity among children due to its low cholesterol as well as protein levels, it is argued that breastfeeding decreases the risk of developing cardiovascular disease in their adulthood (Leeson et al. 2001). Leeson et al. (2001) also showed that there is a likelihood that breastfeeding lowers chances of developing high blood pressure later in life. Furthermore, Mead (2008) suggested that breastmilk decreases the risk of developing cancers despite the fact that it might be susceptible to some environmental pollutants. However, Mead's study did not establish whether breastfeeding provides life-long protection or whether it only delays symptoms of the disease.

2.2.3 Benefits for the mother

There are a number of benefits that a mother derives from breastfeeding although the society tends to overlook or is unaware about them. Steinkraus and Waldor (2007) observed that the benefits range from the oxytocin effects on the uterus to the associated warm emotional gains to the mother. The authors stated that during breastfeeding, there is a continuous release of the breastmilk-stimulating hormone, prolactin, which provides calmness and relaxation to the mother, thus relieving her of stress. They also pointed out that breastfeeding mothers take a longer time before experiencing their menstrual cycle, lactation amenorrhea and this may have the dual benefits of conserving iron and increasing birth spacing. Increased spacing of the childbearing enhances the survival of every child that is born (Steinkraus and Waldor 2007).

Breastfeeding is not protective only for infants against many illnesses, but also against maternity-associated diseases and conditions. It is associated with reduced rates of breast, ovarian and uterine cancers in the breastfeeding mothers (Orshan 2008). According to Steinkraus and Waldor (2007), the risk of exposure to premenopausal breast cancer is lower by 25% in women who breastfeed up to two years. The effect was time-related, with risk reduction proportional to breastfeeding duration. When children are breastfed for a duration of more than 24 months, this could reduce the risk of a mother having rheumatoid arthritis by close to 50% (Orshan 2008). Numerous studies illustrated that non-breastfeeding mothers have the susceptibility to reproductive cancer (McLaughlin et al. 2007). This may have been attributed to recurring ovulatory cycles and the continuous exposure to elevated estrogen levels associated with not breastfeeding. Compared to breastfeeding mothers, studies have shown a high rate of cancer of the non-suckled mothers (McLaughlin et al. 2007).

Breastfeeding assists in weight control. According to Steinkraus and Waldor (2007), breastfeeding is a vigorous metabolic process that requires between 200 and 500 calories in a day for the breastmilk production. The utilisation of this energy helps the mother loose the extra weight that was gained during pregnancy. The considerable amount of weight loss combined with a satisfactory cholesterol level due to breastfeeding results in a lower risk of heart problems among mothers (Rooney and Schauberger 2002). On the other hand, non-breastfeeding mothers lose less weight, thus maintain the extra weight gained during pregnancy and are exposed to the many chronic illnesses associated with obesity and overweight.

Breastfeeding promotes the health and emotional wellbeing of a lactating woman. It may reduce the prevalence of osteoporosis (Steinkraus and Waldor 2007). Women who never breastfed are at a higher risk of fracturing their hips after menopause (Orshan 2008). Also, breastfeeding provides a close and exceptional interaction between the mother-child dyad. The skin to skin attachment of mother to her child provides a unique bond between the two which mothers who use bottle-feeding approach may be forced to work harder to achieve (Steinkraus and Waldor 2007). Response to adrenaline is lower in breastfeeding mothers as a result of the hormone prolactin produced during breastfeeding. The release of oxytocin during nursing helps in the contraction of the uterus after birth thus reducing postpartum bleeding (Hale 2006).

There are a number of indirect benefits associated with breastfeeding. Ortiz, McGilligan and Kelly (2004), pointed out that it reduces child- related illness, and as a result, if the mother is a professional or belongs to the working class, the time that she requires off duty due to the child's illness is significantly reduced when the child is adequately breastfed. The authors observed that this reduces confrontations between the mother and her employer. Mothers who breastfeed their infants might gain the economic benefits of fewer illnesses and fewer physician visits for their infants; hence, breastfeeding mothers enjoy less costs in regards to health care relative to mothers who bottle-feed.

In consideration of household economics, the healthcare cost associated with infant illness is reduced by breastfeeding. Thus, the money can be channelled to other benefits or worthy household ventures (Orshan 2008). Similarly, Hausman (2003) noted that the cost of purchasing formulas for the baby is avoided; thus, saving thousands of dollars per year. When

the mother is available for breastfeeding, there is a likelihood that she is also available for the other members of the family. It keeps the mother within the family circle and in the process; she becomes available for other maternal duties hence strengthening the family bond (Orshan 2008).

2.2.4 Disadvantages of breastmilk substitutes

Breastmilk is a superior of all other human milk substitutes. The World Health Organisation as well as practitioners and researchers advise that breastfeeding is the best approach to feeding a new-born (WHO 2011). Therefore, the global health society has been active against the promotion of products by the infant formula industry, and from time to time there have been boycotts of the major infant formula producers due to their aggressive marketing (Singh, Daar, and Singer 2010). The benefits of breastfeeding are numerous. Failure to breastfeed and the use of breastmilk substitutes increases the risks to the infant. The main disadvantage lies in the composition of breastmilk substitutes which are unable to match the biologically active compounds and living cells of breastmilk (Boyd, Quigley, and Brocklehurst 2007, Victora et al. 2016). First, these substitutes lack antibodies that are present in colostrum which are very essential in protecting the infant against infections and other dangerous illnesses. No even one of the antibodies found in breastmilk is present in the substitutes (Dòrea 2009). Also, the amount of protein added to formulas is more than that present in breastmilk and more than infant nutritional needs. This makes it difficult for the infant to digest and often results in gas and constipation (Cattaneo 2008). Breastmilk substitutes lack many important nutrients that are adequately available in breastmilk and as earlier mentioned it is virtually impossible to artificially duplicate the biochemical balance of these nutriment components as well as ingredients.

Breastfeeding is safer, more practical than formula feeding. Boyd, Quigley, and Brocklehurst (2007) have shown that breastmilk substitutes are costly and time consuming to prepare. All types of formula whether powdered, concentrated, or ready to feed must be purchased. Preparation process is also time-consuming as water has to be sterilised. This is unlike breastmilk which is free and ready to feed whenever the infant is hungry. Preparation of milk substitutes can also be risky to the infant especially when the water or bottle is not properly sterilised or the meal is not freshly prepared. It could introduce pathogenic bacteria which could cause the child to fall sick or in worse situations, cause death, particularly since bottle-fed neonates lack the maternal infection-fighting antibodies that are usually passed through breastfeeding (Boyd, Quigley, and Brocklehurst 2007).

It has been established that infants who are fed on breastmilk substitutes have an increased risk of morbidity and mortality compared to breastfed infants. These illnesses include mortality, asthma and allergy, chronic diseases, otitis media, diabetes, urinary infections, sudden infant death syndrome and nutrient deficiencies such as the lack of fatty acids, amino acids, calcium and iron, which are all essential factors in the development of various systems and organs (Boyd, Quigley, and Brocklehurst 2007, World Health Organisation [WHO] 2000, Ip et al. 2007). These substitutes also result in slower cognitive development possibly because of the deficiency in fatty and amino acids that are required in brain and nervous system development (Dòrea 2009).

In addition, breastmilk substitutes deny the mother the discussed breastfeeding benefits. Most importantly, there is a special bond that develops between the infant and the mother during

breastfeeding which does not exist in cases where infants are fed on breastmilk substitutes (Steinkraus and Waldor 2007). This could expose the mother to postpartum stress and depression. The mother can also easily get pregnant again within months of giving birth (Orshan 2008). Furthermore, mothers who depend on breastmilk substitutes may not be able to reduce weight gained during pregnancy, hence they are susceptible to obesity, type 2 diabetes, blood pressure disorders, cancer and other chronic diseases (McLaughlin et al. 2007, Orshan 2008, Steinkraus and Waldor 2007).

It is widely illustrated that there are many advantages for the mother and her infant in regards to breastfeeding (Smith, Dunstone, and Elliott-Rudder 2008). On the other hand, artificial feeding or feeding on infant formula results in higher rates of infant mortality, and diarrhoeal diseases (Oddy et al. 2010). The infant loses or stops gaining weight, and this interferes with growth and development. Breastmilk is also known to have immunity-boosting components beneficial to the child (Greer, Sicherer, and Burks 2008). Therefore, a baby that experiences low breastfeeding duration is likely to have a weak immune system, making him/her prone to poor health and ailments. Thus, it is strongly advised that at a minimum for the first six months of an infant's life, they be breastfed by their mothers and for this period artificial feeding must be minimised or completely ignored, unless there are special conditions such as the need for vitamins and minerals supplementations or necessary oral medications based on medical advice (Oddy et al. 2010).

2.2.5 Benefits of breastfeeding for society and environment

Breastfeeding has economic and social benefits for families, the health care system, employers, and the nation as a whole. Hence, the World Bank Group is supporting breastfeeding by every effort (Hansen 2016). Families save hundreds of dollars by breastfeeding rather than buying breastmilk substitutes which can be very costly depending on the type (Weimer 2001, León-Cava et al. 2002, Smith 2013). An overview of economic studies has shown that averting from breastfeeding could contribute to an estimated world economic loss of US$ 302 billion (Rollins et al. 2016). Also, in the United States of America (USA), an increase in breastfeeding from 29% to 50% at six months could decrease annual health care costs by up to US$3.6 billion (Weimer 2001). This is a very significant benefit to the society as the money can be re-directed to other development projects. Breastfeeding therefore decreases healthcare costs because it results in healthier children and healthier mothers. It has also been established that breastfeeding reduces tax burden on the society as well as on the government to make sure that children are well fed (León-Cava et al. 2002).

Breastfeeding can benefit the society and economy in indirect way. Weimer (2001) explained that breastfeeding results in healthier babies which in turn reduce the burden on the society's healthcare system. He further added that cognitive benefits of breastfeeding extend to easing the burden on the society's educational system as well. A cohort study (n=1193) conducted in the Australian Capital Territory (ACT) predict that the hospital systems could save up to AU$1-2 million per annum by extending breastfeeding duration to the recommended period (Smith, Thompson, and Ellwood 2002). The immunological benefits of breastfeeding also ultimately lead to reduced insurance premiums for parents and employers. Breastfeeding impacts the corporate world positively by reducing maternal absenteeism at workplaces due to mothers or children illnesses (Ortiz, McGilligan, and Kelly 2004, Rollins et al. 2016). In

addition to reducing medical costs for corporations, breastfeeding also increases employee productivity.

Families who breastfeed save a considerable amount of money, boosting the family income. The cost of breastfeeding is much lower than that of bottle feeding with breastmilk substitutes (Weimer 2001, Rollins et al. 2016). This is regardless of the additional diet required by the nursing mother and after including the cost of breast pumps if one is required. By decreasing infant illness, breastfeeding provides time for attention to their children and other family issues. In terms of family planning, breastfeeding is a safe and natural means of birth spacing, which helps societies and governments to organise and manage services and reasonably implement resources for populations (Steinkraus and Waldor 2007). The cost savings due to breastfeeding demonstrate its financial and health value for all stakeholders in the society.

Breastfeeding is also friendly to the environment. This is because human milk requires very little additional consumption of natural resources and generates no industrial waste (Weimer 2001, Rollins et al. 2016). It is readily available at the right temperature and unlike production of milk substitutes and formulas which requires bottles, teats, labels, cans, packaging, sterilising equipment and advertising which uses metal, plastics, glass, trees, and fuel (Smith and Ingham 2001). Breastmilk places no additional burden on these natural resources as it does not require storage, refrigeration, transport, and packaging (Weimer 2001). Breastfeeding therefore reduces global pollution as its production is harmless to the environment. Waste production associated with disposal of the bottles and cans used to package artificial milk is completely absent in breastmilk production. Moreover, in many cases, only one ounce of four-ounce bottle milk is consumed by babies who are bottle fed

while the rest is discarded (Li, Fein, and Grummer-Strawn 2010). Thus, formula introduction and consumption leads to waste of resources used to produce and transport the milk substitutes (oil, aluminium, electricity, and paper, among others).

Breastfeeding enhances the quality of life for individuals in the society as the money saved can be used to improve other aspects of life. It reduces the use of energy and resources required to process, package, promote, distribute, as well as dispose materials created by the production and use of breastmilk substitutes (Smith and Ingham 2001, Weimer 2001). As such, breastfeeding exclusively and reducing or restricting formula production can lead to a reduction in global environmental pollution.

2.3 Breastfeeding in Saudi Arabia

2.3.1 Background

The Saudi government offers health care free to all Saudi nationals, mainly administered by the Ministry of Health (MOH) hospitals, facilities and primary healthcare centres (PHC). Health insurance schemes developed by their employers and served by the private sector to expatriates (Aldossary, While, and Barriball 2008). The MOH and other health care providers (the private sector and other governmental agencies) implement both preventive and curative health care models (Al-Yousuf, Akerele, and Al-Mazrou 2002).

The Saudi health care system appears to face some difficulties in delivering health services. Almalki, Fitzgerald, and Clark (2011) have conducted a comprehensive overview on the health services in Saudi Arabia. They stated that there have been substantial advancements in

health care recently. However, there still some challenges and difficulties that should be addressed (Almalki, Fitzgerald, and Clark 2011). For example, the Saudi population is increasing at a fast rate while the health workforce suffers severe shortages. Other challenges include prevailing chronic and emerging communicable diseases; vast pressure on health services due to high demand; health care service accessibility, introduction of health insurance schemes that are cooperative, and utilisation of electronic health technologies (Almalki, Fitzgerald, and Clark 2011). Therefore, protecting young and future generations from illnesses and promoting their health are, and should be, a fundamental aim for health authorities to achieve. One of the most effective methods of achieving this target is through breastfeeding. Nevertheless, planning for breastfeeding promotion essentially requires realisation of the current situation of infant feeding and associated factors through rigorous, well-designed observational studies.

2.3.2 Previous research on breastfeeding in Saudi Arabia

2.3.2.1 Overview

United Nations Children's Fund (UNICEF) reports an average worldwide rate of ‘exclusive breastfeeding’ of 38% for infants less than six months old in 2009-2013 with early initiation (<1 hour) rate of 44% during the same period (UNICEF 2014). However, UNICEF (and other United Nations agencies) report data as a period prevalence rate of 0-6 months, hence it is difficult to interpret its relevance and to compare with other studies. In contrast, some developing countries have recently reported ‘exclusive breastfeeding’ rates higher than the global average; such as Kyrgyzstan (56%), Iran (53%) and Ethiopia (52%) (UNICEF 2014). However, these rates can be confusing as often only the experience in the 24 hours prior to reporting are included.

In the Middle East and North African region (MENA), there has been a considerable decline in the percentage of infants (0-5 months) exclusively breastfed from 33% in 1996 to 25% in 2006 (UNICEF 2009). Recent statistics have shown that this rate has been reversed; rising to 34% during the period 2009-2013 (UNICEF 2014). However, this change could simply be a result of the methodology used as period prevalence data measuring a parameter that changes over time is highly dependent on the age composition of the sample.

2.3.2.2 Breastfeeding data in Saudi Arabia

Breastfeeding data in Saudi Arabia is not routinely collected. There is no official data available on breastfeeding practices and on infant and child nutrition (UNICEF 2014, WHO 2015b). The annual statistical book issued by the Saudi Ministry of Health (MOH) does not contain any information on breastfeeding (MOH 2014). Also, a literature review conducted by Al-Jassir, Moizuddin, and Al-Bashir (2003) stated that there was a shortage of reliable and consistent data with a lack of uniformity of research methodologies. All previous studies carried out in Saudi Arabia, either nationally or in regional settings, were cross-sectional, frequently did not use standard definitions for breastfeeding categories and provided inconsistent results (Al-Othaimeen, Villanueva, and Devol 1987, El Mouzan et al. 2009, Khattab 2000). As most of these studies did not utilise appropriate research designs, or provide clear definitions of breastfeeding, the reported rates of infants feeding practices might be overestimated due to misclassification (Binns et al. 2009). Samples used in these studies were usually selected from clients of primary healthcare centres (PHC) for routine vaccination (Al-Jassir, El-Bashir, and Moizuddin 2004, Fida and Al-Aama 2003, Madani, Al-Nowaisser, and Khashoggi 1994). Self-administered questionnaires and interviews were the

common tools used to collect data regarding breastfeeding practices, sociodemographic variables, and patterns of infant feeding (Al-Hreashy et al. 2008, Al-Shehri et al. 1995).

Because the aforementioned studies have been all of cross-sectional design, there is a possibility of recall bias as the length of recall has been variable. A systematic review by some experts stated that recall bias increases as the time elapses (Horta, Victora, and World Health Organisation [WHO] 2013). Data collection in the previous studies was retrospective and based on historical, not current, status of infant feeding practices. Almost all studies asked mothers about feeding their last live infants since birth and up to the time of the cross-sectional surveys were conducted regardless of the time interval between birth and the survey. Only one study (cross-sectional, n=1904, in the Al-Hassa region (East)) used the current status of breastfeeding during the last 24 hours before interview as per the recommendations of the World Health Organisation (WHO) (El-Gilany, Shady, and Helal 2011). Previous studies included infants and children from a wide age range, which increased the chance of recall bias. Some studies questioned mothers about their infant feeding practices across the previous five years (Serenius et al. 1988, Al-Mazrou, Aziz, and Khalil 1994, Al-Shehri et al. 1995, Al-Jassir, El-Bashir, and Moizuddin 2004). In contrast, others included shorter timeframes, analysing data of the last 2.5 years (Kordy et al. 1992, Khattab 2000, El Mouzan et al. 2009, Amin, Hablas, and Al Qader 2011).

Several studies examined infant feeding practices among infants of 12 months or younger (Madani, Al-Nowaisser, and Khashoggi 1994, Shawky and Abalkhail 2003, Al-Ayed and Qureshi 1998, Fida and Al-Aama 2003, Al-Jassir et al. 2006). In contrast, studies done recently such as the ones by Al-Hreashy et al. (2008) (cross-sectional, n= 578, in Riyadh); El-

Gilany, Shady, and Helal (2011) (cross-sectional, n=1904, in the Al-Hassa region (East)) and (Eldeek, Tayeb, and Habiballah 2012) (cross-sectional, n=600, in Jeddah) included infants less than or equal 6 months and one study (national cross-sectional, n=767) included infants and children 0-9 years old (Al-Othaimeen, Villanueva, and Devol 1987). No prospective cohort studies regarding infant feeding in Saudi Arabia have been published.

A more recent review (n = 17 studies) on breastfeeding in the KSA has been conducted by Al Juaid, Binns, and Giglia (2014). The authors have highlighted the importance of implementing adequate research methodologies (such as a cohort design) to document breastfeeding outcomes more accurately. These potential research projects should be based on the standard definitions of breastfeeding recognised by international institutes like the World Health Organisation and the United Nations Children's Fund and other such global health organisations. They should use the appropriate measurement tools and methodologies. The variance in reported breastfeeding rates, especially 'exclusive breastfeeding' rates, among the reviewed studies could be attributed to deficient sample selection and poor study design (Al Juaid, Binns, and Giglia 2014). This shortage in available research clearly demonstrates the need for longitudinal cohort studies of infant feeding practices in Saudi Arabia.

2.3.2.3 Past and current breastfeeding rates

The Middle East and North African countries have experienced high rates of over 60% of early breastfeeding initiation with the vast majority (60%) of mothers continuing to breastfeed up until 12 months (Eastern Mediterranean Regional Office of WHO (EMRO)

2014). Nevertheless, the rates of 'exclusive breastfeeding' have been low in this region, with less than a half of the children being breastfed exclusively (EMRO 2014).

Although results from previous studies on breastfeeding in the KSA may not be reliable, they may provide some indicative information about the breastfeeding status in the country. Initiation rates were above 90% in most of the existing literature (Al Juaid, Binns, and Giglia 2014). A cross-sectional study (n=2196, in central and south-west of the KSA) disclosed that there was a significant discrepancy between rural and urban communities in initiation rates – 76% vs. 90% respectively (Serenius et al. 1988). In terms of timely breastfeeding initiation, a study by El-Gilany, Shady, and Helal (2011) (cross-sectional, n=1904, in the Al-Hassa region (East)) reported that only few mothers (11.4%) initiated breastfeeding early (<1 hour postpartum), whereas Amin, Hablas, and Al Qader (2011) (cross-sectional, n=641, in the Al-Hassa region (East)) reported that the vast majority (77.8%) of recruited mothers started breastfeeding within 24 hours after the delivery of their children. However, a recent cross-sectional study (n=400) done in the Jazan region, southern west of Saudi Arabia, reported an initiation rate of 44.1% within one hour after parturition (Mahfouz et al. 2014).

As most of the available breastfeeding studies were designed as cross-sectional studies, and did not use a standardised definition for the term 'exclusive breastfeeding', the rate of 'exclusive breastfeeding' could not be accurately reported for the KSA. Those studies which utilised the WHO's definition stated that at six months of age the prevalence rate of 'exclusive breastfeeding' at six months of age ranges from 1.7% (Al-Hreashy et al. 2008) to 24.4% (El-Gilany, Shady, and Helal 2011). Various other studies reported low rates of 'exclusive breastfeeding' at six months: 0.8% (n=21507, in Riyadh) (Al-Jassir, El-Bashir, and

Moizuddin 2004); 8.9% (n=476, in Makkah (West)) (Kordy et al. 1992) and 5.6% (n=767), national survey) (Al-Othaimeen, Villanueva, and Devol 1987). On the other hand, two national surveys (n= 6086 and 6308, respectively) found that 'exclusive breastfeeding' were prevalent among 38% and 33% of mothers, respectively (Al-Mazrou, Aziz, and Khalil 1994, Al-Shehri et al. 1995). One of the latest regional studies (n=400, in Jazan (South-West)) noted that the prevalence of 'exclusive breastfeeding' is 26.9% (confidence interval [CI] 22.6-31.6) (Mahfouz et al. 2014). Also, other two studies (n= 1019 and 100, in Taif and Abha Cities, respectively) established that the rate was 47% for 2-year-old babies or younger, but 43.9% for infants under one year of age, suggesting that there may have been a small decline (Madani, Al-Nowaisser, and Khashoggi 1994, Khattab 2000). However, throughout some of these studies, sample sizes were not large, resulting in inconsistency in reporting 'exclusive breastfeeding' prevalence in the KSA and wider confidence intervals. Also, comparisons with reports from other international health organisations such as the WHO are difficult to make due to the variation in the designs of these studies.

There is a greater prevalence in mixed (or partial) breastfeeding practices which involve combining bottle and breastfeeding between mothers in the KSA compared to other infant feeding practices as noted by various studies (Al-Jassir, Moizuddin, and Al-Bashir 2003, Al-Jassir et al. 2006, Batterjee 2010). Another national, cross-sectional study (n= 767) had noted that 57.9% of children under one and a half years of age had been breastfed and fed artificially by bottle and glass compared to only 21.5% being exclusively breastfed and 20.6% of being exclusively bottle-fed (Al-Othaimeen, Villanueva, and Devol 1987). Other studies documented 'partial breastfeeding' rates of: 88.6% (n= 5339) at birth (El Mouzan et al. 2009), 49.8% (n=641) at six months after birth (Amin, Hablas, and Al Qader 2011) and 56% (n=6086) for all children younger than 24 months (Al-Mazrou, Aziz, and Khalil 1994).

A national, cross-sectional study (n=6308) by Al-Shehri et al. (1995) reported that 44% of the children that were studied (0-5 years) were exclusively bottle-fed only and 28% were exclusively breastfed compared to only 16% of children studied being both breast and bottle-fed together and 12% being weaned (on solid foods only). A nationwide cross-sectional study (n=5339) undertaken fourteen years later found that 51% of Saudi mothers introduced formula at one month of age (El Mouzan et al. 2009). Another national survey (n=4872) reported the prevalence of formula introduction at three months as 78.3% (Al-Jassir et al. 2006). Likewise, solid foods were also introduced to infants at times earlier than recommended by the WHO in Saudi Arabia. The introduction of solids between three and six months was reported in 89% of infants (n=578) (Al-Hreashy et al. 2008). A national study (n=5339) found that 80.9% of mothers had introduced their infants to solids and semi-solids between the fourth and the sixth month of life (El Mouzan et al. 2009).

'Any breastfeeding' was practiced by a high proportion of Saudi mothers as reported by most of the studies discussed above. In a relatively recent survey undertaken nationally (n=5339), researchers found the prevalence rate for 'any breastfeeding' to be 10.2%, and that the rate for 'exclusive breastfeeding' among infants up to six months of age was 8% (El Mouzan et al. 2009). On the contrary, a different concurrent study (n=578) carried out in the central KSA (Riyadh); an area with the highest population across the nation; stated that 'any and exclusive breastfeeding' prevalence rates were 94.3% and 1.7%, respectively (Al-Hreashy et al. 2008). This contraindication illustrates the lack of consistency in results due to the lack of appropriate study design where flaws including sample size determination, length of recall, and selection are evident.

During the last three decades, the average duration of breastfeeding in the Kingdom of Saudi Arabia seems to have been on the decline. This decline is hypothesised to be due to the rapid urbanisation and changes in socio-economic status that Saudi women have recently experienced. Figure 2.1 shows the regression analysis of the mean duration as adapted from seven studies that measured it (Al-Jassir, El-Bashir, and Moizuddin 2004, Al-Mazrou, Aziz, and Khalil 1994, Al-Shehri et al. 1995, Amin, Hablas, and Al Qader 2011, Eldeek, Tayeb, and Habiballah 2012, Khattab 2000, Kordy et al. 1992). Even though the mean duration of breastfeeding was as long as 13.4 months in 1987, it has declined to merely 6.8 months in 1999 and 8.5 months in 2010 (Figure 2.1) (Al Juaid, Binns, and Giglia 2014). Such a trend, nevertheless, should be dealt with as an indicative one due to the variance in settings and samples among the different studies that were included.

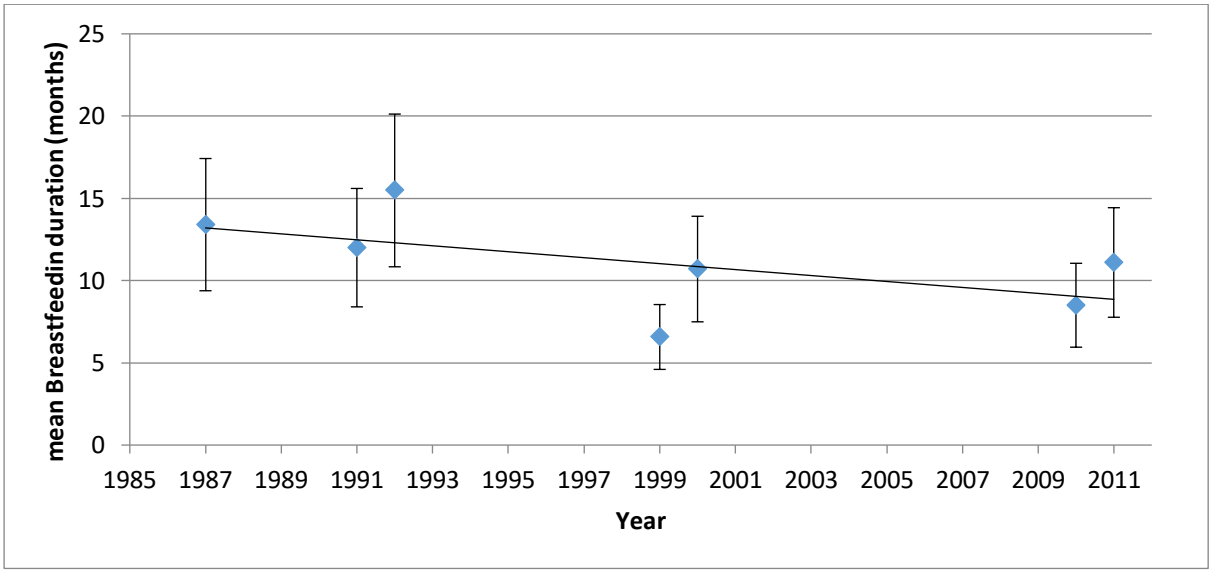

Figure 2.1: The linear regression showing a reduction in breastfeeding duration in Saudi Arabia over the period 1985-2011. Source: (Al Juaid, Binns, and Giglia 2014)

Overall, mothers in Saudi Arabia appeared to demonstrate high rates of breastfeeding initiation, however, they tend to introduce formula and solids too early, which reduces the 'exclusive breastfeeding' rates and shortens duration. Mixed feeding was found to be the most predominant infant feeding method among Saudi mothers; contributing to early cessation of breastfeeding. The mean breastfeeding duration seems to have been constantly decreasing although findings from surveys indicate that women intend to breastfeed longer. Table 2.1 depicts a summary of breastfeeding rates previously reported by other studies as outlined in the review conducted by the researcher (Al Juaid, Binns, and Giglia 2014).

Table 2.1 Results of studies that have investigated breastfeeding in Saudi Arabia

#	Study year & location	Study design	Sample size (n)	Initiation rate (%)	Child age (m†)	Exclusive BF* (%)	Child age (m†)	Any BF* (%) R**	Any BF* (%) U**	BF* duration (m†)
1	1979-81, Central & South-West KSA (Serenius et al. 1988)	Cross-sectional	2196	90 R** 76 U**	-		1 3 6	90 90 85	76 42 22	Median= 17.8 R** 2.1 U**
2	1987, National (Al-Othaimeen, Villanueva, and Devol 1987)	Cross-sectional	767	89.9	<6 6- 12-	4.4 5.6 9.1		29 15 11		-
3	1987, National (Al-Mazrou, Aziz, and Khalil 1994)	Cross-sectional	6086	90.1	1 3 6	55 36 33		95 92 88		Mean= 13.4 14.4 R** 12.3 U**
4	1990, Taif (West) (Madani, Al-Nowaisser, and Khashoggi 1994)	Cross-sectional	1019	98	≤12	43.9		56.1		-
5	1991, National (Al-Shehri et al. 1995)	Cross-sectional	6308	93	<5 6-12 12+	53 38 18		87 67 24		Mean= 13 R** 11 U**
6	1992, Makkah (West) (Kordy et al. 1992)	Cross-sectional	476	97.1	<36	8.9		42.4		Mean= 14.61±3.53
7	1997, Jeddah (West) (Shawky and Abalkhail 2003)	Cross-sectional	400	94	-		6	54		Median= 6
8	1995, Riyadh (Central) (Al-Ayed and Qureshi 1998)	Cross-sectional	347	-	6	22.1		51.6		-
9	1999, Riyadh (Central) (Al-Jassir, El-Bashir, and Moizuddin 2004)	Cross-sectional	21507	98.9	4-6	0.8	6	34.3		Mean= 6.57±5.71
10	2000, Abha (South-West) (Khattab 2000)	Cross-sectional	100	-	<24	37		47		Mean= 10.7±6.9
11	2001-02, Jeddah (West) (Fida and Al-Aama 2003)	Cross-sectional	128	95	-		≤12	82.8		-
12	2002-03, National (Al-Jassir et al. 2006)	Cross-sectional	4872	91.9	3	23.9	4-6	50		-
13	2004-05, National (El Mouzan et al. 2009)	Cross-sectional	5339	91.6	Birth 1 4 6	70.8 39 16.4 8		88.8 49 20.5 10.2		-
14	2005, Riyadh (Central) (Al-Hreashy et al. 2008)	Cross-sectional	578	95	6	1.7		94.3		-
15	2009, AlHassa (East) (El-Gilany, Shady, and Helal 2011)	Cross-sectional	1904	91.9	6	24.4	-			-
16	2010, AlHassa (East) (Amin, Hablas, and Al Qader 2011)	Cross-sectional	641	91	Birth 2 4 6	66.5 32.9 19.2 12.2		77.8 76 67 61		Mean= 8.5±7.4 Median= 6
17	2011, Jeddah (West) (Eldeek, Tayeb, and Habiballah 2012)	Cross-sectional	600		≤6	25		58		Mean= 11.1±6.64

*BF = breastfeeding, m† = months, R** = rural, U** = urban. Source: (Al Juaid, Binns, and Giglia 2014)

2.4 Factors affecting infant feeding in Saudi Arabia

2.4.1 Maternal age

There are several studies that analysed the impacts of the age of the mother on breastfeeding duration and practices in the KSA. Most of these studies came to the conclusion that the popularity of breastfeeding was higher and of a longer duration among older mothers versus younger ones (Serenius et al. 1988, Al-Othaimeen, Villanueva, and Devol 1987, Al-Mazrou, Aziz, and Khalil 1994, Al-Shehri et al. 1995, Kordy et al. 1992, Khattab 2000, Al-Jassir et al. 2006, Amin, Hablas, and Al Qader 2011). Findings from a cross-sectional study conducted recently (n=641) illustrated that increased mother age was notably correlated to longer breastfeeding duration (*p*-value = 0.001); to exclusivity of breastfeeding (odds ratio [OR] = 1.14, 95% confidence interval [CI] = 1.03-1.23, *p*-value = 0.034) and to early initiation (OR = 2.24, 95% CI = 1.37-3.68, *p*-value = 0.016) (Amin, Hablas, and Al Qader 2011). A national cross-sectional study (n=4872) found that younger mothers favour introducing solids within second month, earlier than mothers who are older ($p \leq 0.05$) (Al-Jassir et al. 2006). By comparison, some researchers reported that the impact of a mother's age in relation to breastfeeding was not statistically significant (Madani, Al-Nowaisser, and Khashoggi 1994, Shawky and Abalkhail 2003, Al-Ayed and Qureshi 1998, Fida and Al-Aama 2003, Al-Hreashy et al. 2008, El-Gilany, Shady, and Helal 2011). Interestingly, another cross-sectional study (n=600) reported that the average age of breastfeeding mothers was younger than the mean age of mothers who instead utilised infant formula (Eldeek, Tayeb, and Habiballah 2012).

2.4.2 Mother's working status and education

Education, followed by employment, was not very common pathways for women in the KSA up until recently, with older studies reporting that most of the study participants were illiterate and did not work outside of the home. For example, Madani, Al-Nowaisser, and Khashoggi (1994) (cross-sectional, n=1019, in Taif City) reported that the percentages of mothers in the sample of their study who were illiterate and did not work outside of the home were 80% and 96.2%, respectively. Such proportions have changed with the passage of time, as education and employment levels increased due to accelerated development in economy, education and in many fields of social life in Saudi Arabia. A recent cross-sectional study (n=600) by Eldeek, Tayeb, and Habiballah (2012) reported that, 91% of recruited mothers had schooling to at least an intermediate level whilst 67% of them were employed.

Several studies found that mothers who were employed outside the home breastfeed less often, and for shorter periods of time than those who were not employed and that the differences between working and non-working mothers were statistically significant (Al-Ayed and Qureshi 1998, Al-Hreashy et al. 2008, El-Gilany, Shady, and Helal 2011, Amin, Hablas, and Al Qader 2011). Other studies reported no statistically significant influence regarding breastfeeding duration and practices based on work status of mothers (Madani, Al-Nowaisser, and Khashoggi 1994, Kordy et al. 1992, Shawky and Abalkhail 2003, Khattab 2000, Fida and Al-Aama 2003), and one cross-sectional study (n=600) reported that working mothers breastfeed their infants more than non-working mothers (p-value = 0.005) (Eldeek, Tayeb, and Habiballah 2012).

In general, lower rates of breastfeeding was correlated with higher educational levels, especially in regards to low 'exclusive breastfeeding' rates as well as a shorter breastfeeding duration (Al-Othaimeen, Villanueva, and Devol 1987, Al-Mazrou, Aziz, and Khalil 1994, Madani, Al-Nowaisser, and Khashoggi 1994, Al-Shehri et al. 1995, Kordy et al. 1992, Al-Jassir, El-Bashir, and Moizuddin 2004, Al-Jassir et al. 2006, Al-Hreashy et al. 2008, El-Gilany, Shady, and Helal 2011, Amin, Hablas, and Al Qader 2011). Findings from alternate studies (n=347, 128 and 100, respectively) found that education did not significantly affect breastfeeding duration and status (Al-Ayed and Qureshi 1998, Fida and Al-Aama 2003, Khattab 2000). However, these studies contained very small sample sizes, and hence, these samples may not be representative.

2.4.3 Family income and type of residence

Some researchers have looked into the differences between breastfeeding indicators in urban versus rural areas (Al-Mazrou, Aziz, and Khalil 1994, Al-Shehri et al. 1995, Amin, Hablas, and Al Qader 2011, El-Gilany, Shady, and Helal 2011, Serenius et al. 1988). All of these studies were in accordance that breastfeeding practice, longer breastfeeding durations, and later initialisation of supplements were more common for mothers in rural areas compared to urban areas with three studies (n=6308, 641 and 1904, respectively) showing statistical significance in the difference between these two groups (Al-Shehri et al. 1995, Amin, Hablas, and Al Qader 2011, El-Gilany, Shady, and Helal 2011).

It is important to note that women in rural areas of Saudi Arabia are more likely to have lower education levels or to be illiterate in comparison to urban women (Kordy et al. 1992,

Amin, Hablas, and Al Qader 2011). Mothers living in a rural area are more likely to be less educated, to have lower incomes and to have higher breastfeeding rates.

Four previous studies also studied income of the family as an influencing factor: two of these studies (n=1904 and 128, respectively) concluded that the correlation between income and breastfeeding practices was not significant (El-Gilany, Shady, and Helal 2011, Fida and Al-Aama 2003). The other two (n=347 and 641, respectively) highlighted the undermining impact of high income on breastfeeding (Al-Ayed and Qureshi 1998, Amin, Hablas, and Al Qader 2011). The latter finding might be in consistent with the fact that Saudi Arabia, as a high income country, has seen many changes in women's lifestyles; with an increasing trend away from breastfeeding towards artificial formula feeding.

2.4.4 Parity, contraception and caesarean section

Other factors that are correlated with breastfeeding that have been studied in Saudi Arabia include oral contraceptive use, parity, and caesarean deliveries. Of the eight studies that included parity, four of them noted that multi-parity was associated with higher prevalence and longer durations of breastfeeding (Al-Ayed and Qureshi 1998, Al-Hreashy et al. 2008, Amin, Hablas, and Al Qader 2011, Khattab 2000). For instance, one study (n= 578, in Riyadh) came to the conclusion that primiparous mothers tend to have shorter breastfeeding durations and are more likely to introduce formulae in the first six months in comparison to mothers of two children or more (OR = 0.36, CI = 0.21- 0.64 and OR = 0.18, CI = 0.09 - 0.35; respectively, where prima-parity group is the reference) (Al-Hreashy et al. 2008). The other investigations found no significant correlations between breastfeeding practices, breastfeeding duration, and parity (El-Gilany, Shady, and Helal 2011, Fida and Al-Aama

2003, Shawky and Abalkhail 2003). In addition, in a cross-sectional study (n=476) from rural Western Saudi Arabia, researchers found that the shorter breastfeeding durations were correlated with increased birth order ($p < 0.001$) (Kordy et al. 1992).

Two papers reported that the utilisation of oral contraceptive (OC) methods had an adverse impact on breastfeeding. A cross-sectional study (n=578) concluded that oral contraceptive (combined pill) was correlated with early formula introduction and shortened breastfeeding duration (OR = 4.6, 95% CI = 2.8-7.3) (Al-Hreashy et al. 2008). Another cross-sectional study (n=400) found that mothers who use OC faced an elevated risk of breastfeeding cessation compared with those who did not use OC (OR = 1.5, 95% CI = 1.1-2.2) (Shawky and Abalkhail 2003). Shawky and Abalkhail (2003) stated that a shorter breastfeeding duration has been correlated with caesarean delivery (OR = 1.9, 95% CI = 1.3 - 2.8). Nonetheless, the other study did not establish such a relationship (OR = 0.81, 95% CI = 0.45 - 1.43) (Al-Hreashy et al. 2008). Albokhary and James (2014) conducted a study in Jeddah City (n=60) and concluded that mothers having a caesarean section had less likelihood of starting breastfeeding within 1-24 hours after delivery than those who gave births vaginally. The authors attribute this difference to inability of caesarean section mothers to hold, care for, and breastfeed their infants soon after birth due to anaesthesia or post-operative pain. Also, caesarean delivery has been found to carry a potential risk in regards to delayed onset of lactation (aOR = 2.40, 95% CI 1.28 – 4.51) (Scott, Binns, and Oddy 2007).

2.4.5 Mothers attitudes and preferences

Knowledge and attitudes towards breastfeeding among Saudi women have been widely investigated. Findings revealed that rates of actual practice of breastfeeding are not as high as corresponding attitudes and preferences rates. A study investigating attitudes of Saudi women towards infant feeding methods (n=848) found that only 36.8% of mothers preferred 'exclusive breastfeeding' whereas 48.5% preferred 'mixed feeding' (breast and bottle), 78.6% have tried to access information about breastfeeding and 66.4% agree that breastfeeding reduces the incidence of postpartum depression (Alwelaie et al. 2010). Another study (n=400) revealed that knowledge and positive attitudes of women in the KSA towards breastfeeding was high at rates of 91.8% and 91.5%, respectively, while the practice of "absolute" breastfeeding was less prevalent (20%) (Al-Yousif et al. 2011). However, these studies used tools for data collection (questionnaires and scales) that were developed locally and had not been adequately validated; hence their results may not be directly comparable to international findings.

2.5 Factors not investigated before

There are several important risk factors for breastfeeding cessation in Saudi Arabia that have been not reported in the existing literature. For instance, one risk factor for not breastfeeding and also for shorter durations of breastfeeding is maternal obesity (Li, Jewell, and Grummer-Strawn 2003). Regardless, previous studies in the KSA have not considered the association of chronic maternal illnesses such as maternal obesity, type 2 diabetes and post-partum depression with infant feeding (Al Juaid, Binns, and Giglia 2014). Furthermore, factors including the type and commercial advertising of formulae as well as maternal attitude toward breastfeeding, which are thought to influence infant feeding practices have yet to be rigorously investigated.

2.5.1 Maternal obesity

One of the most significant factors affecting breastfeeding practices across many societies is maternal obesity. Amir and Donath (2007) have systematically reviewed the impact of maternal obesity in regards to the initiation and duration of breastfeeding. The reviewers concluded that obese or overweight mothers have lower likelihood of breastfeeding compared to those who are not. Another recent systematic review concluded that obese mothers have less intention to breastfeed, lower initiation rates, shorter duration and less milk supply compared to mothers of normal weight (Turcksin et al. 2014).

However, maternal obesity may have variable influences on breastfeeding practices among different populations and races. A community-based study carried out in the USA investigated the relationship between obesity during gestation and breastfeeding duration and initiation on a group of Hispanic (n=587) and Black mothers (n=640) (Kugyelka, Rasmussen, and Frongillo 2004). Results have revealed that obesity was negatively associated with breastfeeding outcomes in Hispanic mothers. Nonetheless, no such association was detected among the Black mothers' group (Kugyelka, Rasmussen, and Frongillo 2004). In a study done in Australia on a sample of 3075 infants, researchers have found that obese mothers who started breastfeeding were more likely to cease breastfeeding at the first week postpartum compared to normal weight mothers (OR = 2.54, 95% CI 1.70-3.79) (Donath and Amir 2008). Maternal obesity was also found to significantly delay the onset of lactogenesis II (Nommsen-Rivers et al. 2010).

The epidemic of overweight and obesity affects almost all age categories and both genders of the Saudi population. In a recent national survey recruiting 10,735 Saudi subjects (aged 15 years and older, 51.1% females), it was found that obesity (body mass index [BMI] ≥ 30 Kg/m^2) was more prevalent among females (33.5%) compared to males (24.1%) (Memish et al. 2014). The authors also found that the obesity prevalence rate has been increasing from 13.1% in 1980s to 35% in 1995 and has continued to increase. Furthermore, Al-Baghli et al. (2008) (n=195,874, aged 30 years and above) have documented an obesity prevalence rate of 51.8% among Saudi women versus 36.1% among males. The overweight and obesity prevalence rate (BMI ≥ 25) was estimated at 72.5% (Alqurashi, Aljabri, and Bokhari 2011). In a study conducted in Jeddah (n = 1172 healthy women), the mean ± SD of BMI was 30.61±6.6 kg/m^2 (Ardawi et al. 2011). Based on the WHO growth reference, the prevalence of severe obesity, obesity, and overweight were 2%, 9.3%, and 23.1% respectively, as reported in a national survey of 19,317 Saudi children and adolescents of ages 5-18 years (El Mouzan et al. 2010). It is obvious that obesity is widely spread throughout the KSA's population, with females at a higher risk of becoming obese. Yet, no studies have been conducted to examine whether maternal obesity has an impact on breastfeeding practices across this country.

Physical activity is one of the superior protective factors for obesity. Physical activity as shown to be successful in preventing obesity; hence either postponing the commencement of, or outright reducing the risk of developing many chronic diseases associated with obesity (Aljoudi and Taha 2009). However, a critical study reported that the KSA's poor urban design throughout has resulted in inappropriate community development and infrastructure, which includes the absence of physical activity and sporting facilities including playgrounds, walkways, as well as health clubs and parks (Mubarak 2004). The lack of promotional

initiatives and absence of sports facilities have resulted in 72.3% of Saudi individuals being physically inactive, and yet, this rate is higher within the female groups (Al-Hazzaa 2007). Thus, it is not surprising that this country has reported a high obesity rate.

Since the 1970s, the oil industry has been the main contributor the KSA's national income. In 2014, the Ministry of Finance in Saudi Arabia (2015) reported that the KSA's national budget was SR 1,046 (US $278.9) billion. The sudden, booming economic development over three decades has brought about significant changes to the Saudi society. This has resulted in approximately 7.5 million foreign labourers coming to the KSA to work in both the public and private sectors (Central Department of Statistics and Information in the KSA [CDSI] 2014). Foreign workforce is also depended on heavily by households in almost all aspects of daily tasks. In addition, consumerism has increased significantly with less healthy diets, infant formula and imported goods encroaching on traditional foods found in local markets (Assad 2008). These changes have contributed to a higher prevalence of obesity and chronic diseases as well as shifting from breastfeeding to artificial feeding methods.

2.5.2 Diabetes mellitus

Diabetes mellitus (DM) and obesity are related conditions such that when one is prevalent in a community, the other is co-existing. One of the most significant risk factors that leads to diabetes mellitus is obesity (Alqurashi, Aljabri, and Bokhari 2011). Breastfeeding may reduce both the infant's and mother's risks of type 1 and 2 diabetes mellitus (DM) and obesity (Taylor, Nothnagle, and Magee 2010). However, compared to infants of healthy mothers, biological children of mothers who are diabetic have higher risks of diabetes mellitus and other health issues such as prematurity, macrosomia (birth weight >4000g.), and hence

possibly obesity, particularly with poor management of maternal DM before and during pregnancies (Snell-Bergeon and Dabelea 2010, Weindling 2009). An important contributing factor to these complications might be the high maternal glucose concentrations which can cause foetal hyperglycaemia (Weindling 2009). Appropriate management and care for pregnant mothers who have this condition, before, during and after pregnancy is essential to optimise outcomes.

Breastfeeding has beneficial effects on metabolic control for both the infant and mother, including improvement in glucose metabolism, stability of glucose levels and insulin sensitivity (Chertok et al. 2009, Gunderson et al. 2012, Weindling 2009, Taylor, Nothnagle, and Magee 2010). A study of 3808 women with diabetes in the United Kingdom recommended breastfeeding for these mothers to improve health outcomes (Confidential Enquiry into Maternal and Child Health). Also, stages 1 and 2 of the Nurses' Health Study (NHS) (NHS II) have investigated the association of breastfeeding practices with the risk of type 2 diabetes (Stuebe et al. 2005). Findings revealed that for each extra year of breastfeeding, breastfeeding mothers in the last 15 years had a 15% lower risk of DM among the NHS' cohort and a 14% lower risk of DM in the NHS II group (Stuebe et al. 2005). Although there may be potential differences in the composition of breastmilk of women with and without DM, this should not prevent those with DM from breastfeeding (Taylor, Nothnagle, and Magee 2010). Also, most diabetic medications are considered safe during breastfeeding, especially when adhering to their guidelines (Hale 2006, Taylor, Nothnagle, and Magee 2010). It has been reported that obese mothers and those with diabetes are less inclined to breastfeed, and when they do so, they do so less frequently and for a shorter duration compared to non-diabetic mothers (Taylor, Nothnagle, and Magee 2010, Weindling

2009). Thus, special care and support should be provided to obese mothers and those with DM to initiate and maintain breastfeeding, considering their special needs for breastfeeding.

Similar to obesity, the prevalence rate of diabetes mellitus has been high and rising within the Saudi Arabian population. In a recent study of 6024 Saudi nationals, 30% were reported as having diabetes (type 1 or 2), and men under 50 years had lower prevalence (25.1%) than women within the same age group (34.1%) ($p < 0.0001$) (Alqurashi, Aljabri, and Bokhari 2011). Research carried out in the northwest of the KSA (Al-Madinah region) during 2001-2010 concluded that the mean annual incidence rate of permanent neonatal diabetes mellitus and type 1 diabetes were 4.7 and 27.6 per 100,000 subjects (Habeb et al. 2012, Habeb et al. 2011). Gestational diabetes mellitus (GDM) was prevalent in 12.5% of Saudi mothers based on the WHO criteria as reported by a recent study (Al Rowaily and Abolfotouh 2010). The study also stated that the likelihood of GDM is correlated to higher ages amongst women who are still within their reproductive age (Al Rowaily and Abolfotouh 2010). Although diabetes is so prevalent among the Saudi society especially in women of reproductive age, there are insufficient research studies to examine the association between such a disease and infant feeding practices and intentions.

Beside physical inactivity and obesity, the traditional diet in Saudi Arabia has contributed significantly to increasingly high prevalence of diabetes. In the population of the KSA, a regular diet consists of only a few kinds of food, and especially focuses on meat and rice (Al-Saleh et al. 2006). Rice is sometimes replaced by unleavened bread (Al-Saleh et al. 2006, Assad 2008). Cooking oils, either vegetable or animal, are usually added to rice and the meat that is used in cooking tends to have a high fat content (Al-Saleh et al. 2006). Usual drinks

include soft drinks, Arabic coffee and black tea made with plentiful quantities of white sugar (Almas et al. 2003). Additionally, there are other significant heredity and genetic factors that cause obesity and diabetes, and contribute to their incidence over generations of Saudi citizens (Al-Daghri et al. 2014).

2.5.3 Postpartum depression

Postpartum depression can be defined as a "non-psychotic mental health problem characterised by emotional disorders and depressive mood, occurring in at least one episode during the first year after delivery" (Gibson et al. 2009). Research that investigates the relationship between breastfeeding and postpartum depression consistently shows negative association between the two variables, that is, high scores on postpartum depression scales indicate a low likelihood of breastfeeding (Hamdan and Tamim 2012). Also, failure in the establishment and continuation of breastfeeding was reported to be correlated to an increased risk of postpartum depression (Al-Hreashy et al. 2008, Yount and Smith 2012). During the early weeks of infancy, postpartum depression might be more influential on breastfeeding practices. Hatton et al. (2005) found that depressive symptoms negatively affect breastfeeding practices at six weeks after delivery ($p<0.001$), however, this relationship does not exist at 12 weeks. Furthermore, postpartum depression appears to have impact on shortening breastfeeding duration. A cohort study, that followed subjects for up to 12 months, concluded that postpartum depression is a significant risk factor for early cessation of breastfeeding, (adjusted hazard ratio 1.25, 95% confidence interval 1.03- 1.52) (Henderson et al. 2003). Additionally, a systematic review revealed that postpartum depression does not only have negative impact on breastfeeding, yet it could be associated with other barriers of breastfeeding such as the insufficient social support and the experience of major life events (Robertson et al. 2004).

There have been only a few studies that investigated postpartum depression, its prevalence and associated factors. A total of 15 studies conducted since 1983 reported variant rates of depression prevalence; ranging from 12% to 73% (Inam 2007). Female groups record higher scores on depression detection scales than males (Abdel-Khalek 2009). In terms of postpartum depression, a cross-sectional study (n=190 Saudi mothers, Al-Ahsa region) reported the prevalence of psychological distress; which was 35.3% using the General Health Questionnaire (GHQ) at eight weeks postpartum (Amr, Balaha, and Al Moghannum 2012). Two cross-sectional studies from Dammam (East) and Riyadh (Central) (n=450 and 571) that utilised the Edinburgh Postnatal Depression Scale (EPDS) revealed that the prevalence of postpartum depression was 17.8% and 14%, respectively (Alasoom and Koura 2014, Al-Modayfer et al. 2015). Another study in Riyadh, KSA (n=200 Saudi mothers diagnosed with postpartum depression) showed that low socio-economic status, delivery mode (caesarean section), increased number of previously dead children, and maternal middle age were significant risk factors for postpartum depression (Moawed and Al-Shami 2012). Despite the high prevalence of postpartum depression in the Saudi population, no studies have examined its impact on breastfeeding initiation and duration.

2.6 Difficulties and underlying causes of breastfeeding cessation

Previous studies on breastfeeding in Saudi Arabia have reported many reasons for refraining from breastfeeding. ‘Insufficient breastmilk’ was cited as the most prevailing reason by most studies, with approximately 50% of the populations studied reporting this as a reason to cease breastfeeding (Al-Ayed and Qureshi 1998, Al-Jassir, El-Bashir, and Moizuddin 2004, Al-Jassir et al. 2006). The dominance of this reason could be related to lower stimulation of

breasts, resulting in less milk secretion due to decreased breast suckling when bottle feeding is introduced (Kordy et al. 1992, Al-Ayed and Qureshi 1998). Despite the fact that physiological deficiency can occur, it is most likely not the principal reason behind what seems to be insufficient milk (Fida and Al-Aama 2003, El Mouzan et al. 2009). In addition, mothers may have simply believed that breastmilk on its own is not enough for a healthy baby (Al-Hreashy et al. 2008). A recent descriptive study (n=157) in Dammam City (East) reported a low percentage (3.8%) of breastfeeding difficulties such as mastitis, abscess and inverted nipples (Salem and Al Madani 2015). Other reasons include sickness of the child or the mother, the mother being pregnant again, problems with breastfeeding, and other such reasons (Al Juaid, Binns, and Giglia 2014). These reasons were provided less often, but still considerable despite the varying percentages of mothers across the published literature.

However, there might be other underlying, indirect determinants that lead to early breastfeeding cessation. Some of these are a lack of social support and promotional programs, and lack of knowledge about breastfeeding that mothers and the medical community have. Nowadays, women and young mothers have few opportunities to learn about breastfeeding due to the loss of traditional sources such as older women in the family as extended families have been replaced by nuclear ones (Giugliani 2004). So, new mothers become unknowledgeable about breastfeeding; which makes them very vulnerable to usual breastfeeding difficulties and perceived breastmilk insufficiency. These difficulties may induce breastfeeding cessation and early formula introduction whereas they were easily managed in the past (Giugliani 2004). Also, the present dominance of artificial formula feeding, along with intense marketing of formula can persuade mothers to believe that formula is the same, or even better than breastmilk (Bailey, Pain, and Aarvold 2004). Although mothers in Saudi Arabia appear to have sound knowledge about breastfeeding, they

might be placed under social pressure and adopt modern partial breastfeeding (Al-Yousif et al. 2011). Hence, many concerned health bodies have called for development of support and promotion programs to support breastfeeding practices and promote its knowledge within families and medical societies (Moran et al. 2006). In the KSA, promotional programs to assure healthy behaviours and practices, including breastfeeding, are ineffective, suffer severe shortage and need to be re-planned, increased and well implemented (Almalki, Fitzgerald, and Clark 2011). Acquiring knowledge is not sufficient to improve breastfeeding prevalence as norms, behaviours and practices that mothers are exposed to significantly affect breastfeeding and infant feeding choices.

Health professionals have a crucial part in giving support to mothers to enable them to practice breastfeeding, and in convincing them that artificial breastmilk substitutes are unnecessary. However, the medical staff might deprive the proper knowledge about breastfeeding due to poor breastfeeding education within medical schools (Rea et al. 1999). Alwelaie et al. (2010) reported that only about 5% of Saudi mothers received help in breastfeeding from the health team (doctors, midwives and lactation consultants). In addition, 62% of the health personnel working in Saudi Arabia are foreigners; most of them are non-Arabic speakers (Almalki, Fitzgerald, and Clark 2011). This has created cultural and language barriers for the medical staff in communicating with Saudi mothers and delivering breastfeeding instructions and support. Shortage in knowledge and lack of effective communication could cause reduction in breastfeeding education, promotion and rates.

The lack of promotional programs, supporting policy and effective implementation might lead mothers to stop breastfeeding and adopt artificial feeding. Breastfeeding initiation and

sustenance relies on promotion, support and educational programs which can be delivered by health care providers, medical staff, and mass-media and community groups. One of the programs that has been the most successful in improving breastfeeding rates and prevalence is the Baby Friendly Hospital Initiative (BFHI) developed and approved by the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) in 1991 and updated in 2009 (UNICEF and WHO 2009). This initiative authorises educational training, practices, as well as guidelines for health professionals and management in hospital to make breastfeeding for babies and mothers easier, providing clear policies that result in effective breastfeeding initiation and sustenance of the practice. Saudi Arabia has introduced the BFHI in 1995 to a limited number of its hospital and primary health care centres (Baldo et al. 2001).

However, Batterjee (2011) reported that the KSA does not have in place skilled training for Baby Friendly Hospital Initiative (BFHI), no national programs or policies in regards to breastfeeding, no support or community-based programs for other mothers, as is stipulated by the BFHI, as well as no infant nutrition training programs for providers, at least none of an ideal quantity or level. The author indicated that although there exists national legislation for maternity leave, codes regarding the advertising of breastmilk substitutes and other starting steps with regards to introducing the BFHI to few hospitals, the progression is still weak, with no surveillance or evaluation programs in place.

Across the KSA, many researchers have suggested that breastfeeding educational and promotional programs are in desperate need to be improved, well-planned, expanded and evaluated (Al-Jassir, Moizuddin, and Al-Bashir 2003, Al-Jassir et al. 2006, Alwelaie et al. 2010, Amin, Hablas, and Al Qader 2011, Batterjee 2010). Also, recent studies conducted in

Saudi hospitals noted that healthy term infants who do not require intensive care are typically isolated from their mothers and fed free formula (Albokhary and James 2014, Mosalli et al. 2012). It is not clear whether hospital policies in Saudi Arabia support breastfeeding or encourage artificial alternatives.

Wealth, affluence and prosperity, high consumerism and intensive formula advertising could be potential causes that underlie breastfeeding decline in Saudi Arabia. The massive increase in oil-related wealth brought about dramatic changes to the local, traditional community (Assad 2008). During the time of enormous growth, the country has expanded with businesses, investments, and consequently, changes in societal attitudes and lifestyles. International companies found a new land of massive opportunities where the Saudi authorities had not yet set rules and legislation to restrict and monitor imported products (Al-Shehri et al. 1995, Kordy et al. 1992). As a result, corporates that manufacture infant formulas have aggressively marketed their products without control, until 2004, when the first regulations and laws were passed under the Saudi Code of advertising substitutes of breastmilk (The Saudi Ministerial Council 2011). In front of this marketing, almost all Saudi families have been able to afford buying infant formulas because of the high consumerism brought by wealth affluence and prosperity (Assad 2008). In fact, declines in breastfeeding rates in the KSA have, directly and indirectly, resulted from a complex variety of social, economic, practical and professional causes.

2.7 The need for large longitudinal studies to investigate breastfeeding in the KSA

There are numerous studies in the literature that were conducted in order to report infant feeding patterns and to identify factors affecting breastfeeding and reasons behind its cessation. As discussed earlier in this chapter, all of these investigations were based on cross-sectional design. That means collecting data on infant feeding and associated factors have been done at one point in any time after delivery. The time lag was extending in some studies to as long as five years. However, breastfeeding is dynamic in nature, hence it needs to be studied through longitudinal research projects that monitor and track it over several time points in infant's first year; considering influences and factors that affect it alongside.

Also, sample sizes in some previous studies are very small that they could not provide reliable results. For example, sample sizes of 100, 128, 20, 102 mother-infant dyads have been used in the following studies, respectively: Khattab (2000), Fida and Al-Aama (2003), Batterjee (2010), and (Shahbar 2014). These small sizes of samples might undermine the power, reliability and generalizability of studies' findings. In addition, most previous studies have recruited their samples during routine vaccination in the centres of primary health care. This may make these samples not representative, could lead to misclassification; resulting in over- or under-estimated breastfeeding rates. Inclusion, exclusion criteria and peri-natal factors could not be effectively assured in such sample selection.

Furthermore, data analyses in previous research appeared to focus only on univariate statistics in analysing factors that are associated with infant feeding practices. Thus, available studies lack a standard list of covariates for adjustment; implying possibly confounded results. Although accurate measurement and reporting of breastfeeding rates depends mainly

on the use of standard definitions of breastfeeding categories, most investigations of breastfeeding in the KSA did not apply recognised definitions of breastfeeding indicators as agreed on by reputable international health organisations. Finally, despite the wide prevalence of disorders that are metabolic including diabetes mellitus and obesity in the Saudi population and their potential effects on breastfeeding, there is no studies yet to explore the association of these conditions with breastfeeding practices in this particular community.

Therefore, large-scale longitudinal cohort studies using standard definitions are strongly needed to accurately measure breastfeeding in Saudi Arabia and provide a clear understanding of infant feeding situation as well as factors and covariates influencing it. Based on findings of these proposed longitudinal investigations, Saudi health authorities would be able to plan, implement and evaluate breastfeeding promotion programs and campaigns; and consequently could achieve a rising trend in breastfeeding rates.

Chapter 3

3.0 Methodology

3.1 Overview

This section of the thesis outlines the procedures of the study. The study was carried out at two public hospitals in Western Saudi Arabia over the period from December 2013 to July 2014. Mothers who took part in this study filled in a questionnaire in hospital or shortly after discharge for purposes of gathering baseline data. They were followed up at 6, 16 and 26 weeks after birth by telephone interviews. The chapter describes the process involved and how all of the participants in the study were contacted by the research team at a six-month time postpartum and interviewed in relation to their breastfeeding behaviours during the six months and up to that point.

3.2 Data collection

3.2.1 Sample recruitment

In this study, a consecutive (systematic) sample of 600 mothers with their infants from two public hospitals in Western Saudi Arabia: Maternity and Children's Hospital in Jeddah City and Women and Maternity Hospital in Taif City was used. These two hospitals are the largest in the area and are typical of Saudi health care institutions. Although large public hospitals are occupied by most mothers giving birth, the small percentage of mothers giving birth at other hospitals (including private hospitals) is similar in breastfeeding practices due to the high homogeneity among the Saudi population (Ba'Aqeel 2009, Lacey 2011, Ministry of Health in the KSA [MOH] 2014). The recruiting period continued for two months from December 2013 to January 2014. Every day, an average of four to five mothers were recruited in each hospital during this period. After delivery, mothers usually remain in

hospital with their infants for two to three days before discharge. While in hospital, all eligible mothers were contacted by the trained female research staff and were given invitations to become participants in this study. Interested mothers were given information sheets containing description of the study's objectives and methodology along with verbal explanations. When the mother had agreed to be involved in the study, she was then enjoined to sign and return a form that demonstrated that they had given consent. A mother was considered appropriate for being a study participant based on the criteria of inclusion, which are explained below.

3.2.2 Criteria of inclusion and exclusion

Criteria of inclusion are mothers above 18 years of age who deliver healthy, full term infants of normal weight (≥2500g), both primi- and multi-parous mothers, and singleton births. For the purposes of this study (and for comparability with other studies) a healthy infant is defined as one who was not admitted to a neonatal intensive care unit for longer than 72 hours. Mothers who are considered by the nursing or medical staff to be unable (or not advisable for them) to participate in the study were excluded. Also, exclusion criteria include mothers who are not Saudi citizens.

3.2.3 Sample size calculation

The software Statcalc V.7 from Epi Info (2013) was used to determine the sample size. Assuming that the rate of 'any breastfeeding' at half a year is 60%, alongside a confidence level of 0.05, a sample of 576 mothers will give a 95% confidence interval of 56% to 64% (± 4). So, a sample of 700 mothers will be a target for recruitment, taking into consideration the rates of no response and drop-out to be 10% each. This method in study sample calculation

was used in previous breastfeeding studies (Cox, Giglia, and Binns 2015, Karkee et al. 2014, Tang et al. 2013).

3.2.4 Study design and data collection procedure

This current study was constructed to be a cohort study whereby the researcher followed subjects from birth up to six months from December 2013 to July 2014. At the selected time points during this period, information was collected in regards to socio-demographics, the patterns and practices of infant feeding, the status of type 2 diabetes, maternal obesity, postnatal depression, breastfeeding initiation, duration and intensity, and attitudes towards breastfeeding. Specifically, data were collected four times: in hospital, at 6, 16, and 26 weeks after birth. In hospital, participating mothers were contacted personally by the trained female research team to invite them and provide them with information sheet. Mothers who concurred to be participants in the study signed an informed consent and completed a baseline questionnaire. After discharge, mothers were followed up by telephone interview, or when needed at the time of primary health care centre visits to undertake periodic vaccinations. Early breastfeeding initiation is defined as within the first hour after birth (World Health Organisation [WHO] 2008). However, breastfeeding is more likely to be established when it is initiated as soon as possible after birth. In this study, breastfeeding initiation was categorised into four groups: mothers who initiated breastfeeding within one hour, 1 -4 hours, 4-24 hours and more than 24 hours after birth. 'Any breastfeeding' duration was calculated up to 26 weeks.

Data on type 2 diabetes were available from the patients' records at the hospitals, and the use of this data was included in the consent form. Questions on pre-pregnancy maternal weight,

height and type 2 diabetes status were included in the baseline questionnaire. Mothers' weight and height at six months after birth were measured by research personnel at primary health care centres during vaccination visits. The researcher entered the collected data to the computer for processing and analysis.

3.2.5 Data collection instruments

A demographic and breastfeeding information questionnaire was completed by participating mothers shortly after delivery in hospital to collect baseline data. Then, it was used again to follow up mothers at 6, 16 and 26 weeks after birth. The questionnaire collected information on breastfeeding outcomes (such as initiation and duration) together with socio-demographic (for example age and education), biomedical (parity, obstetric experience), health services related factors (rooming-in, demand feeding) and psychosocial and cultural factors (for example social support) related to breastfeeding. This tool was previously validated and utilised in infant feeding research in many countries including Australia, China, Kenya and Vietnam (Binns and Graham 2005, Duong, Binns, and Lee 2004, Lakati, Binns, and Stevenson 2002, Xu et al. 2007). The standard definitions of breastfeeding categories and terms endorsed by the World Health Organisation (WHO) were used in the present study to classify subjects to their corresponding categories (WHO 2008).

The Arabic version of the Iowa Infant Feeding Attitudinal Scale (IIFAS) was integrated into the questionnaire to collect information on attitudes and knowledge of participating mothers towards infant feeding methods at birth and 26 weeks postpartum (De La Mora et al. 1999). This scale consists of 17 items; each item scores from 1 to 5. Scores are then summed, and the total ranges from 17 to 85. A higher score achieved on IIFAS indicates a more positive

attitude toward breastfeeding. IIFAS is a valid and reliable assessment tool for attitudes towards infant feeding and was translated to Arabic, validated and used in some Arabic countries such as Syria, Jordan and Saudi Arabia (Al-Akour et al. 2010, Al-Madani, Vydelingum, and Lawrence 2010). This tool achieved a Cronbach alpha reliability test of $\alpha = 0.6$ when applied in the KSA (Al-Madani, Vydelingum, and Lawrence 2010). Attitudes of mothers toward breastfeeding were divided into two levels: low when the total score of the Iowa Infant Feeding Attitudinal Scale (IIFAS) is below the mean score, and high if the total IIFAS score is above or equal the mean. Taking the mean or the median of IIFAS as a cut-off point has been adopted by other studies (Scott et al. 2009).

To screen for postnatal depression among participating mothers, the Edinburgh Postnatal Depression Scale (EPDS) was administered to participants in hospital before discharge and at 26 weeks after birth (Cox, Holden, and Sagovsky 1987). This tool is a reliable and valid instrument which was validated and has been used by investigators in the United Arab Emirates, Iran, and India (Ghubash, Abou-Saleh, and Daradkeh 1997, Hamdan and Tamim 2012, Mazhari and Nakhaee 2007, Savarimuthu et al. 2010). EPDS is a scale of ten items, which are added up to total scores that range from zero to 30. For analysis of postnatal depression, the mothers in the whole sample were classified into two groups using a cut-off point of the total score of the Edinburgh Postnatal Depression Scale (EPDS) of below or above 12. For the purposes of analysis, an EPDS score of greater than 12 was considered depressive mode. The cut-off point of 12 on EPDS has been used in other studies (Cooke, Schmied, and Sheehan 2007, Cox, Holden, and Sagovsky 1987).

Anthropometric measurements including infant weight and height; and routine biochemistry were obtained directly from the hospital records. Maternal obesity was determined using the body mass index (BMI) that is calculated through dividing weight (in kilograms) by squared height (in metres squared). The cut-off points of BMI will follow the WHO standards (WHO 2015a). Type 2 diabetes diagnostic criteria were set according to standards adopted by the International Diabetes Federation (IDF) and the WHO (WHO and IDF 2006).

The collection of these data and information from the projected sample size population enabled investigation of the proposed objectives. All the questionnaires were translated into the Arabic language and translated back into English (included in Appendix 4). The translation was certified by staff at Taif University, KSA and by an independent, accredited translation office. The training of data collectors (research staff) was conducted at research training sessions prior to entering the field. The training sessions focused on the need for consistency between collectors, the correct completion of the surveys and standardised anthropometric methods. The training was followed by the implementation of the survey with a pilot group of 20 volunteer mothers.

3.3 Statistical analysis

Collected data were coded and entered to the computer to be checked for any unexpected responses, entries or errors, and then to be cleaned appropriately. The statistical package for social sciences (SPSS V.20) was utilised to manage, process and analyse data, and to present results and findings. Descriptive statistics were generated for the main variables and outcomes to determine ‘any’ as well as ‘exclusive’ breastfeeding rates, initiation rate and the prevalence of other conditions, including maternal obesity, type 2 diabetes, and postnatal

depression. The data were analysed at the selected time points: at birth, week 6, 16 and 26 after birth in order to monitor breastfeeding trends over this period. Bivariate analyses were conducted to explore unadjusted relationships between characteristics of the study sample and outcome variables of interest (breastfeeding practices). Chi-square and t-test analyses calculated the relationship between any socio-demographic, biological or psychosocial factors and breastfeeding outcomes. Chi square tests were used to compare groups of mothers in the two places of study as well as to evaluate the relationship between categorical variables. Student's t-test was used to determine the association between continuous variables and outcomes. Multivariable logistic regression and Cox regression analyses were carried out to investigate the relationship between the main variables. The durations of 'any' and 'exclusive' breastfeeding were calculated along the study period (six months) using Kaplan Meier survival analysis. Risk factors associated with breastfeeding (any and exclusive) to 16 and 26 weeks were assessed using logistic regression. Common covariates identified in the literature from similar studies were included in multivariate models. The final models were obtained using stepwise (backward elimination or forward selection) procedure. All proposed tests were two-tailed, and a *p*-value of less than 0.05 is considered statistically significant.

3.4 Ethical consideration

An application for ethical approval was submitted to the Human Research Ethics Committee of Curtin University, and the project was approved (approval number HR120/2013, a copy is included in Appendix 1). Also, applications for ethics approval were applied for at both the maternity and children's hospitals at the two study sites: Jeddah and Taif cities in Western Saudi Arabia, and were approved (approval numbers: Jeddah: H-02-J-002; Taif: 46758/302/47 J, included in Appendix 1). All invited mothers were provided with information sheets and verbal explanations of the study, illustrating the study objectives,

significance, methods and contact details, and that participants' privacy is fully respected (a copy of information sheet is included in Appendix 2). The research staff informed participating mothers that the anonymity and confidentiality of collected information will be ensured throughout the study procedure and publication of findings. Subjects who agree to be participants were asked to endorse and return the forms of informed consent (a copy is included in Appendix 3). Participants were notified that involvement in the study is completely voluntary, as well as the fact that they had rights to decline or withdraw from the study at any time without any impact on treatment or health services provided to them. The consent forms also request permission to use routinely collected biomedical and haematological data. All questionnaires will be stored in secure premises of Curtin University for a minimum period of seven years.

Chapter 4

4.0 Results

4.1 Introduction

This chapter reports results from the study. It begins with presenting the descriptive results, which include the demographic, biomedical and psychosocial characteristics of the studied sample. Details of the current prevalence of infant feeding practices (objective 1), prevalence of maternal obesity, type 2 diabetes and postpartum depression follow the descriptive results. Then, analytical statistics will explore associations between breastfeeding outcomes (initiation and duration) and health conditions of interest (maternal obesity, type 2 diabetes and postpartum depression) (objective 3). The role of maternal attitudes toward breastfeeding in determining infant feeding methods will be included in the analysis (objective 4). Findings also include risk factors associated with breastfeeding cessation (objective 2), breastfeeding difficulties (objective 6) and comparisons of subgroups in terms of city of residence (objective 5).

4.2 Response rate

The study targeted a consecutive sample of 600 mother-infant dyads. Six hundred eligible mothers were invited to participate in the study, and a total of 578 contacted mothers agreed to participate and have been followed up to a period of six months. Therefore, the response rate was 96.3%. The whole sample was followed up to six months after birth, however, some cases were missing or missed some values for certain variables. These missing values are indicated in tables and figures where applicable.

4.3 The descriptive results

4.3.1 Demographic and social characteristics of the study sample

Demographic and social characteristics of the sample are shown in Table 4.1. The comparison between subgroups is based on the place of residence; Taif and Jeddah Cities. Numbers and percentages in each city and each variable are presented in the table. Chi square results are used to test the differences between groups in the two cities in terms of each variable and *p*-values are, therefore, provided (*p*-value below 0.05 implies significant difference).

As it is shown in Table 4.1, there are several differences between mothers from Taif City and Jeddah City. First, a significantly higher proportion of mothers from Taif were in the age groups of 30–34 and ≥35 while there was a higher proportion of mothers from Jeddah in the other two age groups. Second, it appears that Jeddah's mothers are more educated than Taif's mothers. It is worth noting that no mothers have higher education (master and doctorate degrees) in the sample. Also, there are more mothers from low socio-economic status in Taif while mothers from intermediate socio-economic status are more likely to live in Jeddah.

Table 4.1, also, reveals that the clear majority of mothers in both cities are not working (housewives) although 33.4% of all mothers have bachelor degrees. The nuclear family is the predominant type of family among all mothers (in both cities). Differences between mothers from both cities are statistically significant (*p*-value <0.05) in all variables, except for maternal employment and family monthly income, where the differences are not significant (*p*-value >0.05).

Table 4.1 Demographic and social characteristics of the study sample (n=578).

Variables	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
Maternal age (years)			
<25	44 (15.5)	57 (19.7)	0.001
25-29	76 (26.8)	114 (39.3)	
30-34	103 (36.3)	77 (26.6)	
≥35	61 (21.5)	42 (14.5)	
Maternal education (years)			
Before high school (<12)	101 (35.1)	65 (22.6)	<0.001
High school and diploma (12-15)	88 (30.6)	129 (44.9)	
Bachelor degree (16-17)	99 (34.4)	93 (32.4)	
Maternal employment			
Not working (housewife)	249 (86.5)	253 (87.5)	0.698
Working	39 (13.5)	36 (12.5)	
Family monthly income (in Saudi Riyal)*			
≤6000	136 (47.2)	120 (41.7)	0.246
6001-12000	120 (41.7)	140 (48.6)	
>12000	32 (11.1)	28 (9.7)	
Family type			
Nuclear	267 (92.7)	253 (87.2)	0.029
Extended	21 (7.3)	37 (12.8)	
Residence type			
Rented	146 (50.7)	147 (50.7)	0.028
Owned	142 (49.3)	136 (46.6)	
Governmental or company	0 (0)	7 (2.4)	
Socio-economic status			
High	26 (9)	23 (7.9)	<0.001
Intermediate	124 (43.1)	184 (63.4)	
Low	138 (47.9)	83 (28.6)	

* 1 Australian Dollar = 2.9 Saudi Riyals.

4.3.2 Biomedical and psychological characteristics of the study sample

Biomedical and psychological characteristics of the sample are maternal body mass index (BMI), parity, delivery type, type 2 diabetes status, infant's gender and weight, total scores of the Edinburgh Postnatal Depression Scale (EPDS) and the Iowa Infant Feeding Attitudinal Scale (IIFAS). Table 4.2 shows the biomedical and psychological characteristics of the study sample. The table includes numbers as well as percentages in each city and each variable.

BMI score was calculated before pregnancy in kilograms per metres squared (Kg/metres squared). Categories of BMI used for classification were according to the definition of the World Health Organisation (WHO) (WHO 2015a). Type 2 diabetes diagnostic criteria have been set according to standards adopted by the International Diabetes Federation (IDF) and the WHO, and its results presented here are based on the subjects' health records (WHO and IDF 2006).

For analysis of postnatal depression, the mothers in the whole sample were classified into two groups using a cut-off point of the total score of the Edinburgh Postnatal Depression Scale (EPDS) of below or above 12. For the purposes of analysis, an EPDS score of greater than 12 was considered depressive mode. The cut-off point of 12 on EPDS has been used in other studies (Cooke, Schmied, and Sheehan 2007). Attitudes of mothers toward breastfeeding were divided into two levels: low when the total score of the Iowa Infant Feeding Attitudinal Scale (IIFAS) is below the mean score (the sample mean IIFAS is 61), and high if the total IIFAS score is above or equal the mean. Taking the mean or the median of IIFAS as a cut-off point has been adopted by other studies (Scott et al. 2009).

From Table 4.2, it appears that some differences exist between mothers from the two cities. In terms of obesity, the proportions of overweight and obese mothers in the sample are higher than those of normal weight, particularly in Taif City (34.7% and 20.8% for overweight and obesity, respectively). The differences in obesity and overweight proportions between the two subgroups are significant (p-value = 0.001). The multi-parity is predominant in the sample (over 70%), and the most delivery route is through vagina (above 80%). In regards to infant's gender, there are more females in the Jeddah group than in Taif group (56% versus 48%). The infants' weights were slightly heavier in the Jeddah group (p-value <0.001). Significantly more diabetic mothers were observed in the Taif sample than in Jeddah sample (11.8% versus 6.2%, p-value = 0.019). There was no difference in the EPDS scores between the mothers from Taif and those from Jeddah. According to the Iowa Infant Feeding Attitudinal Scale (IIFAS), higher positive attitudes toward breastfeeding were observed among Jeddah mothers, compared to the Taif mothers (p-value <0.001).

Table 4.2 Biomedical and psychological characteristics of the study sample (n=578).

Variables	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
Maternal body mass index (Kg/m^2) [a]			
Normal (<25)	128 (44.4)	175 (60.6)	<0.001
Overweight (25-<30)	100 (34.7)	84 (29.1)	
Obese (≥30)	60 (20.8)	30 (10.4)	
Parity			
Primiparous	67 (24.3)	87 (30)	0.126
Multiparous	209 (75.7)	203 (70)	
Delivery type			
Vaginal	240 (83.3)	235 (81)	0.47
Caesarean	48 (16.7)	55 (19)	
Infant's gender			
Male	150 (52.1)	128 (44.1)	0.056
Female	138 (47.9)	162 (55.9)	
Infant's weight (gm)			
<3000	160 (55.6)	116 (40)	<0.001
3000-4000	128 (44.4)	162 (60)	
Maternal type 2 diabetes [a]			
Yes	34 (11.8)	18 (6.2)	0.019
No	254 (88.2)	272 (93.8)	
Edinburgh Postnatal Depression Scale (EPDS)			
Normal (≤12)	239 (83)	244 (84.7)	0.571
Depressive (>12)	49 (17)	44 (15.3)	
Iowa Infant Feeding Attitudinal Scale (IIFAS)			
Low (<61) [b]	178 (61.8)	113 (39.1)	<0.001
High (≥61)	110 (38.2)	176 (60.9)	

a= based on the WHO and IDF criteria. b= the mean IOWA total score is 61.

4.4 Breastfeeding indicators

Breastfeeding establishment and duration were explored through reporting initiation and duration of breastfeeding. Also, the prevalence of 'exclusive', 'partial (mix)' and 'any' breastfeeding are presented to illustrate breastfeeding intensity among mothers in the sample.

4.4.1 Breastfeeding initiation

Early breastfeeding initiation is defined as within the first hour after birth (World Health Organisation [WHO] 2008). However, breastfeeding is more likely to be established when it is initiated as soon as possible after birth. Numbers and percentages of mothers who initiated breastfeeding within: one hour, 1-4 hours, 4-24 hours and more than 24 hours after birth in both cities Taif and Jeddah are presented in Table 4.3.

The timely (less than one hour) breastfeeding initiation prevalence among mothers in the study sample is 36.1%. The mothers tended to either initiate breastfeeding early (less than one hour after birth), or delayed it after 4 hours or even 24 hours after birth (see Table 4.3). There are no significant differences between study groups from Taif and Jeddah in terms of breastfeeding initiation timing (p-value = 0.421).

Table 4.3 Breastfeeding initiation rates in Taif and Jeddah depending on time after birth (n = 578).

Time of breastfeeding initiation	Total N (%)	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
Less than one hour	206 (36.1)	104 (36.1)	102 (36)	0.421
Within 1-4 hours	77 (13.5)	33 (11.5)	44 (15.5)	
Within 4-24 hours	143 (25)	73 (25.3)	70 (24.7)	
More than 24 hours	134 (23.5)	74 (25.7)	60 (21.2)	
Missing data	18 (1.9)	4 (1.4)	14 (2.6)	

4.4.2 The prevalence of breastfeeding

Table 4.4 presents numbers and percentages of mothers in each breastfeeding category at each time point during the study course: at birth, 6, 16, and 26 weeks postpartum. The category of partial (mixed) breastfeeding includes infants who were fed breastmilk and formula. The percentages in the table columns exceed 100% in total because some categories of breastfeeding overlap others.

In Table 4.4, 'exclusive breastfeeding' rate has decreased over time, from 48.6% at birth to only 7.7% at six months after birth. There are high prevalence rates of 'any breastfeeding' during the first three months of life. However, this rate dropped to 46.6% at six months.

Partial (mixed) feeding, which includes breastmilk as well as its substitutes, has been a predominant method of infant-feeding at 6 and 16 weeks postpartum (adopted by more than

half of mothers). However, the prevalence of this method has decreased sharply at six months (38.9%) due to an increase in exclusive bottle-feeding (50.3%) (Table 4.4).

Table 4.4 The prevalence of infant feeding practices among mothers at each time point (n = 578).

Infant feeding method	N (%)			
	At discharge	6 weeks postpartum	16 weeks postpartum	26 weeks postpartum
Exclusive Breastfeeding	281 (48.6)	161 (28.9)	107 (18.7)	44 (7.7)
Partial (mixed) feeding	181 (31.3)	322 (56.1)	312 (54.5)	223 (38.9)
Any Breastfeeding	462 (79.9)	483 (84.1)	419 (73.1)	267 (46.6)
Bottle-feeding	116 (20.1)	91 (15.9)	154 (26.9)	288 (50.3)
Missing cases	0 (0)	4 (0.69)	5 (0.86)	23 (3.9)

Comparison between Taif and Jeddah cities in Table 4.5 shows the prevalence rates of breastfeeding in the two cities at each time point, with mean percentages and *p*-values from Chi square tests to evaluate the differences.

At discharge from hospital, more than half of mothers in Taif were exclusively breastfeeding while less than half of mothers in Jeddah were doing so. However, at the same time the Taif mothers had a higher rate of formula feeding. 'Partial (mixed) feeding' and 'any breastfeeding' were more prevalent among mothers from Jeddah (Table 4.5). These differences were statistically significant (*p*-value = 0.034 for 'any breastfeeding' category, and *p*-value = 0.001 for other infant feeding categories).

At 16 weeks postpartum, the same trend was observed in both cities (the same as at six weeks postpartum). The prevalence rate of ‘exclusive breastfeeding’ at 26 weeks after birth was higher in the Jeddah group than in Taif group (12.6% versus 2.8%, *p*-value <0.001). At six months after birth, ‘exclusive breastfeeding’ was less prevalent among Taif group. The ‘any breastfeeding’ rates at Taif and Jeddah were almost identical.

Table 4.5 Comparison of the prevalence (numbers and percentages) of infant feeding practices between mothers from Taif and Jeddah at each time point (n = 578)

Infant feeding method	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
At discharge			
Exclusive Breastfeeding	150 (52.1)	131 (45.2)	0.001
Partial (mixed) feeding	70 (24.3)	111 (38.3)	
Bottle-feeding	68 (23.6)	48 (16.6)	
Any Breastfeeding	220 (76.4)	242 (83.5)	0.034
At 6 weeks postpartum			
Exclusive Breastfeeding	73 (25.3)	88 (30.8)	<0.001
Partial (mixed) feeding	199 (69.1)	123 (43)	
Bottle-feeding	16 (5.6)	75 (26.2)	
Any Breastfeeding	272 (94.4)	211 (73.8)	<0.001
At 16 weeks postpartum			
Exclusive Breastfeeding	46 (16)	61 (21.4)	<0.001
Partial (mixed) feeding	199 (69.1)	113 (39.6)	
Bottle-feeding	43 (14.9)	111 (38.9)	
Any Breastfeeding	245 (85.1)	174 (61.1)	<0.001
At 26 weeks postpartum			
Exclusive Breastfeeding	8 (2.8)	36 (12.6)	<0.001
Partial (mixed) feeding	126 (43.8)	97 (34)	
Bottle-feeding	154 (53.5)	134 (47)	
Any Breastfeeding	134 (46.5)	133 (46.7)	0.973

4.4.3 Breastfeeding duration

'Any breastfeeding' median duration was calculated from the 26-week follow up as more than 50% had stopped breastfeeding by that time. Table 4.6 presents the medians and interquartile ranges (IQR) of 'any breastfeeding' duration in the total sample as well as

between groups of residence. The comparison between the two groups was determined by the Kaplan Meier survival analysis.

Table 4.6 Breastfeeding duration (in weeks) in the whole sample, and comparing it between Taif and Jeddah.

Any breastfeeding duration (weeks)	Whole sample (n = 578)	Taif (n=288)	Jeddah (n=290)	*p*-value
Median (in weeks)	18	18	18	0.037
Interquartile range (IQR)	18	12.75	21	

The median duration of 'any breastfeeding' among the whole sample is 18 weeks (interquartile range IQR = 18). The same median of 'any breastfeeding' duration was observed in both places of residence: Taif and Jeddah (Table 4.6). However, the dispersion measure (IQR) between the two cities is widely different (12.75 in Taif versus 21 in Jeddah). The *p*-value from Mann-Whitney U test is 0.037 (see Table 4.6) which indicates a statistically significant difference in the median breastfeeding duration between the two cities. To further examine this difference, Figures 4.2 and 4.2.1 show that mothers from Taif City had a longer duration than those from Jeddah.

The Kaplan Meier survival analysis was used to draw the survival curves of 'any breastfeeding' along its duration from birth to 26 weeks postpartum. Figure 4.1 depicts the survival analysis of 'any breastfeeding' duration for the whole sample (n = 578). The percentage of breastfed infants begins with 100% at birth because mothers who did not initiate breastfeeding at all are not included in the analysis. 'Any breastfeeding' rates began

to decline after discharge from hospital and then decreased gradually over time until it reached 46% at 26 weeks postpartum (see Table 4.3 and Figure 4.1).

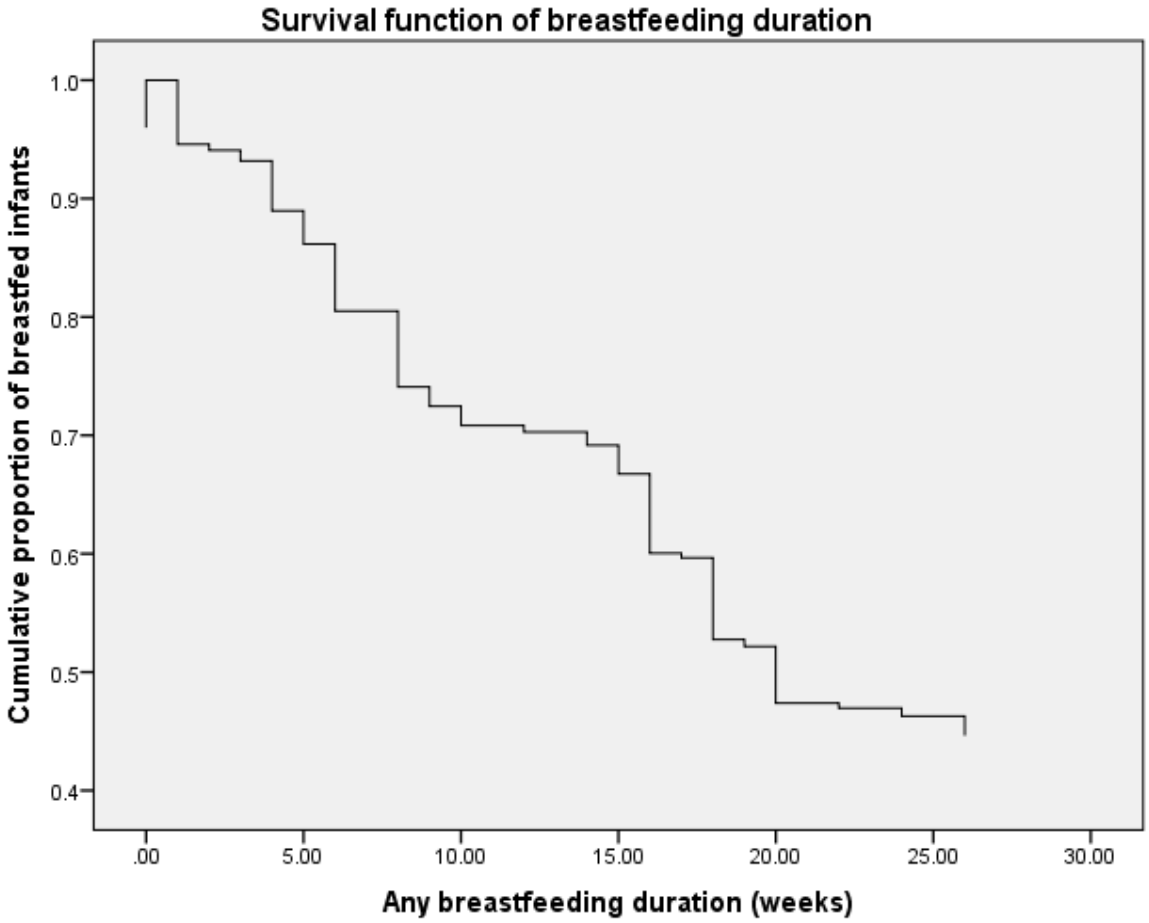

Figure 4.1 Breastfeeding duration over six months after delivery among the whole study sample*.

(*Mothers who did not initiate breastfeeding at all are not included in the analysis).

Log-rank test was used to examine the equality of survival distribution between the two cities of residence. Figure 4.2 shows the survival analysis of breastfeeding duration separated for

each city of residence, Taif and Jeddah while Figure 4.2.1 presents box-plots for the distribution of 'any breastfeeding' duration across the two cities. Survival curves in Figure 4.2 and box-plots in Figure 4.2.1 suggest that infants from Taif City had a longer breastfeeding duration than those from Jeddah City. This is consistent with comparison from the Mann-Whitney U test, where there is a significant difference between medians of breastfeeding duration in the two cities (p-value = 0.037, Table 4.6).

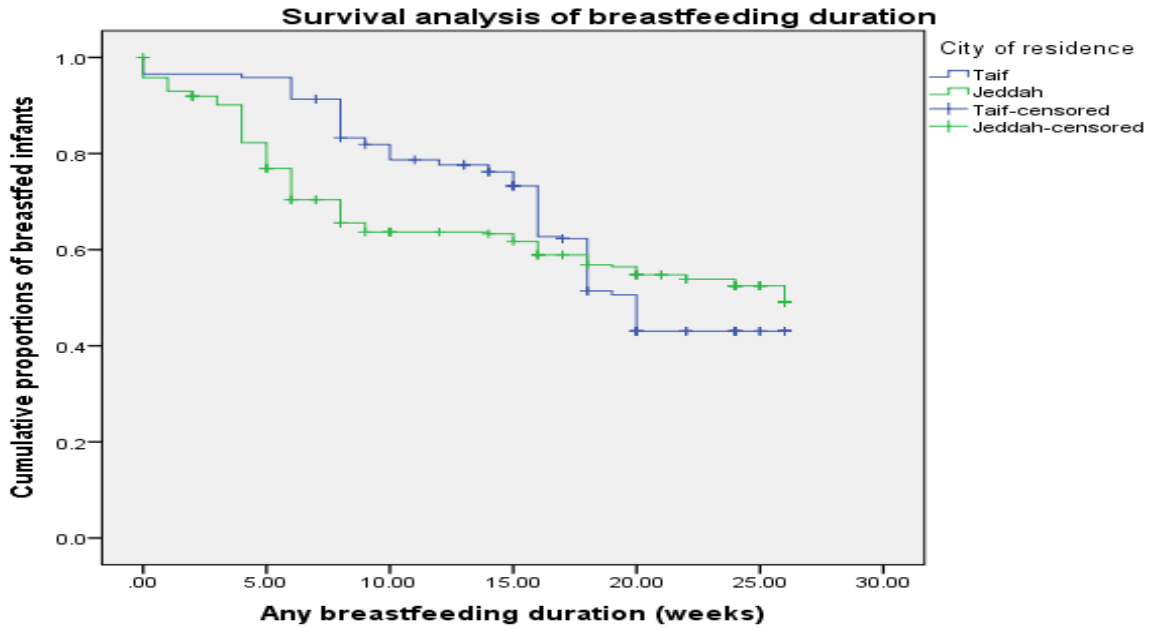

Figure 4.2 Breastfeeding duration over six months after delivery among mothers* from Taif and Jeddah, separately. (*Mothers who did not initiate breastfeeding at all are not included in the analysis).

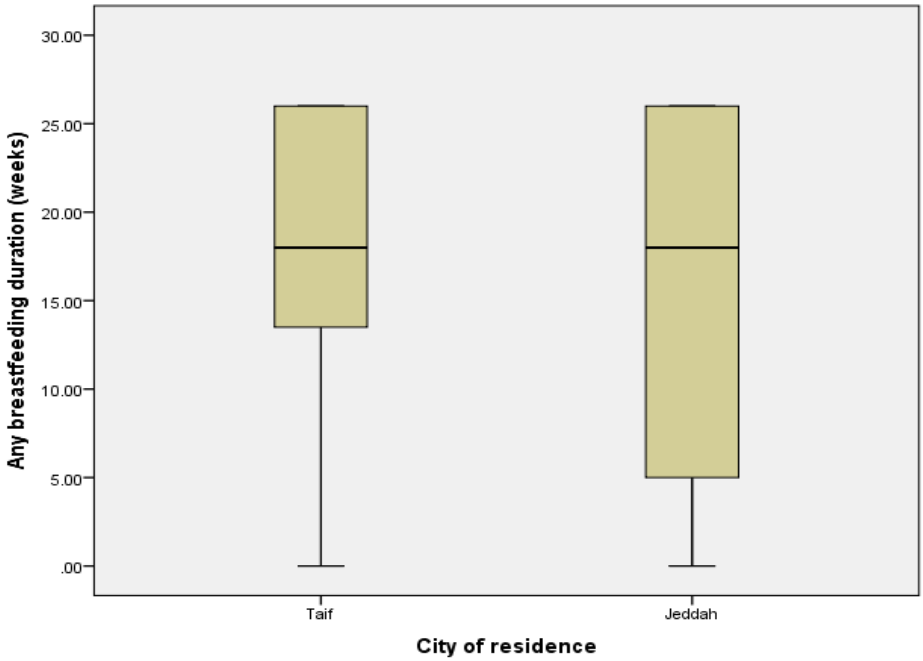

Figure 4.2.1 Box-plots of 'any breastfeeding' duration distribution across the two cities: Taif and Jeddah.

4.4.4 Formula introduction

Infant formula had been introduced to many infants soon after birth, and at six weeks 71% of the sample had been given some infant formula. Table 4.7 shows numbers and percentages of mothers who introduced formula to their infants within: less than six weeks, 6-16 weeks and 17-26 weeks, in both cities of residence: Taif and Jeddah, along with Chi square and p-value.

In general, most mothers introduced infant formula very early, before six weeks of infants' age (71%), with the mothers in Jeddah introducing infant formula slightly earlier than in Taif (77.3% versus 67% within six weeks of age). The difference between Taif and Jeddah is statistically significant (*p*-value = 0.022).

Table 4.7 Formula introduction in Taif and Jeddah separately and in the whole sample (n = 578).

Age when formula introduced	Total N (%)	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
< 6 weeks	412 (71.3)	191 (67)	221 (77.3)	0.022
6-16 weeks	122 (21.1)	71 (24.9)	51 (17.8)	
17-26 weeks	37 (6.4)	23 (8.1)	14 (4.9)	
Missing cases	7 (1.2)	3 (1)	4 (1.4)	

4.4.5 Solid food introduction

Solid foods were, almost always introduced after the introduction of infant formula. Numbers and percentages of mothers who introduced solids to their infants within: less than six weeks, 6-16 weeks and 17-26 weeks, in both cities of residence: Taif and Jeddah, are presented in Table 4.8.

From Table 4.8, no mother had introduced solid food to infants before six weeks of age. The vast majority (90.2%) of mothers delayed the introduction of solid foods until 16 weeks and after (Table 4.8). The mothers in Jeddah had introduced solid food earlier (in the period 6-16 weeks) than in Taif (4.2% versus 3.3%), but the difference was too small to be significant with our sample size.

Table 4.8 Solid food introduction in Taif and Jeddah separately and in the whole sample (n = 578).

Age when solids introduced	Total N (%)	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
< 6 weeks	0	0	0	0.583
6-16 weeks	20 (3.4)	9 (3.1)	11 (3.8)	
17-26 weeks	521 (90.2)	267 (92.7)	254 (87.6)	
Missing data	37 (6.4)	12 (4.2)	25 (8.6)	

4.4.6 Maternal attitudes toward breastfeeding

Maternal attitudes toward breastfeeding were measured using the Iowa Infant Feeding Attitudinal Scale (IIFAS) (De La Mora et al. 1999). This scale consists of 17 items; each item scores from 1 to 5. Scores are then summed, and the total ranges from 17 to 85. A higher score achieved on IIFAS indicates a more positive attitude toward breastfeeding. Descriptive statistics (means and standard deviations) of the total IIFAS scores for the whole sample and within the two cities of residence are presented in Table 4.9, along with the *p*-value from *t*-test for comparison.

From Table 4.9, the mean IIFAS score among the whole sample (n=578) is 61.25 (SD = 8.09). Mothers from Jeddah City achieved relatively higher scores on IIFAS than mothers from Taif (the mean in Jeddah is 62.73 and in Taif is 59.77, see Table 4.9). This difference is statistically significant (*p*-value < 0.001).

Table 4.9 Descriptive results for maternal attitudes toward breastfeeding (IIFAS^ scale as a continuous variable) in the whole sample (n = 578) and in Taif and Jeddah separately.

Maternal attitudes (total IIFAS^)	Mean	Standard deviation	*p*-value (*t*-test)
Total	61.25	8.09	
Taif City	59.77	8.69	< 0.001
Jeddah City	62.73	7.16	

^ IIFAS Iowa Infant Feeding Attitudinal Scale.

The mean IIFAS score in the total sample (61) was taken as a cut-off point to differentiate between the high and low scores of IIFAS. Maternal attitudes were then categorised into two classes: high and low. Table 4.10 shows the proportion of high and low maternal attitudes toward breastfeeding (high and low IIFAS scores) in the whole sample and among each city, including *p*-value from Chi square test.

Almost half of mothers in the whole sample had positive (high scores) attitudes toward breastfeeding (49.5%) (Table 4.10). Taif City had a lower percentage of mothers who had positive attitudes toward breastfeeding (38.2%) compared to Jeddah City which had a higher percentage (60.7%). The difference between both cities regarding attitudes toward breastfeeding is statistically significant (*p*-value < 0.001) (see Table 4.9).

Table 4.10 The proportion of high and low maternal attitudes toward breastfeeding in the whole sample (n = 578) and in Taif and Jeddah separately.

Maternal attitude (total IIFAS*)	Total N (%)	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
High (≥61)	286 (49.5)	110 (38.2)	176 (60.7)	< 0.001
Low (< 61)	291 (50.3)	178 (61.8)	113 (38.9)	
Missing cases	1 (0.2)	0 (0)	1 (0.4)	

* IIFAS Iowa Infant Feeding Attitudinal Scale.

4.4.6.1 The role of maternal attitudes in determining feeding method

To investigate the role of maternal attitude toward breastfeeding in determining which method of infant feeding will be chosen, cross-tabulation and Chi square tests were performed between attitudes categories and breastfeeding status at discharge and 26 weeks postpartum. Table 4.10.1 shows numbers and percentages of mothers in each category.

There were no differences between mothers with positive (high scores) and negative (low scores) attitudes when choosing feeding methods at discharge and after six months (*p*-values = 0.678 and 0.111, respectively).

Table 4.10.1 Cross-tabulation of high and low maternal attitudes toward breastfeeding and breastfeeding status at discharge and after 26 weeks.

Maternal attitudes toward breastfeeding (based on IIFAS* score)	Low (n=291) N (%)	High (n=286) N (%)	*p*-value
Breastfeeding status at discharge			
Yes	230 (79)	231 (80.8)	0.678
No	61 (21)	55 (19.2)	
Missing	0 (0)	0 (0)	
Breastfeeding status at 26 weeks			
Yes	124 (42.6)	143 (50)	0.111
No	163 (56)	142 (49.6)	
Missing	4 (1.4)	1 (0.4)	

* IIFAS Iowa Infant Feeding Attitudinal Scale.

4.5 Prevalence of obesity, diabetes and postpartum depression

4.5.1 Obesity prevalence among mothers

Maternal obesity levels were examined using the body mass index (BMI). In order to calculate BMI, mothers' weights and heights were measured and recorded during visits to the primary healthcare centres. The pre-pregnancy BMI was calculated on the basis of respondent reported weight and height that were included in the baseline questionnaire. BMI data were categorised according to the World Health Organisation classification (WHO) (WHO 2015a). Table 4.11 includes numbers and percentages of mothers by their BMI and

place of residence. Chi square tests were performed to determine the significant difference in mothers' BMI between the two cities.

From Table 4.11, the prevalence rates of overweight and obesity among mothers before pregnancy were 31.8% and 15.5%, respectively. This data has to be interpreted conservatively as it is self-reported. At 26 weeks after birth, overweight and obesity were prevalent in 46.5% and 27% of the subjects, respectively. It is noticeable that overweight and obesity rates at 26 weeks postpartum are still higher than before pregnancy (Table 4.11).

Comparison between the two cities of residence showed that Taif City had more overweight and obese mothers at both points of measurement than Jeddah. At both measurement phases, the differences in mothers' BMI between Taif and Jeddah were statistically significant (p-value < 0.001).

Table 4.11 Numbers and percentages of mothers by their body mass index (BMI) and city at each time point (n = 578)

Maternal body mass index (Kg/m^2)*	Total N (%)	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
Pre-pregnancy				
Normal (<25)	303 (52.5)	128 (44.4)	175 (60.3)	<0.001
Overweight (25-<30)	184 (31.8)	100 (34.7)	84 (28.9)	
Obese (≥30)	90 (15.5)	60 (20.8)	30 (10.4)	
Missing	1 (0.2)	0 (0)	1 (0.4)	
At 26 weeks postpartum				
Normal (<25)	147 (25.4)	54 (18.8)	93 (32.1)	0.001
Overweight (25-<30)	269 (46.5)	151 (52.4)	118 (40.7)	
Obese (≥30)	156 (27)	83 (28.8)	73 (25.2)	
Missing	6 (1.1)	0 (0)	6 (2)	

* According to the World Health Organisation categories.

4.5.2 Type 2 diabetes prevalence

Data on type 2 diabetes was available from the patients' records at the hospitals. Type 2 diabetes diagnostic criteria were according to standards adopted by the International Diabetes Federation (IDF) and the WHO (WHO and IDF 2006). The prevalence rates of type 2 diabetes among the whole sample as well as in each city are presented in Table 4.12, including the Chi square test results and *p*-values.

In general, the prevalence of type 2 diabetes (and gestational diabetes) increased from 6.2% prior to pregnancy to 9% at birth. This is might be attributed to the noticeable incidence of

gestational diabetes. The proportion of type 2 diabetes at 26 weeks after birth returned to almost the same level as before pregnancy (Table 4.12). Comparing Taif and Jeddah cities, Taif appears to have a higher prevalence rate of type 2 diabetes among its mothers than Jeddah, especially after six months postpartum (10.8% versus 3.2%). These differences between both cities in type 2 diabetes prevalence are statistically significant (see Table 4.12).

Table 4.12 The prevalence of type 2 diabetes in the whole sample (n = 578) and in cities of Taif and Jeddah separately.

Time of type 2 diabetes screening^	Total N (%)	Taif (n=288) N (%)	Jeddah (n=290) N (%)	*p*-value
Pre-pregnancy	36 (6.2)	28 (9.7)	8 (2.8)	0.001
At birth	52 (9)	34 (11.8)	18 (6.2)	0.019
At 26 weeks postpartum	40 (6.9)	31 (10.8)	9 (3.2)	<0.001
Missing	5 (0.9)	0 (0)	5 (1.7)	

^ According to the WHO and IDF criteria.

Figures 4.3 and 4.4 show the prevalence of maternal obesity at 26 weeks postpartum and type 2 diabetes, respectively. Overweight and obesity as well as type 2 diabetes were more prevalent among mothers from Taif City than those reside in Jeddah City.

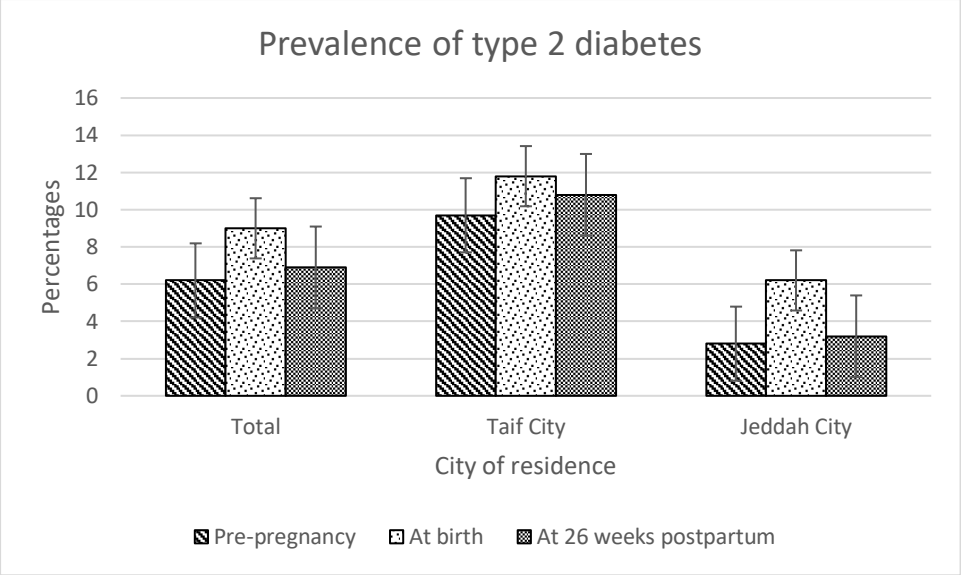

Figure 4.3 The prevalence of type 2 diabetes among mothers by city of residence.

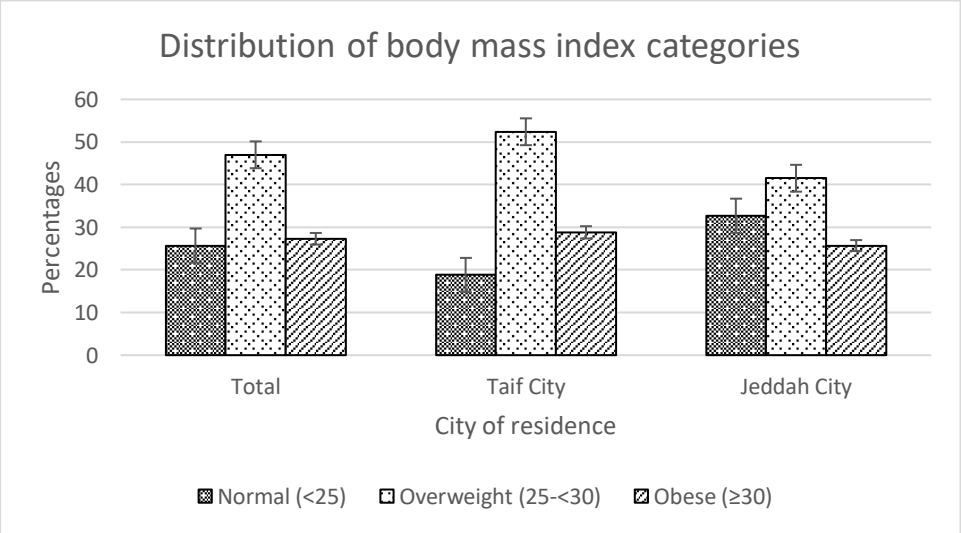

Figure 4.4 The prevalence of maternal obesity and overweight **at 26 weeks** postpartum in both cities and in the total sample.

4.5.3 Postpartum depression prevalence

The Edinburgh Postnatal Depression Scale (EPDS) was utilised to screen for postnatal depression among participating mothers in two phases: in hospital before discharge and at 26 weeks after birth. EPDS is a scale of ten items, which are added up to total scores that range

from zero to 30. Mothers who score more than 12 on EPDS is considered to be in depressive mode (Cox, Holden, and Sagovsky 1987). Table 4.13 shows descriptive statistics (means and standard deviations) of the total EPDS score as a continuous variable, at birth and at 26 weeks postpartum, among the whole sample and between the two cities of residence. To compare the two cities, *t*-test was conducted and *p*-values are included in Table 4.13.

The mean EPDS score of the whole sample was 9.86 (standard deviation [SD] = 5.12) before discharge while it dropped to 8.18 (SD = 4.46) at six months after delivery (Table 4.13). There was no significant difference between the two places of residence in terms of EPDS scores at birth. However, at 26 weeks postpartum, Taif City had a slightly higher mean EPDS score among its mothers than Jeddah (8.61 versus 7.76). Although this difference was statistically significant (p-value < 0.001), it is not clinically significant (see Table 4.13). There was a small decline in the mean EPDS score from discharge to six months, slightly greater in Jeddah City than in Taif City during the same period.

Table 4.13 Descriptive results for post-partum depression as a continuous variable in the whole sample (n = 578) and in Taif and Jeddah separately.

Postpartum depression (total EPDS^)	Mean	Standard deviation	*p*-value (*t*-test)
At birth			
Total	9.86	5.12	
Taif City	9.32	5.27	0.14
Jeddah City	10.37	4.92	
At 26 weeks postpartum			
Total	8.18	4.46	
Taif City	8.61	4.28	< 0.001
Jeddah City	7.76	4.52	

^ EPDS Edinburgh Postnatal Depression Scale.

To determine the proportion affected by postnatal depression and for analysis purposes, total EPDS score was categorised into two categories: normal (12 or less), and depressive mode (more than 12). Table 4.14 presents numbers and percentages of mothers who appeared to be in depressive mode (scored more than 12 on EPDS scale).

From Table 4.14, the prevalence of postpartum depression was higher at birth (33.2) than it was at 26 weeks after birth (16.1%). In terms of comparison between the two cities, Taif had more mothers in depressive mode than Jeddah at six months postpartum. Although the mean EPDS score in Taif did not change from ‘at birth’ to ‘26 weeks postpartum’ (Table 4.13), the

proportion of mothers in depressive mode had dropped from 32.6% to 17% in that city (Table 4.14).

Table 4.14 Prevalence of post-partum depression in the whole sample (n = 578) and in Taif and Jeddah separately.

Postpartum depression **(total EPDS* > 12)**	Total N (%)	Taif (n=288) N (%)	Jeddah (n=290) N (%)	p-value
At birth	192 (33.2)	94 (32.6)	98 (33.9)	0.746
Missing	1 (0.2)	0 (0)	1 (0.3)	
At 26 weeks postpartum	93 (16.1)	49 (17)	44 (15.3)	0.571
Missing	2 (0.3)	0 (0)	2 (0.7)	

* EPDS Edinburgh Postnatal Depression Scale.

4.6 Factors associated with breastfeeding initiation

4.6.1 Sociodemographic factors

There are several factors that have an impact on whether a mother initiates breastfeeding within the first hour after birth as the World Health Organisation (WHO) recommends (WHO and UNICEF 2007). To identify these elements, mothers in this study were classified into two groups based on their initiation of breastfeeding: early initiation (≤1 hour) and delayed initiation (>1 hour). Logistic regression analysis was performed to determine the odds ratio (OR) of early versus delayed initiation between the subgroups of each factor.

Sociodemographic factors included in the analysis are maternal age, city of residence, family monthly income, and maternal education. Main factors in this study include maternal obesity measured by body mass index (BMI), maternal diabetes, postpartum depression, and maternal attitudes toward breastfeeding. Table 4.15 presents the crude and adjusted odds ratio (OR) of early breastfeeding initiation for the sociodemographic and the main factors. It also shows the 95% confidence intervals (CI) for ORs as well as *p*-values from the analysis. Adjustment was made for all of the listed variables.

Table 4.15 Early breastfeeding initiation (≤1 hour) and associated social, demographic, and medical factors.

	Crude odds ratio (95% CI[a])	*p*-value[d]	Adjusted odds ratio (95% CI[a])	*p*-value[d]
Maternal education				
<High school	1		1	
High school or diploma	0.60 (0.39-0.92)	0.018	0.51 (0.32-0.82)	0.005
Bachelor or above	0.88 (0.56-1.38)	0.585	0.76 (0.47-1.24)	0.275
Maternal body mass index (Kg/m^2) [b]				
Normal (<25)	1		1	
Overweight (25-<30)	1.12 (0.73-1.70)	0.605	1.05 (0.67-1.65)	0.833
Obese (≥30)	0.96 (0.60-1.52)	0.845	0.98 (0.59-1.64)	0.936
Maternal type 2 diabetes [b]				
No	1		1	
Yes	0.57 (0.27-1.20)	0.139	0.65 (0.30-1.42)	0.279
Edinburgh Postnatal Depression Scale (EPDS)				
Normal (≤12)	1		1	
Depressive (>12)	0.53 (0.34-0.84)	0.006	0.49 (0.30-0.80)	0.004
Iowa Infant Feeding Attitudinal Scale (IIFAS)				
High (≥61)[c]	1		1	
Low (<61)	0.81 (0.58-1.14)	0.231	0.69 (0.47-1.01)	0.058

*Adjustment for all the listed variables. ^1 Australian Dollar = 2.9 Saudi Riyals. a= CI is Confidence Interval. b= based on the WHO and IDF criteria. c= the mean IOWA total score is 61. d= from Wald Chi square test.

Maternal education level of 'high school or diploma' was associated with lower likelihood of early breastfeeding initiation compared to the level of 'under high school' (adjusted odds ratio [aOR] = 0.51, 95% (CI) = (0.32-0.82), and *p*-value = 0.005).

A higher EPDS score (depressive mode) was associated with lower likelihood of initiating breastfeeding within the first hour (aOR = 0.49, 95% CI = (0.30-0.80), *p*-value = 0.004).

However, having type 2 diabetes and low scores on IOWA scale (low attitudes toward breastfeeding) had no association with early initiation of breastfeeding as these results were not statistically significant (*p*-values = 0.279 and 0.058, respectively). Also, maternal obesity was not associated with breastfeeding initiation. Adjusted odds ratios for overweight and obese mothers compared to those of normal weight are 1.05 and 0.98 (95% CI = 0.67-1.65 and 0.59-1.64, *p*-values = 0.833 and 0.936, respectively).

4.6.2 Factors related to infant feeding preferences

Breastfeeding initiation was also examined against other relevant variables, especially those factors related to father and grandmother (infant's grandmother) preferences toward infant feeding methods. Multivariate logistic regression was performed to calculate the odds ratios and determine the factors significantly associated with breastfeeding initiation.

These variables include infant gender, parity, previous child feeding methods, prelacteal feed, antenatal education about how to feed infants, whether grandmother breastfed any of her children, father and grandmother preferences toward infant feeding methods. Table 4.16 shows the crude and adjusted odds ratios of early initiation of breastfeeding among mothers within categories of each variable, along with confidence intervals and *p*-values.

Table 4.16 Early breastfeeding initiation (≤1 hour) and associated factors related to infant feeding and family preferences.

	Crude odds ratio (95% CI[a])	*p*-value[b]	Adjusted odds ratio (95% CI[a])	*p*-value[b]
Parity				
Primiparous	1		1	
Multiparous	1.4 (0.97-2.15)	0.07	1.56 (1.02-2.42)	0.049
Previous child feeding				
Breastfeeding	1		1	
Bottle-feeding	0.39 (0.20-0.76)	0.006	0.38 (0.17-0.82)	0.014
Bottle- + breastfeeding	0.30 (0.20-0.47)	<0.001	0.25 (0.15-0.42)	<0.001
Prelacteal feeding				
Yes	1		1	
No	3.64 (2.51-5.27)	<0.001	5.19 (3.02-8.90)	<0.001
Antenatal education				
Yes	1		1	
No	0.35 (0.24-0.50)	<0.001	0.42 (0.26-0.69)	0.001
Grandmother breastfed before				
Yes	1		1	
No	0.39 (0.24-0.63)	<0.001	0.25 (0.13-0.45)	<0.001

*Adjustment for all the listed variables. a= 95% CI is Confidence Interval. b= from Wald Chi square test.

From Table 4.16, multi-parity and avoidance of prelacteal feeds were associated with early initiation of breastfeeding (adjusted odds ratio [aOR] = 1.56 and 5.19, 95% confidence interval [CI] = (1.02-2.42) and (3.02-8.90), *p*-values = 0.049 and <0.001, respectively). Using bottle-feeding, and mixed methods (breast- and bottle-feeding) when feeding a previous child were associated with lower rates of early breastfeeding initiation (aOR = 0.38 and 0.25, 95% CI = (0.17-0.82) and (0.15-0.42), *p*-values = 0.014 and <0.001, respectively). Infant gender had no effect on timing of breastfeeding initiation (see Table 4.16).

Missing antenatal education about infant feeding, and when grandmothers did not breastfeed any of their children were associated with delayed breastfeeding initiation (aOR = 0.42 and 0.25, 95% CI = (0.26-0.69) and (0.13-0.45), *p*-values = 0.001 and <0.001, respectively). Factors such as maternal employment, delivery type, mother or father smoking status, infant weight and support from hospital staff had no association with breastfeeding timely initiation.

4.7 Factors associated with breastfeeding duration

4.7.1 Sociodemographic factors

Multiple logistic regression was performed to investigate the association of breastfeeding duration and independent sociodemographic variables by calculating the crude and adjusted odds ratio (OR). Confidence intervals (95% CI) and p-value were also calculated to assess the significance of the association.

The median breastfeeding duration (18 weeks, Table 4.6) was taken as a cut-off point to define the short breastfeeding duration. Table 4.17 presents the odds ratio (crude and adjusted) of short breastfeeding duration (≤18 weeks) within categories of the included variables.

Sociodemographics included in the analysis are maternal age, socio-economic status, family monthly income and parity. Main variables are maternal body mass index (BMI), maternal type 2 diabetes status, postpartum depression presence and maternal attitudes toward breastfeeding. Adjustment was made for all the listed variables.

Table 4.17 Short 'any breastfeeding duration' (≤18 weeks) and associated social, demographic, and medical factors.

	Crude odds ratio (95% CI[a])	*p*-value[d]	Adjusted odds ratio (95% CI[a])	*p*-value[d]
Maternal age (years)				
≥35	1		1	
30-34	1.76 (1.08-2.87)	0.023	1.12 (0.56-2.24)	0.761
25-29	2.62 (1.59-4.30)	<0.001	3.00 (1.37-6.58)	0.006
<25	0.68 (0.39-1.20)	0.187	0.43 (0.14-1.35)	0.148
Socio-economic status				
Low	1		1	
Intermediate	1.33 (0.94-1.89)	0.107	1.52 (0.86-2.67)	0.153
High	2.71 (1.38-5.33)	0.004	4.56 (1.89-10.97)	0.001
Maternal body mass index (Kg/m^2) [b]				
Normal (<25)	1		1	
Overweight (25-<30)	1.63 (1.08-2.44)	0.019	1.62 (0.80-3.28)	0.181
Obese (≥30)	2.38 (1.50-3.78)	<0.001	2.79 (1.41-5.56)	0.003
Parity				
Multiparous	1		1	
Primiparous	2.34 (1.57-3.47)	<0.001	2.39 (1.60-3.57)	<0.001
Maternal type 2 diabetes [b]				
No	1		1	
Yes	1.86 (0.94-3.69)	0.074	2.94 (0.89-9.79)	0.078
Edinburgh Postnatal Depression Scale (EPDS)				
Normal (≤12)	1		1	
Depressive (>12)	1.05 (0.74-1.49)	0.774	1.09 (0.76-1.57)	0.631
Iowa Infant Feeding Attitudinal Scale (IIFAS)				
High (≥61)[c]	1		1	
Low (<61)	0.91 (0.65-1.26)	0.553	1.26 (0.89-1.76)	0.199

*Adjustment for all the listed variables. ^1 Australian Dollar = 2.9 Saudi Riyals. a= CI is 95% Confidence Interval. b= based on the WHO and IDF criteria. c= the mean IOWA total score is 61. d= from Wald Chi square test.

Younger ages (25-34 years), and high socio-economic class were associated with a shorter breastfeeding duration (aOR = 3.00 and 4.56, 95% CI = (1.37-6.58) and (1.89-10.97), respectively). These associations were statistically significant (*p*-values = 0.006 and 0.001, respectively, Table 4.17).

Primi-parity was associated with higher likelihood of having a shorter breastfeeding duration (aOR = 2.39, 95% CI = (1.60-3.57), *p*-value <0.001). Maternal obesity (body mass index [BMI] ≥30 kg/m^2) was associated with a shorter duration of breastfeeding (aOR = 2.79, 95% CI = (1.41-5.56), *p*-value = 0.003). Having type 2 diabetes had no effect on the length of breastfeeding duration (aOR = 2.94, 95% CI = (0.89-9.79)). However, considering the odds ratio, this could be due to a lack of power in the study. Being in depressive mode (total score on Edinburgh Postnatal Depression Scale [EPDS] > 12) and having low attitudes toward breastfeeding (total score on Iowa Infant Feeding Attitudinal Scale [IIFAS] < 61) had no effects on breastfeeding duration (aOR = 1.09 and 1.26, 95% CI = (0.76-1.57) and (0.89-1.76), *p*-values = 0.631 and 0.199, respectively).

4.7.2 Factors related to infant feeding

Associations between 'any breastfeeding' duration and some factors related to infant feeding were also investigated through logistic regression. These variables include infant birth weight (in grams), healthcare staff encouraging breastfeeding, initiation timing, feeding method of the previous child, prelacteal feeds, exposure to formula advertisement and timing of formula introduction.

The crude and adjusted odds ratio (OR) of short breastfeeding duration (≤ 18 weeks) within groups of the aforementioned variables are presented in Table 4.18, including 95% confidence intervals (CI) and *p*-values. Adjustment was made for all the listed variables.

Table 4.18 Short 'any breastfeeding duration' (≤18 weeks) and associated factors related to infant feeding.

	Crude odds ratio (95% CI[a])	*p*-value[b]	Adjusted odds ratio (95% CI[a])	*p*-value[b]
Baby birth weight (gm)				
<3000	1		1	
≥3000	0.74 (0.53-1.03)	0.075	0.43 (0.23-0.80)	0.008
Staff encourage breastfeeding				
Yes	1		1	
No	1.13 (0.81-1.58)	0.462	2.38 (1.24-4.55)	0.009
Previous child feeding				
Breastfeeding	1		1	
Bottle-feeding	1.41 (0.70-2.86)	0.340	3.36 (1.09-10.34)	0.035
Bottle- + breastfeeding	1.61 (1.05-2.49)	0.029	2.86 (1.36-6.03)	0.006
Prelacteal feed				
No	1		1	
Yes	3.54 (2.50-5.02)	<0.001	2.01 (1.02-3.96)	0.043
Exposed to formula advertisement				
No	1		1	
Yes	1.81 (1.30-2.53)	<0.001	2.64 (1.51-4.60)	0.001
Formula introduction				
≥ 6 weeks	1		1	
< 6 weeks	3.93 (2.65-5.82)	<0.001	3.69 (1.85-7.36)	<0.001

*Adjustment for all the listed variables. a= 95% CI is Confidence Interval. b= from Wald Chi square test.

From Table 4.18, the factors associated with a shorter duration of breastfeeding are adopting bottle-feeding for the previous child and introducing formula for the current baby very early (< 6 weeks after birth) (adjusted odds ratio [aOR] = 3.36 and 3.69, 95% confidence intervals [CI] = (1.09-10.34) and (1.85-7.36), *p*-values = 0.035 and < 0.001, respectively). Also, adopting mixed feeding (bottle- and breastfeeding) for the previous child was associated with a shorter duration of breastfeeding the current child (aOR = 2.86, 95% CI = (1.36-6.03), and *p*-value = 0.006).

Having not received support and encouragement from medical staff to breastfeed, exposure to formula advertisement, and giving prelacteal feeds to infants were associated with higher likelihood to breastfeed for a shorter duration (aOR = 2.38, 2.64, and 2.01, *p*-values = 0.009, 0.001, and 0.043, respectively). Birth weight (≥3000 grams) was associated with a longer duration of breastfeeding (aOR = 0.43, 95% CI = (0.23-0.80), and *p*-value = 0.008, see Table 4.16).

4.8 Risk factors associated with breastfeeding cessation before six months

There are some factors associated with the risk of early cessation of breastfeeding. To assess the risk related to each factor, survival analysis (Cox regression) was performed to compute the crude and adjusted hazard ratio (HR) of breastfeeding cessation before six months. The 95% confidence interval and p-value (at the significance level of 0.05) were also calculated. Variables were divided to two groups: 1- the sociodemographic and main variables (obesity, type 2 diabetes, postpartum depression and attitude toward breastfeeding); and 2- other risk factors associated with breastfeeding discontinuation.

4.8.1 Sociodemographic variables

Table 4.19 Risk of breastfeeding cessation and associated social, demographic, and medical factors.

	Crude hazard ratio (95% CI[a])	*p*-value[d]	Adjusted hazard ratio (95% CI[a])	*p*-value[d]
Maternal age (years)				
≥35	1		1	
30-34	1.72 (1.18-2.50)	0.005	1.66 (1.12-2.45)	0.012
25-29	2.34 (1.62-3.38)	<0.001	2.71 (1.85-3.97)	<0.001
<25	1.18 (0.76-1.83)	0.462	1.28 (0.81-2.04)	0.297
Family monthly income (in Saudi Riyal)^				
≤12000	1		1	
>12000	1.54 (1.12-2.13)	0.009	1.65 (1.08-2.51)	0.020
Maternal body mass index (Kg/m^2) [b]				
Normal (<25)	1		1	
Overweight (25-<30)	1.24 (0.93-1.64)	0.137	1.25 (0.93-1.67)	0.136
Obese (≥30)	1.15 (0.83-1.58)	0.410	1.18 (0.84-1.66)	0.347
Maternal type 2 diabetes [b]				
No	1		1	
Yes	1.23 (0.75-2.00)	0.410	1.04 (0.63-1.72)	0.873
Edinburgh Postnatal Depression Scale (EPDS)				
Normal (≤12)	1		1	
Depressive (>12)	1.03 (0.76-1.39)	0.835	1.06 (0.77-1.45)	0.716
Iowa Infant Feeding Attitudinal Scale (IIFAS)				
High (≥61)[c]	1		1	
Low (<61)	1.07 (0.85-1.34)	0.595	1.08 (0.85-1.36)	0.554

*Adjustment for all the listed variables. ^1 Australian Dollar = 2.9 Saudi Riyals. a= CI is Confidence Interval. b= based on the WHO and IDF criteria. c= the mean IOWA total score is 61. d= from Wald Chi square test.

Risk of stopping breastfeeding that is associated with sociodemographic and main variables is presented in Table 4.19 in the form of crude and adjusted hazard ratio. These factors include maternal age, family socioeconomic status, family monthly income in Saudi Riyals (SAR), maternal obesity measured in body mass index (BMI), maternal type 2 diabetes, postpartum depression and maternal attitudes toward breastfeeding.

The significant risk factors associated with early cessation of breastfeeding were young maternal age and high family income. Mothers of younger age (25-29 and 30-34 years old) were at higher risk of breastfeeding cessation before 26 weeks compared to those of older age (35 years and above) (adjusted hazard ratios [aHR] = 2.71 and 1.66, 95% CI = (1.85-3.97) and (1.12-2.45), *p*-values = <0.001 and 0.012, respectively). Also, mothers from families with a higher monthly income (more than 12000 SAR) were one and a half times at higher risk of stopping breastfeeding compared to mothers with low income (aHR = 1.65, 95% CI = (1.08-2.51), *p*-value = 0.020).

Being obese, having type 2 diabetes, being in depressive mode and low attitudes toward breastfeeding had no effects on breastfeeding cessation (aHR = 1.18, 1.04, 1.06, and 1.08, respectively) as these effects were not statistically significant (*p*-values = 0.347, 0.873, 0.716, and 0.554, respectively). Although results were not statistically significant (*p*-values = 0.136, 0.347, respectively), maternal obesity and overweight might be associated with increased risk of breastfeeding cessation if the study had a larger sample size. Figure 4.5 illustrates the hazard function for risk of breastfeeding cessation among different categories of mothers' body mass index (BMI). It is clear from the figure that the risk of stopping breastfeeding had increased for overweight and obese mothers compared to those of normal weight.

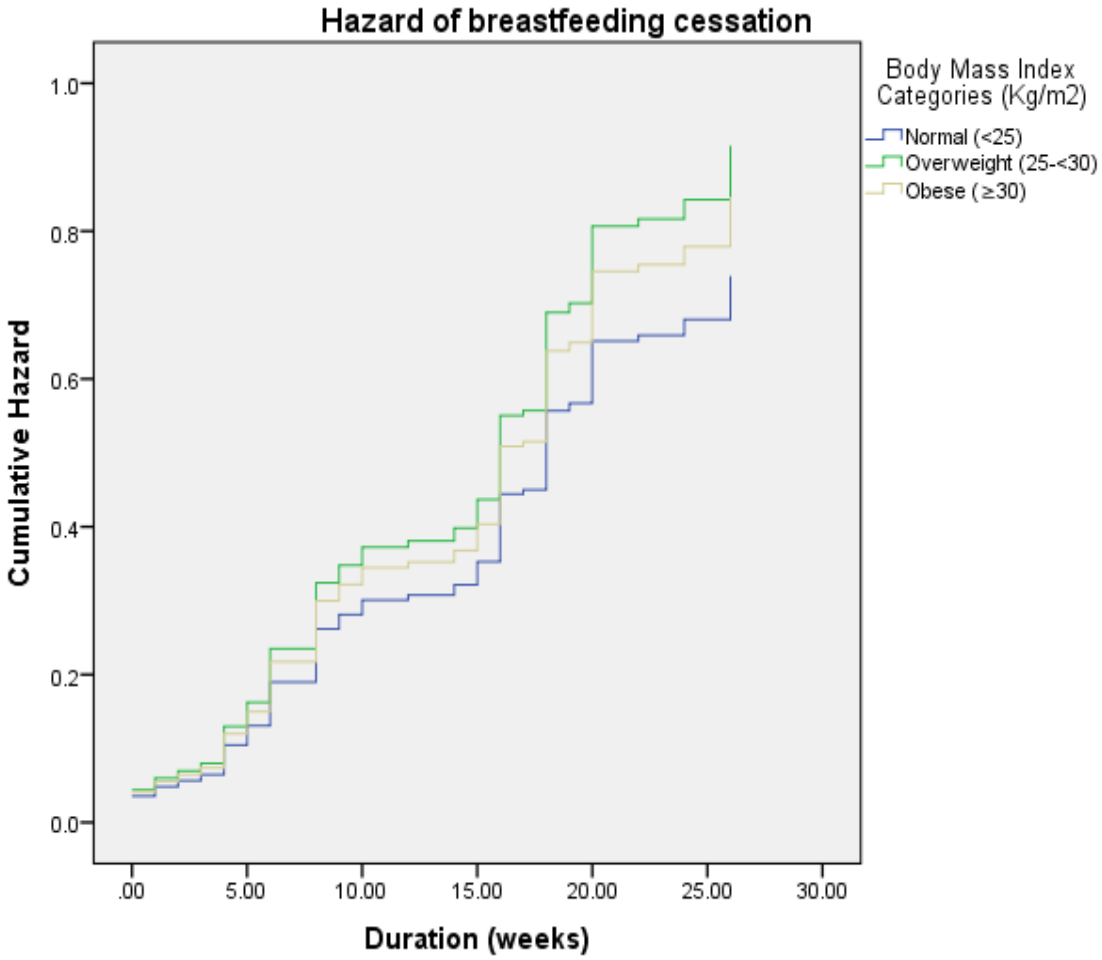

Figure 4.5 Cumulative hazard of breastfeeding cessation within categories of body mass index over 26 weeks.

4.8.2 Other risk factors

Table 4.20 illustrates other risk factors that were associated with breastfeeding cessation before six months of childbirth. The table presents the crude and adjusted hazard ratios (HR) for these factors, along with 95% confidence intervals (CI) and *p*-values. These factors are parity, delivery route, prelacteal feed, previous child feeding, formula introduction, formula reception in hospital, exposure to formula advertisement, and paternal smoking status.

Table 4.20 Risk of breastfeeding cessation and associated factors related to infant feeding.

	Crude hazard ratio (95% CI[a])	*p*-value[b]	Adjusted hazard ratio (95% CI[a])	*p*-value[b]
Parity				
Multiparous	1		1	
Primiparous	1.85 (1.46-2.35)	<0.001	1.66 (1.30-2.12)	<0.001
Formula introduction				
≥ 6 weeks	1		1	
< 6 weeks	2.39 (1.42-4.04)	0.001	1.56 (1.08-2.23)	0.017
Exposed to formula advertisement				
No	1		1	
Yes	1.51 (1.20-1.90)	<0.001	1.69 (1.24-2.31)	0.001
Father smoking				
No	1		1	
Yes	1.34 (1.05-1.70)	0.018	1.66 (1.22-2.26)	0.001

*Adjustment for all the listed variables. a= 95% CI is Confidence Interval. b= from Wald Chi square test.

Parity (primiparous), exposure to formula advertisement and paternal smoking status (yes) were significant risk factors of breastfeeding cessation before six months (adjusted hazard ratio [aHR] = 1.66, 1.69 and 1.66, 95% CI = (1.30-2.12), (1.24-2.31), and (1.22-2.26), *p*-values = <0.001, 0.001 and 0.001, respectively). Mothers who introduced formula to their

infants before six weeks of age were at higher risk of stopping breastfeeding prematurely compared to those who introduced formula later (aHR = 1.56, 95% CI = (1.08-2.23), p-value = 0.017).

4.9 Reasons behind choosing infant feeding methods

4.9.1 Reasons for choosing breastfeeding

Mothers who participated in the study were asked to report on reasons behind their choice of infant feeding methods. Most mothers provided more than one reason. Reasons were ordered based on importance, and the first, second and third choices were documented. Table 4.21 presents the most important reasons (the first choice) cited by mothers who chose to breastfeed at discharge.

Table 4.21 Reasons for choosing breastfeeding **at discharge** (the first choice).

Reasons	N	%
Breastmilk is better	119	20.6
Islam recommends it	93	16.1
Father choice	60	10.4
Breastfed babies are healthier	44	7.6
Mother-infant bonding	40	6.9
Fewer infection	37	6.4
My mother advice	29	5.0
It is a natural way	14	2.4
To lose weight	13	2.2
Other people advice	7	1.2
It is convenient	6	1.0
Traditions recommend it	3	0.5
Other	2	0.3
Missing	111	19.2
Total	578	100.0

As it appears from Table 4.21 above, the reason most cited by mothers was “breastmilk is better” (20.6%), followed by “Islam recommends it” (16.1%), and “choice of baby’s father” by 10.4% of interviewed mothers. One hundred and eleven (19.2%) of mothers did not provide reasons for choosing breastfeeding because either they did not initiate breastfeeding basically, or they chose not to provide an answer for this question. Tables presenting the second and third choices can be found in Appendix 6.

Table 4.22 Reasons for choosing breastfeeding **at 26 weeks** after delivery (the first choice)

Reasons	N	%
Breastmilk is better	81	14.0
Fewer infections	37	6.4
Islam recommends it	36	6.2
Traditions recommend it	23	4.0
Mother-infant bonding	23	4.0
Father's choice	21	3.6
Breastfed babies are healthier	15	2.6
My mother's advice	11	1.9
It is convenient	10	1.7
It is a natural way	5	0.9
Other	5	0.9
To lose weight	3	0.5
Missing	308	53.3
Total	578	100.0

Reasons for choosing breastfeeding at 26 weeks after childbirth (the first choice) are presented in Table 4.22. "Breastmilk is better" was the most frequently reported reason by 14% of mothers, followed by "fewer infection" (6.4%), and "Islam recommends it" by 6.2% of participated subjects. It is noteworthy that more than half of the whole sample did not answer this question as the number of mothers who stopped breastfeeding had increased by this stage (26 weeks). Reasons representing the second and third choices are shown in tables that are included in the Appendix 7.

4.9.2 Reasons for choosing bottle-feeding

Mothers who chose to bottle-feed their infants were also asked at each interview to provide reasons for choosing this method. Reasons were multiple and so that they are ordered as the most important reason is the first choice. Table 4.23 shows reasons (the first choice) for choosing bottle-feeding at discharge as reported by mothers.

Table 4.23 Reasons for choosing bottle-feeding **at discharge** (1st choice)

Reasons	N	%
Insufficient breastmilk	164	28.4
Other	30	5.2
Breastfeeding is restrictive	27	4.7
Back to work or study	7	1.2
Formula helps baby grow bigger	5	0.9
It is the way babies feed in Saudi Arabia	3	0.5
Formula is better	2	0.3
Friends suggest formula	1	0.2
Missing	339	58.7
Total	578	100.0

From Table 4.23, the most cited reason by mothers for choosing formula to feed their babies at discharge was “insufficient breastmilk” (28.4%), followed by “other” (5.2%) and “breastfeeding is restrictive” by 4.7% of mothers. More than half (58.7%) of mothers refrained from providing reasons as the majority was adopting breastfeeding. The second and third choices of reasons are shown in the Appendix 8.

Reasons provided for choosing formula feeding at 26 weeks after childbirth are presented in Table 4.24. They were chosen by mothers as the most important reasons (the first choice).

Table 4.24 Reasons for choosing bottle-feeding **at 26 weeks** after delivery (1st choice)

Reasons	N	%
Insufficient breastmilk	404	69.9
Back to work or study	42	7.3
Breastfeeding is restrictive	35	6.1
Other	9	1.6
To continue smoking	5	0.9
Formula is better	4	0.7
Formula helps babies grow bigger	4	0.7
To play sports	2	0.3
Friends suggest bottle-feeding	1	0.2
Missing	72	12.5
Total	578	100

"Insufficient breastmilk" was still the most frequently cited reason as perceived by mothers who chose to bottle-feed at 26 weeks of their infants' age (69.9%). The second reason was "back to work or study" (7.3%), followed by "breastfeeding is restrictive" by 6.1% of mothers. Tables of the second and third choices of reasons are included in the Appendix 9.

4.9.3 Time when mothers first decided on infant feeding methods

Timing of taking a decision on how to feed infants was included in the study questionnaire, and mothers had stated when they first decided on feeding methods of their infants. Timing

provided ranged from “before pregnancy” to “after delivery”. Table 4.25 shows numbers and percentages of mothers based on their decision timing.

Table 4.25 Distribution of mothers based on when they first decided on infant feeding methods

Decision timing	N	%
Before I became pregnant	232	40.1
Early in my pregnancy	168	29.1
Late in my pregnancy	60	10.4
During labour	29	5.0
After birth	87	15.1
Missing	2	0.3
Total	578	100.0

The majority of mothers (40.1%) reported that they had decided on which feeding method to adopt for their infants before pregnancy. About one third (29.1%) of mothers had decided early in pregnancy while 10.4% had decided later. Only 5% of respondents had decided during labour and 15.1% of them had delayed this decision until after delivery (Table 4.25).

4.10 Difficulties encountered by breastfeeding mothers

Breastfeeding mothers are often faced with difficulties related to infant feeding. Subjects in this study were asked to report the difficulties related to infant feeding they had encountered.

Tables 4.26 and 4.27 present these difficulties as reported by mothers at discharge, and at 26 weeks after childbirth, respectively.

Table 4.26 Difficulties faced by recruited mothers **at discharge**.

Difficulties	N	%
None	216	37.4
Sore or painful nipples	130	22.5
Not enough breastmilk	98	17.0
Breast engorged	68	11.8
N/A, did not breastfeed	32	5.5
Flat or inverted nipples	12	2.1
Stomach ache	8	1.4
Mastitis	7	1.2
Fever	2	0.3
Breast pain	1	0.2
Missing	4	0.7
Total	578	100.0

Table 4.27 Difficulties faced by recruited mothers **at 26 weeks** after delivery.

Difficulties	N	%
N/A, did not breastfeed	191	33.0
None	184	31.8
Not enough breastmilk	140	24.2
Sore or painful nipples	23	4.0
Breast engorged	12	2.1
Mastitis	7	1.2
Fever	5	0.9
Flat or inverted nipples	1	0.2
Missing	15	2.6
Total	578	100.0

The most frequent problem reported by mothers at 26 weeks after delivery was “not enough breastmilk” (24.2%) while this difficulty was observed by 17% of mothers at discharge (see Table 4.26). The difficulty with the highest frequency at discharge was “sore or painful nipples” (22.5%), followed by “not enough breastmilk”, then by “breast engorged” (11.8%) (see Table 4.26). Mastitis was reported in seven cases (1.2%) of mothers at both phases of data collection.

4.11 Summary of results

The prevalence of ‘exclusive’ and ‘any breastfeeding’ decreased as the infant’s age increased. The rate of early initiation was very low, and average duration of ‘any breastfeeding’ was about four months. Maternal obesity and postpartum depression had negative effects on breastfeeding outcomes. Type 2 diabetes was not related to breastfeeding outcomes. Maternal attitudes toward breastfeeding were not consistent with actual practices, and thus had no effects on breastfeeding indicators. Taif City mothers had higher rates of breastfeeding practices than those of Jeddah.

Chapter 5

5.0 Discussion

5.1 Introduction

This chapter contains discussion of the results following the structure of the study aim and objectives. It specifically discusses findings related to the current infant feeding practices within the western region of Saudi Arabia and the association with demographic factors and maternal chronic diseases.

Discussion will mainly focus on initiation, prevalence and duration of breastfeeding, risk factors leading to breastfeeding cessation, association with maternal medical conditions such as: obesity, type 2 diabetes and postpartum depression, breastfeeding difficulties and maternal attitudes towards breastfeeding. The chapter also includes comparisons of the present results to findings from other studies in the available literature.

5.2 Response rate

The response rate was 96.3%, which is similar to response rates from studies carried out in the central region, Riyadh (n=622, 99%) (Al-Makoshi et al. 2013) and in the eastern region, AlHassa (n=667, 92.3%) (Amin, Hablas, and Al Qader 2011). The achievement of a high response rate in our study was the result of careful explanation of the purpose of the study and the promotion of breastfeeding and its importance within most health facilities in the Kingdom of Saudi Arabia (KSA) including the two hospitals where the study was conducted. The involvement of female medical students, who undertook the interviews with mothers, has satisfied the sensitivity of a conservative culture and encouraged mothers to participate.

Also, the response rate in the present study is in the highest range of studies at the international level, such as in China (n=695, 96%) (Tang et al. 2013) and in Nepal (n=639, 91.1%) (Karkee et al. 2014).

5.3 Breastfeeding prevalence

5.3.1 Initiation of breastfeeding and associated factors

The rate of early initiation of breastfeeding (within the first hour after birth) in the present study was 36.1%. This rate is slightly higher than previously reported in other regions of the KSA such as the Southwestern Province (31%) (Al-Binali 2012) and nationally (23.2%, n= 5339) (El Mouzan et al. 2009). However, it is lower than that of some other Arabic countries including Egypt (56%) (United Nations Children's Fund [UNICEF] and United Nations Population Fund [UNFPA] 2011). It is also lower than some rates at the international level such as 45.6% in Vietnam (Dibley, Senarath, and Agho 2010) and 43% in Brazil (Boccolini et al. 2011).

The low rate of early initiation of breastfeeding (within one hour after birth) might be due to inappropriate policies and procedures within hospitals and misconceptions that mothers hold about colostrum. A study that investigated breastfeeding practices in Jeddah City found that 40% of studied infants were separated from their mothers in hospital and the infants fed formula without the mothers' permission (Albokhary and James 2014). The authors stated that even though some mothers (28.3%) gave permission for their infants to be formula-fed, hospital staff did not educate these mothers about breastfeeding advantages. In our study, 43.1% of mothers in Jeddah City reported that their infants had received formula during their stay in hospital after delivery. A study carried out in Alkhobar City (Eastern KSA) found that

“healthy newborn infants are often separated from their mothers and may not be put to the breast for hours, or days depending on the artificial milk that they received in nursery” (Salem and Al Madani 2015, 16). The researchers pointed out that feeding formula to newborns in hospital shortly after their birth was a common procedure.

Some mothers in Saudi Arabia tend to avoid giving colostrum to their infants, and thus delay breastfeeding initiation until the third to fifth day after birth when more mature breastmilk is produced. One study (n=384) found that 10.7% of mothers in the Southern Region disagreed with colostrum feeding while 66.7% of respondents used liquid formula provided by hospital to feed their infants (Al-Binali 2012). Another study conducted (n=120) in Western Saudi Arabia reported that 23% of studied mothers had no knowledge about colostrum benefits (Mosalli et al. 2012).

Similar unsupportive hospital protocols have been found in other countries. An observational study, in which researchers had continuously observed 481 births in the Philippines, found that procedures of infants’ care were not performed in the correct order (Sobel et al. 2011). The study showed that only 9.6% of newborns were put on the breast immediately after delivery while the vast majority of infants had been separated from their mothers for unnecessary procedures. Also, a longitudinal study conducted in Kuwait (n=373) concluded that hospital staff should discourage formula feeding within their hospital (Dashti et al. 2010). The authors pointed out that many Kuwaiti mothers have negative attitudes towards giving colostrum to their infants.

The rate of breastfeeding initiation (within 24 hours after delivery) in our study was 74.6%. This rate is lower than pervious rates documented in the KSA. In a recent review by Al Juaid, Binns, and Giglia (2014) which included studies on breastfeeding in Saudi Arabia from 1979 to 2012, most reported initiation rates were over 90%. Also, higher rates of breastfeeding initiation were noticed in other countries: Australia (92%, n=699) (Maycock et al. 2013), China (95.9%, n=681) (Liu et al. 2013), and Nepal (90%, n=639) (Karkee et al. 2014). This low rate of breastfeeding initiation might be due to inappropriate hospital protocols discussed above, and it confirms the downward trend recently noted in breastfeeding practices among Saudi Arabian mothers.

Early initiation of breastfeeding, in the present study, was more prevalent among multiparous mothers and those who had a lower level of education (below secondary school). Similar results were also noticed in a study (n= 667) done in the eastern region by Amin, Hablas, and Al Qader (2011). The authors concluded that early initiation was significantly associated with increasing maternal age, vaginal delivery and being a housewife. In our study, breastfeeding initiation was greatly influenced by depressive mode, the method of previous child feeding, prelacteal feeds, antenatal education and whether grandmother had breastfed before. Health education and more support should be directed to categories who have been identified in our study and other studies to have low likelihood of early breastfeeding initiation.

Some international reviews and studies have investigated factors affecting breastfeeding initiation. While three reviews concluded that maternal obesity was associated with low rates of breastfeeding initiation (Turcksin et al. 2014, Babendure et al. 2015, Wojcicki 2011), we found no association between the two variables. However, in this study the mean pre-

pregnancy BMI level was high and the number in a low BMI comparison group was low. Similar to our findings, a review of 30 studies established an association between reduced breastfeeding initiation rates and perinatal depression (Grigoriadis et al. 2013). Also, a study conducted on 2669 mothers in Western Australia reported that parity and maternal education were significant predictors of breastfeeding initiation (Hauck et al. 2011). It is fundamental for Saudi health authorities to pay attention for these maternal conditions and its adverse impact on breastfeeding practices.

5.3.2 Breastfeeding intensity

The 'exclusive breastfeeding' rate at discharge reported in this study was 48.6%. This rate is lower than the most recent national rate (n= 5339) reported by El Mouzan et al. (2009) (70.8%) and in the Eastern Province (n=667) which was 66.5% (Amin, Hablas, and Al Qader 2011). Studies from other countries documented higher prevalence rates of 'exclusive breastfeeding' at discharge such as Western Australia (n=2669) (69%) and Canada (n=5615, a national survey) (63.6%) (Al-Sahab et al. 2010, Hauck et al. 2011). However, reported rates of exclusive breastfeeding initiation are highly dependent on the definition used and the way the definition is interpreted (Binns et al. 2009). In some reports no effort was made to measure prelacteal formula feeds accurately or they were simply excluded from the assessment of exclusivity.

The rate of 'exclusive breastfeeding' in our study had decreased within six months after birth to only 7.7%, which is similar to the reported national rate (8%) (El Mouzan et al. 2009) and to the rate reported in Abha (South Province of Saudi Arabia, n=600) (7.3%) (Ayed 2014). However, another study in the Eastern Region which included 1904 mothers from urban and

rural areas as well as from the Hegar ethnic group (nomads living in desert) had found a higher rate of 'exclusive breastfeeding' at six months of age (24.4%) (El-Gilany, Shady, and Helal 2011). The authors also stated that mothers from rural and Hegar areas were more likely to report 'exclusive breastfeeding' than those from urban residence (adjusted odds ratio = 2.2, 95% confidence interval 1.7 – 2.9). Based on the data of United Nations Children Fund (UNICEF), the prevalence rate of 'exclusive breastfeeding' among infants under five in the developing world was 39% in 2010 (Cai, Wardlaw, and Brown 2012). However, the UNICEF data is based on recall within the past 24 hours and may not report the breastfeeding experience since birth. The Canadian National Survey reported a rate of 13.8% of 'exclusive breastfeeding' at six months of age (Al-Sahab et al. 2010).

The present study found a partial (mixed) feeding (bottle- and breastfeeding) rate of 31.3% at discharge. However, this rate had increased to be more than 50% at 3-4 months after discharge. This result is similar to findings reported in a study (n=622) conducted in Riyadh, the central region (54.7%) (Al-Makoshi et al. 2013). Higher rates of partial feeding were also observed in other studies. A study on 4872 mothers reported a rate of 76.1% (Al-Jassir et al. 2006). Another national study (n = 5339) found that 79.5% of mothers adopted a mixed feeding method (El Mouzan et al. 2009). The popularity of partial (mixed) feeding in the KSA may be explained by the double impact of breastfeeding encouragement by the society and culture as well as the effects of formula milk promotion and conflict social advice.

The 'any breastfeeding' rate at discharge was 79.9% while El Mouzan et al. (2009) reported a rate of 88.8% at the national level. In the Al Hassa area (Eastern KSA), this rate was reported to be 77.8% (Amin, Hablas, and Al Qader 2011). Higher rates of 'any breastfeeding' at two

months of age have been reported in some developed and less developed countries such as Brazil (96.8%, n=1000) and the UK (84.3%, n=5000) (Brion et al. 2011).

In our study, the ‘any breastfeeding’ rate declined to 46.6% at six months postpartum whereas ‘bottle-feeding’ prevalence rate was 50.3% at the same time. Other studies have reported higher rates of ‘any breastfeeding’ at six months of age such as 50% nationally (n=4872) (Al-Jassir et al. 2006) and 61% in the Eastern Region (n=667) (Amin, Hablas, and Al Qader 2011). Also, a higher rate of ‘any breastfeeding’ has been noticed in Iran (n=8434) (94.7%) at six months of age (Olang et al. 2012). However, a cohort study including 1317 mother-infant dyads in Hong Kong revealed that while 98.9% of infants received ‘any breastfeeding’ at birth, only 26.9% of them continued receiving this feeding method at the age of six (Tarrant et al. 2010). It appears that the rate of 'any breastfeeding' is related to its exclusivity rate, social and cultural values.

Comparison between the two cities of our study (Taif and Jeddah) shows that while ‘exclusive breastfeeding’ and bottle-feeding at discharge were more prevalent among the mothers from Taif, partial (mixed) feeding and ‘any breastfeeding’ were more frequently practiced by the Jeddah mothers. This indicates that Taif group tended to prefer breastfeeding. However, a high rate of using infant formula within the hospital setting may then become a high rate of bottle-feeding at discharge. Also, the mothers in Taif adopted partial (mixed) feeding more than Jeddah group at 6, 16 and 26 weeks postpartum. However, in general, the mothers from Jeddah tended to practice bottle-feeding less frequently. This may support the view that mothers from rural areas are more likely to prefer breastfeeding than their urban peers.

5.3.3 The duration of 'any breastfeeding' and associated factors

The present study showed that the median duration of 'any breastfeeding' was 18 weeks (approximately four months). In their review of breastfeeding in Saudi Arabia, Al Juaid, Binns, and Giglia (2014) found a progressive decline from year to year in breastfeeding duration, with the mean duration of 'any breastfeeding' dropping from 13.4 months in 1987 to only 8.5 months in 2010. Furthermore, Al-Makoshi et al. (2013) (n=622) reported that 51% of participating mothers practiced 'any breastfeeding' for less than three months. Another study found that the median duration was six months (Al-Binali 2012). A more recent study by Salem and Al Madani (2015) concluded that the average duration of less than six months was found in 36.9% of studied mothers. Longer durations have been reported in other countries such as Iran (n=400) where the mean duration reached 19 months (Nayeri et al. 2015) and China (n=681, median duration = 9 months) (Liu et al. 2013). In Malaysia, a cohort study (n=1078) found that 87% of mothers had continued breastfeeding for at least six months (Yusuff et al. 2015). Overall, the average duration of 'any breastfeeding' in our study is lower than the previous ones documented in recent research in Saudi Arabia and other countries. This confirms a downward trend in breastfeeding duration over time with reciprocal increases in infant formula usage.

The current analysis of factors expected to have an impact on duration of 'any breastfeeding' revealed that a younger maternal age (adjusted odds ratio [aOR] = 3.00), higher socio-economic status (aOR = 4.56) and prima-parity (aOR = 2.39) were associated with a short breastfeeding duration. These findings are consistent with results from cross-sectional studies such as Al-Hreashy et al. (2008) (n=578) and Amin, Hablas, and Al Qader (2011) (n=667). However, to the best of our knowledge, the present study is the first one in Saudi Arabia in

investigating the relationship between breastfeeding duration and maternal chronic diseases and conditions including obesity and type 2 diabetes mellitus. Our study showed that the presence of maternal obesity was associated with a shorter duration of breastfeeding. A 30-month cohort study in China (n=681) found that younger maternal age (aOR=1.81) and maternal illnesses (aOR=1.51) were associated with a shorter duration (Liu et al. 2013). Also, a systematic review of 15 papers stated that maternal age and socio-economic status were correlated to breastfeeding duration (Di Manno, Macdonald, and Knight 2015).

The present study also showed that other factors such as lack of support from hospital staff (adjusted odds ratio [aOR] = 2.38), adopting bottle-feeding (aOR = 3.36) and mixed feeding (aOR = 2.86) for the previous child, exposure to formula advertisements (aOR = 2.64) and early introduction of infants' formula (aOR = 3.69) were all associated with a shorter breastfeeding duration. Another study conducted in Riyadh (n=578) found a relationship between a shorter breastfeeding duration and maternal employment (OR = 2.69) as well as having oral contraceptives (OR = 4.6) (Al-Hreashy et al. 2008). Also, Amin, Hablas, and Al Qader (2011) concluded that mothers who had a lower education level, low income and who were from a rural area tended to have a longer breastfeeding duration. Early introduction of formula were observed to be associated with shorter breastfeeding duration in a Chinese study (aOR=1.59, CI=1.26-1.99) (Liu et al. 2013). Similarity between findings from the presents study and other local studies ensures the importance of tackling factors associated with short breastfeeding duration.

5.3.4 Breastfeeding cessation and associated factors

At each data collection, information was obtained on the proportion of mothers who had ceased breastfeeding their infants. More than half (53%) of mothers in the current study ceased breastfeeding before the infant was six months of age. Similar proportions were noticed in other studies in the KSA including (52%) by Al-Makoshi et al. (2013) (n=622) and (50%) by Al-Hreashy et al. (2008) (n=578). Furthermore, Al-Binali (2012) reported that 82% of studied mothers had stopped breastfeeding within four to six months postpartum. The continuation of breastfeeding for a long-enough period is also important for health. Hence, early breastfeeding cessation undermines the benefits earned by early initiation.

There are many risk factors that contribute to higher percentages of mothers who cease breastfeeding too early. Our study revealed that younger maternal age (adjusted hazard ratio [aHR] = 2.71), higher income (aHR = 1.65), prima-parity (aHR = 1.66), early introduction of formula before six weeks of infant's age (aHR = 1.56) and adopting mixed feeding for the previous child (aHR = 1.64) were associated with early termination of breastfeeding. Several other studies have investigated potential associations in Saudi Arabia. Two cross-sectional studies conducted in the Eastern and Southern regions of the country (n=667 and 384, respectively) concluded that employment and work-related problems were significant factors impeding the continuation of breastfeeding (Amin, Hablas, and Al Qader 2011, Al-Binali 2012). Also, lack of rooming-in was associated with early stopping of breastfeeding as shown in a recent study by Salem and Al Madani (2015). Risk factors of early cessation of breastfeeding should be considered when planning for programs of breastfeeding promotion.

In our study, the Cox regression analysis reveals that maternal obesity, type 2 diabetes, postnatal depression and low attitudes toward breastfeeding had no effects on breastfeeding cessation. Although results were not statistically significant, these factors might be associated with increased risk of breastfeeding cessation if the study had a larger sample size. For instance, the graph of hazard function for risk of breastfeeding cessation among different categories of mothers' body mass index (BMI) showed that the risk of stopping breastfeeding had increased for overweight and obese mothers compared to those of normal weight. Health promotional programs should be directed towards eliminating and controlling such conditions to allow for better settings and acceptance of breastfeeding practices among affected mothers.

5.3.5 The introduction of formula and solid foods

The early introduction of formula and solid foods may affect the status and continuation of breastfeeding. A high percentage of mothers recruited in the present study (71.3%) introduced infants' formula as early as six weeks post-delivery while only 6.4% of them delayed it until after 17 weeks. However, solid foods had not been introduced until 17-26 weeks after birth among the majority of mothers (90%). These results are in agreement with findings from Al-Hreashy et al. (2008), where 75.7% of mothers introduced formula from the first month and 89.2% of them begun solids feeding within four to six months. Also, Al-Binali (2012) noticed that the mean age of formula introduction was 2.5 months. While it seems that solid foods were introduced within a later stage in our study and others, artificial formulas were usually introduced very early.

The World Health Organisation (WHO) recommends that complementary foods are introduced at six months while breastfeeding is continued (WHO 2011). Other countries are

closer to achieving this goal than the KSA. A meta-analysis of data from seven West African countries (n = 4158) revealed that the percentages of infants who began to receive solid or semi-solid foods (within three to five months) ranged from 13% in Burkina Faso to 59% in Benin (Issaka et al. 2015). Also, an American study recruiting 847 subjects from Massachusetts found that the proportions of infants who had been introduced to artificial formula and solid foods at four months of age were 33% and 16% respectively (Huh et al. 2011).

Comparing the two cities in our study in terms of infant formula and solids introduction, the Jeddah mothers introduced supplementary foods slightly earlier than Taif group. This comparison suggests that more mothers in Taif City tried to maintain breastfeeding until the recommended time of introducing supplementary foods.

5.3.6 Maternal attitudes toward breastfeeding

The Iowa Infant Feeding Attitude Scale (IIFAS) was used in our study to examine maternal attitudes toward breastfeeding. The mean IIFAS score was 61.25, which indicates a positive attitude toward breastfeeding. However, the actual infant feeding practices by the mothers in our sample did not reflect this highly positive attitude. Analysis of our data showed that there were no differences between mothers with low and high attitudes toward breastfeeding when choosing feeding methods. Furthermore, a contraindication between maternal attitudes toward breastfeeding and actual practices was observed in a cross-sectional study conducted in the western region of Saudi Arabia (Elbur et al. 2014). In their study, Elbur et al. (2014) noticed that 49% of recruited mothers had a positive attitude toward breastfeeding (on IIFAS scale), however, they still adopted bottle- or mix-feeding. An explanation for this might be

that the Saudi society highly appreciate breastfeeding because it is strongly recommended in Islam, the predominant religion in this country (Al-Jassir, Moizuddin, and Al-Bashir 2003). Thus, mothers commonly have positive attitudes towards breastfeeding based on its religious value. However, the lack of supportive environment in hospital and the absence of promotional interventions significantly contribute to the low rates of breastfeeding prevalence (Batterjee 2010).

Similar attitudes toward breastfeeding have been reported in other studies. Amin et al. (2014) stated that the mean IIFAS score in their study was 57, however, no actual feeding practices were reported. Also, Saied et al. (2013) reported a mean IIFAS of 60.6, which is similar to the one found in the present study. More positive maternal attitudes towards breastfeeding were reported in Europe. A cohort study conducted in four European countries (n=389) showed that the mean IIFAS score ranged from 61.3 in Spain to 64.4 in Scotland (Scott et al. 2015). Unlike the Saudi settings, in the European study, maternal attitudes towards breastfeeding reflected adoption of its practices. Scott et al. (2015) reported that breastfeeding mothers had a significantly higher mean IIFAS score than non-breastfeeding ones (*p*-value = 0.038). Indeed, although Saudi women hold positive attitudes toward breastfeeding and consider it as a traditional and cultural value, in reality infant feeding practices do not correspond with such attitudes.

Studies in other parts of the world suggest that positive maternal attitudes towards breastfeeding may influence breastfeeding practices. A longitudinal study in Italy (n=562) concluded that a higher score on the IIFAS scale was significantly associated with a longer breastfeeding duration (odds ratio [OR] = 1.9, *p*-value = 0.023) (Bertino et al. 2012). Also, a

cohort study conducted in rural Western Australia (n=427) stated that the positive maternal attitudes were associated with longer 'exclusive' and 'any breastfeeding' at 6 and 12 months, respectively (Cox, Giglia, and Binns 2015). Our findings revealed no associations between IIFAS scores and breastfeeding indicators. The future use of the IIFAS Scale in the KSA and similar countries will need to be re-examined in the light of these results. The scale may have to be modified or even a new, more appropriate and culture-specific scale developed.

5.4 Maternal medical conditions

5.4.1 Obesity

The body mass index (BMI) was used to identify the levels of obesity within the study sample. In this study, the obesity rate among recruited mothers was 15.5% prior pregnancy. This rate has increased to 27% at 26 weeks after birth. Taif City was found to have higher rates of obesity than Jeddah City. As a modern, multicultural city, Jeddah has begun to adopt healthy life styles earlier and more frequently than other cities in Saudi Arabia. This might explain the variation in obesity rates between the two cities. However, the general trend of obesity in this country is for the rates to increase. The Saudi Health Information Survey (SHIS), recently conducted by the Ministry of Health, revealed that 33.5% of Saudi women are obese (BMI > 30) (Memish et al. 2014). Obesity is one of the major public health issues in Saudi Arabia.

Our study has found that maternal obesity after delivery was associated with shorter breastfeeding duration. Also, it was considered as a risk factor for early breastfeeding cessation. Except the present study, no studies in Saudi Arabia on the relationship between maternal obesity and adopting breastfeeding have been published. Our findings are in line

with results from other international studies. In their systematic review about the impact of maternal obesity on breastfeeding which included 19 studies, Turcksin et al. (2014) have concluded that obese mothers are less likely to intend, initiate and maintain breastfeeding with comparison with mothers of normal weight. These results suggest that breastfeeding promotional programs should focus on obese and overweight prospective mothers and young females to adopt healthy life styles and achieve weight control before commencing motherhood.

5.4.2 Type 2 diabetes

In the present study, 6.2% of mothers reported they had type 2 diabetes prior pregnancy. New cases of gestational diabetes increased this rate to 9% at the time of delivery. However, the rate returned to almost the same level as before pregnancy (6.9%) at 26 weeks postpartum. A national survey conducted recently by the Saudi Ministry of Health (n=10,735) found that the prevalence rate of type 2 diabetes was 14.76% among Saudi females (El Bcheraoui et al. 2014). However, another study (n= 2355) carried out in the central region (Riyadh) reported a higher rate (25.4%) (Al Khudairy et al. 2015). While there is no national data on gestational diabetes in this country, two regional studies (n=1718 and 3041, respectively) have reported rates of 13.8% and 18.7%, respectively (Al Serehi et al. 2015, Wahabi et al. 2013).

The multivariate analysis in our study revealed that there were no associations between maternal diabetes and breastfeeding initiation and duration. However, the absolute number of mothers with diabetes was relatively poor, and the small sample size in our study with the consequent lack of power means that a larger study is needed to further examine and clarify

the association between type 2 diabetes among mothers and breastfeeding outcomes. While no studies have investigated the effects of type 2 diabetes on breastfeeding practice in Saudi Arabia, a systematic review of other ten international studies concluded that maternal diabetes was associated with delayed breastfeeding initiation (De Bortoli and Amir 2015). In brief, diabetes mellitus has recorded high rates in the Kingdom of Saudi Arabia, and it may have several adverse effects on pregnancy including on breastfeeding.

5.4.3 Postpartum depression

The Edinburgh Postpartum Depression Scale (EPDS) was utilised in this study to detect predisposition towards postpartum depression. Our findings revealed that the mean EPDS score among the sample was 9.86 shortly after birth, dropping to 8.18 at 26 weeks postpartum. When taking the commonly used cut-off point of 12 on EPDS, the proportion of mothers with depressive mode was 33.2% at discharge. However, this percentage had decreased to 16.1% at 26 weeks postpartum. Taif City experienced a slower decline in postpartum depression during the first six months of the postpartum period, compared to Jeddah City. The means of the EPDS scores were statistically significantly higher in Taif City, however, this difference is not clinically significant. The actual difference is small enough that it would not affect the clinical examination and management. Although there is no data on postpartum depression in Taif, the city has seen high rates of depression and other mental health disorders (Koenig et al. 2014). A study on 490 Taif residents utilising the Beck Depression Inventory (BDI) revealed that 33% of the sample had moderate to severe depressive symptoms, while 11% showed severe to very severe of such symptoms (Abdel-Fattah and Asal 2006). The study also reported that females were more likely to have these symptoms compared to males. Studies in other Saudi regions reported prevalence rates of postpartum depression similar to our results. Alasoom and Koura (2014) and Al-Modayfer et

al. (2015) found that postpartum depression prevalence was 17.8% and 14% in the eastern and central provinces, respectively.

The statistical analysis of the current data showed that postpartum depression was significantly associated with a lower breastfeeding initiation rate, but there was no association with breastfeeding duration. These results are in agreement with other studies in Saudi Arabia and at the international level. Mosli et al. (2015) found that mothers with postpartum depression were less compliant with breastfeeding practices. Also, a systematic review of 30 studies by Grigoriadis et al. (2013) concluded that postpartum depression was associated with decreased rates of and delayed breastfeeding initiation.

5.5 Difficulties of breastfeeding

'Sore or painful nipples' (22.5% at discharge) and 'insufficient breastmilk' (24.2% at 26 weeks postpartum) were the most common difficulties faced by mothers in the current study. A cross-sectional study conducted in Abha (south west, n=384) reported the difficulty of breastmilk insufficiency among 44% of subjects (Al-Binali 2012). The concept of 'insufficient breastmilk' may be perceived by mothers rather than being a real difficulty of breastfeeding. Some studies suggested that while about half of mothers claimed they realise breastmilk insufficiency, only 5% had physiologically insufficient breastmilk (Hector and King 2005, Singh 2010).

5.6 Study strengths and limitations

The present study is the first of its kind to investigate the effects of prevalent maternal chronic diseases such as obesity and overweight, type 2 diabetes, and postnatal depression on breastfeeding practices in Saudi Arabia. These conditions have noticeable prevalence rates in this country, and thus their impact on breastfeeding and overall maternal and infant health cannot be ignored. Also, the study is longitudinal as it monitored breastfeeding indicators over a period of six months, documenting the trend of each outcome and the effects of associated variables.

However, the present study has some limitations. This sample was recruited from the Western Region of Saudi Arabia. Therefore, one should take into account the variations between the Western and other regions of the country if the findings are to be generalised to other areas or at the national level. Also, some socio-demographic and infant feeding data were self-reported, and this might introduce several types of bias, including measurement, and recall bias. In future studies, independent anthropometry should be undertaken, but in this study this was not possible due to limitations of funding and time that was available. The reliability of IIFAS scale was questionable; however, this is the most available tool for this study to measure maternal attitudes toward infant feeding.

Chapter 6

6.0 Conclusion and recommendations

6.1 Introduction

This chapter seeks to draw conclusions based on the main findings of the study. It will also include brief summaries of the main results including breastfeeding indicators and associated risk factors. The chapter will end by providing recommendations for future research on infant feeding within this region as well as for policy makers and public health professionals.

6.2 Breastfeeding indicators

6.2.1 Initiation and intensity of breastfeeding

The early breastfeeding initiation (within one hour of delivery) rate was relatively low at 36.1%. However, most of the mothers (74.6%) in the study initiated breastfeeding within the first 24 hours after birth. The rate of early breastfeeding initiation was greatly affected by inappropriate policies and procedures implemented by hospitals as well as mothers' misconception about colostrum feeding. Many mothers expressed the traditional belief that colostrum was of little or no value to their infants. The early breastfeeding initiation rate was significantly influenced by parity, maternal education, postpartum depression, the method of previous child feeding, prelacteal feeds, antenatal education and whether grandmother had breastfed before.

Less than half of mothers were exclusively breastfeeding at discharge from hospital, which is lower than what has been reported in many other local areas (KSA) and in international settings. The rate of 'exclusive breastfeeding' has gradually declined over recent years to the

current low rate. Less than one in ten infants was still being exclusively breastfed at six months of age.

The ‘partial (mixed) infant feeding’ (bottle- and breastfeeding) was the predominant feeding method during the 6 to 16-week period. At 26 weeks after birth, bottle-feeding of infant formula had been adopted by half of mothers. It is a common practice among Saudi mothers to adopt the partial feeding most of the time.

The ‘any breastfeeding’ rate at discharge was relatively high (79%). This rate was almost stable until 16 weeks postpartum, and then it fell rapidly to below 50%, to be replaced by and equivalent rise in exclusive bottle-feeding.

In comparison between the two cities in the study, Taif and Jeddah, Jeddah was characterised by adoption of the partial feeding method at discharge while more mothers in Taif were exclusively breastfeeding. At the subsequent points of measurement (6, 16 and 26 weeks after birth), the Jeddah group of mothers continued ‘exclusive breastfeeding’ more than Taif group, while the latter group tended to change to the ‘partial breastfeeding’.

6.2.2 Breastfeeding duration

The study found that median breastfeeding duration was very short. The median duration of 'any breastfeeding' reported among participants was 18 weeks (four months). This figure confirms that breastfeeding duration in the Saudi society has been declining, as this average is actually shorter than has been reported recently by other studies. Mothers from Taif City had a longer breastfeeding duration compared to those from Jeddah City.

The duration of 'any breastfeeding' was significantly influenced by maternal age, family socio-economic status, parity, maternal obesity, infant's birth weight, support from hospital staff, the feeding method of the previous child, prelacteal feeds, exposure to formula advertisements and early formula introduction.

6.2.3 Formula and solid foods introduction

Infant formula was introduced very early (before six months) among a large proportion of mothers (71%). However, solid foods were not introduced until 17 weeks postpartum or later by the majority of respondents. No significant differences were observed between the two study cities in the timing of the introduction of formula and solids.

6.3 Maternal attitudes and breastfeeding practices

Based on the IOWA scale, almost half of mothers had positive attitudes toward breastfeeding. Nevertheless, these positive attitudes toward breastfeeding held by mothers were not reflected in actual practices. Subjects from Jeddah group demonstrated more positive attitudes than Taif group, but overall had lower rates of 'exclusive' and 'any breastfeeding'.

6.4 Breastfeeding difficulties

The most frequent difficulty faced by mothers was “not enough breastmilk”, whether perceived or actual. This problem was more manifest at 26 weeks after birth than at discharge. “Sore or painful nibbles” and “breast engorged” were among other difficulties cited in this cohort.

Overall, breastfeeding prevalence rates in Western Saudi Arabia were low compared to studies from other countries and the recommended levels by the international health organisations, including WHO and UNICEF. Breastfeeding duration appears to be decreasing over time and the median time is now 18 weeks. Mothers of younger ages, those who are primiparous or of higher socio-economic status are less likely to initiate and maintain breastfeeding. Furthermore, maternal obesity and postpartum depression have negative impacts on breastfeeding practices. Although the effect of maternal type 2 diabetes on breastfeeding was not clear, it may have the same adverse effect of obesity.

6.5 Recommendations

6.5.1 Recommendations for research studies

This is a cohort study that has been conducted in the Western part of Saudi Arabia. Due to the large area of the KSA and the wide cultural and geographical differences between its provinces, more cohort studies are needed in other areas. Multiple research studies in different areas are necessary to synthesise consistent national data on infant feeding practices.

Findings from the current study showed low rates of breastfeeding prevalence and a decrease in its duration. Thus, specific research should be designed to address the planning of effective

promotional programs that aim to enhance breastfeeding adoption and to reverse the decline in its duration. Also, emphasis should be placed on why mothers with positive attitudes toward breastfeeding do not actually practice it, which may include developing a new infant feeding attitudes scale for the KSA. The influence of fathers, grandmothers and other family and society members on the decision of choosing infant feeding methods can be among future research questions.

Future research studies with larger sample sizes are warranted to further understand and clarify the effects of maternal chronic diseases such as metabolism disorders, hypertension, heart diseases and depression on breastfeeding intention and practices. Common difficulties of breastfeeding and reasons behind bottle-feeding identified in the current study may be included in future research to assess the reality and origins of such problems and reasons.

6.5.2 Recommendations for health policies and professionals

The current study suggests some recommendations for better health practices regarding infant feeding. These recommendations are outlined below:

1. Support potential mothers in Saudi Arabia to engage in antenatal education programs as this would help increase initiation rates and maintenance of breastfeeding.
2. Apply updated guidelines as recommended by trusted international health organisations and institutes, and encourage all maternity hospitals to be accredited by recognised health standards regulatory bodies. The Baby Friendly Hospital Initiative would be a suitable standard to aim for.
3. The free distribution and use of infant formula within maternity hospitals should be strictly restricted. Health professionals involved in maternal health services should be

aware of the harmful effects of early formula feeding on breastfeeding initiation and establishment.

4. New mothers should be encouraged to initiate breastfeeding after delivery as soon as possible, with full support from hospital staff.
5. Promotional programs aiming at the enhancement of breastfeeding should focus on groups vulnerable to not breastfeeding such as younger mothers, those of high socio-economic status, primiparous mothers and those with chronic diseases.
6. Within antenatal education and promotional programs, perceived insufficient breastmilk supply should be clarified for mothers by educating them about methods of stimulating and maintaining breastmilk secretion.
7. Medical schools and colleges are to attract more female students due to cultural and religious sensitivity in this population, and their courses should include training on how to support breastfeeding mothers.

Bibliography

Abdel-Fattah, M M, and A A Asal. 2006. "Prevalence, symptomatology, and risk factors for depression among high school students in Saudi Arabia." *Europe's Journal of Psychology* no. 2 (3):8-16.

Abdel-Khalek, A M. 2009. "Religiosity, subjective well-being, and depression in Saudi children and adolescents." *Mental Health, Religion & Culture* no. 12 (8):803-815.

Al-Akour, N A, M Y Khassawneh, Y S Khader, A Ababneh, and A M Haddad. 2010. "Research factors affecting intention to breastfeed among Syrian and Jordanian mothers: A comparative cross-sectional study." *International Breastfeeding Journal* no. 5 (6):6.

Al-Ayed, I. H., and M. I. Qureshi. 1998. "Breastfeeding practices in urban Riyadh." *Journal of Tropical Pediatrics* no. 44 (2):113-117. doi: 10.1093/tropej/44.2.113.

Al-Baghli, N A, A J Al-Ghamdi, K A Al-Turki, A G El-Zubaier, M M Al-Ameer, and F A Al-Baghli. 2008. "Overweight and obesity in the eastern province of Saudi Arabia." *Saudi Medical Journal* no. 29 (9):1319-1325.

Al-Binali, A M. 2012. "Breastfeeding knowledge, attitude and practice among school teachers in Abha female educational district, southwestern Saudi Arabia." *International Breastfeeding Journal* no. 7 (10).

Al-Daghri, N M, K M Alkharfy, O S Al-Attas, S Krishnaswamy, A Mohammed, O M Albagha, A M Alenad, G P Chrousos, and M S Alokail. 2014. "Association between type 2 diabetes mellitus-related SNP variants and obesity traits in a Saudi population." *Molecular Biology Reports* no. 41 (3):1731-1740.

Al-Hazzaa, H M. 2007. "Health-enhancing physical activity among Saudi adults using the International Physical Activity Questionnaire (IPAQ)." *Public Health Nutrition* no. 10 (01):59-64.

Al-Hreashy, F. A., H. M. Tamim, N. Al-Baz, N. H. Al-Kharji, A. Al-Amer, H. Al-Ajmi, and A. A. Eldemerdash. 2008. "Patterns of breastfeeding practice during the first 6 months of life in Saudi Arabia." *Saudi Medical Journal* no. 29 (3):427-431.

Al-Jassir, M., S. K. Moizuddin, and B. Al-Bashir. 2003. "A review of some statistics on breastfeeding in Saudi Arabia." *Nutrition and Health* no. 17 (2):123-30.

Al-Jassir, M. S., B. M. El-Bashir, and S. K. Moizuddin. 2004. "Surveillance of infant feeding practices in Riyadh City." *Annals of Saudi Medicine* no. 24 (2):136.

Al-Jassir, M. S., B. M. El-Bashir, S. K. Moizuddin, and A. A. R. Abu-Nayan. 2006. "Infant feeding in Saudi Arabia: Mothers' attitudes and practices." *Eastern Mediterranean Health Journal* no. 12 (1/2):6.

Al-Madani, M, V Vydelingum, and J Lawrence. 2010. "Saudi mothers' expected intentions and attitudes toward breast-feeding." *Infant, Child, and Adolescent Nutrition* no. 2 (3):187-198.

Al-Makoshi, A, A Al-Frayh, S Turner, and G Devereux. 2013. "Breastfeeding practice and its association with respiratory symptoms and atopic disease in 1–3-year-old children in the city of Riyadh, Central Saudi Arabia." *Breastfeeding Medicine* no. 8 (1):127-133.

Al-Mazrou, Y. Y., K. M. S. Aziz, and M. Khalil. 1994. "Breast-feeding and weaning practices in Saudi Arabia." *Journal of Tropical Pediatrics* no. 40 (5):267-271.

Al-Modayfer, O, Y Alatiq, O Khair, and S Abdelkawi. 2015. "Postpartum depression and related risk factors among Saudi females." *International Journal of Culture and Mental Health* (ahead-of-print):1-9.

Al-Othaimeen, A.I., B.P. Villanueva, and E.B. Devol. 1987. "The present trend in infant feeding practices in Saudi Arabia." *Food and Nutrition Bulletin* no. 9 (2):62-8.

Al-Sahab, B, A Lanes, M Feldman, and H Tamim. 2010. "Prevalence and predictors of 6-month exclusive breastfeeding among Canadian women: A national survey." *BMC Pediatrics* no. 10 (1):20.

Al-Saleh, I, G Billedo, I El-Doush, G ED Mohamed, and G Yosef. 2006. "Selenium and vitamins status in Saudi children." *Clinica Chimica Acta* no. 368 (1):99-109.

Al-Shehri, S. N., M. K. Farag, M. H. Baldo, Y. Y. Al-Mazrou, and K. M. S. Aziz. 1995. "Overview on breastfeeding patterns in Saudi Arabia." *Journal of Tropical Pediatrics* no. 41 (1):38-44. doi: 10.1093/tropej/41.1.38.

Al-Yousif, G, A A Sabra, A M Sebiany, and A S Hafez. 2011. "Predictors of breastfeeding practices in primary health care facilities at Al-Khobar city, Eastern Saudi Arabia." *Egyptian Journal of Community Medicine* no. 29 (3).

Al-Yousuf, M, TM Akerele, and YY Al-Mazrou. 2002. "Organization of the Saudi health system." *Eastern Mediterranean Health Journal* no. 8 (4-5):645-53.

Al Juaid, D, C Binns, and R Giglia. 2014. "Breastfeeding in Saudi Arabia: A review." *International Breastfeeding Journal* no. 9 (1).

Al Khudairy, L, K Rees, S Kumar, N Al-Daghri, O Al Attas, M Al Okail, K Al Kharfy, and S Stranges. 2015. "Central obesity and the emerging epidemic of type 2 diabetes in Saudi Arabia." *Circulation* no. 131 (Suppl 1):263-268.

Al Rowaily, MA, and MA Abolfotouh. 2010. "Predictors of gestational diabetes mellitus in a highparity community in Saudi Arabia." *Eastern Mediterranean Health Journal* no. 16 (6):636-641.

Al Serehi, A, A M Ahmed, F Shakeel, K Alkhatani, N K El-Bakri, B M Buhari, U Al Mohareb, and N Aljohani. 2015. "A comparison on the prevalence and outcomes of gestational versus type 2 diabetes mellitus in 1718 Saudi pregnancies." *International Journal of Clinical and Experimental Medicine* no. 8 (7):11502-07.

Alasoom, L I, and M R Koura. 2014. "Predictors of postpartum depression in the eastern province capital of Saudi Arabia." *Journal of Family Medicine and Primary Care* no. 3 (2):146.

Albokhary, A A, and J P James. 2014. "Does cesarean section have an impact on the successful initiation of breastfeeding in Saudi Arabia?" *Saudi Medical Journal* no. 35 (11):1400-1403.

Aldossary, A, A While, and L Barriball. 2008. "Health care and nursing in Saudi Arabia." *International Nursing Review* no. 55 (1):125-128.

Aliyu, M H, A P Alio, and H M Salihu. 2010. "To breastfeed or not to breastfeed: a review of the impact of lactational exposure to polychlorinated biphenyls (PCBs) on infants." *Journal of Environmental Health* no. 73 (3):8-14; quiz 32.

Aljoudi, A S, and A ZA Taha. 2009. "Knowledge of diabetes risk factors and preventive measures among attendees of a primary care center in Eastern Saudi Arabia." *Annals of Saudi Medicine* no. 29 (1):15.

Allen, J, and D Hector. 2005. "Benefits of breastfeeding." *New South Wales Public Health Bulletin* no. 16 (4):42-46.

Almalki, M, G Fitzgerald, and M Clark. 2011. "Health care system in Saudi Arabia: an overview." *Eastern Mediterranean Health Journal* no. 17 (10).

Almas, K, M Al-Amri, A Al-Eid, and S Al-Shahrani. 2003. "Oral hygiene, dietary pattern and smoking habits of Bedouin (nomadic Arabs) population in Saudi Arabia." *Tropical Dental Journal* no. 26 (103):19-23.

Alqurashi, K A, K S Aljabri, and S A Bokhari. 2011. "Prevalence of diabetes mellitus in a Saudi community." *Annals of Saudi Medicine* no. 31 (1):19.

Alwelaie, Y A, E A Alsuhaibani, A M Al-Harthy, R H Radwan, R G Al-Mohammady, and A M Almutairi. 2010. "Breastfeeding knowledge and attitude among Saudi women in Central Saudi Arabia." *Saudi Medical Journal* no. 31 (2):193-198.

Amin, T T, A G Abdulrahman, N S Al Muhaidib, and O A Al Hamdan. 2014. "Breastfeeding attitudes and knowledge among future female physicians and teachers in Saudi Arabia." *Health Science Journal* no. 8 (1):102-115.

Amin, T., H. Hablas, and A. A. Al Qader. 2011. "Determinants of initiation and exclusivity of breastfeeding in Al Hassa, Saudi Arabia." *Breastfeeding Medicine* no. 6 (2):59-68. doi: 10.1089/bfm.2010.0018.

Amir, L H, and S Donath. 2007. "A systematic review of maternal obesity and breastfeeding intention, initiation and duration." *BMC Pregnancy and Childbirth* no. 7 (1):9.

Amr, MA, M Balaha, and M Al Moghannum. 2012. "Postpartum mental health among young women." *Online Journal of Health and Allied Sciences* no. 10 (4).

Ardawi, M-SM, MH Qari, AA Rouzi, AA Maimani, and RM Raddadi. 2011. "Vitamin D status in relation to obesity, bone mineral density, bone turnover markers and vitamin D receptor genotypes in healthy Saudi pre-and postmenopausal women." *Osteoporosis International* no. 22 (2):463-475.

Armstrong, J, and J Reilly. 2002. "Breastfeeding and lowering the risk of childhood obesity." *The Lancet* no. 359 (9322):2003-2004.

Assad, S W. 2008. "The rise of consumerism in Saudi Arabian society." *International Journal of Commerce and Management* no. 17 (1/2):73-104.

Ayed, A A. 2014. "Knowledge, attitude and practice regarding exclusive breastfeeding among mothers attending primary health care centers in Abha City." *International Journal of Medical Science and Public Health* no. 3 (11):1355-1363.

Ba'Aqeel, H. 2009. "Cesarean delivery rates in Saudi Arabia: a ten-year review." *Annals of Saudi Medicine* no. 29 (3):179.

Babendure, J, E Reifsnider, E Mendias, M W Moramarco, and Y R Davila. 2015. "Reduced breastfeeding rates among obese mothers: A review of contributing factors, clinical considerations and future directions." *International Breastfeeding Journal* no. 10 (1):1.

Bai, YK, SE Middlestadt, C-Y Joanne Peng, and AD Fly. 2009. "Psychosocial factors underlying the mother's decision to continue exclusive breastfeeding for 6 months: An elicitation study." *Journal of Human Nutrition and Dietetics* no. 22 (2):134-140.

Bailey, C, R H Pain, and J E Aarvold. 2004. "A 'give it a go' breast-feeding culture and early cessation among low-income mothers." *Midwifery* no. 20 (3):240-250.

Baldo, MH, TA Khoja, YY Al Mazrou, MO Basuliman, and KM Aziz. 2001. "Integrating maternal and child health with primary health care in Saudi Arabia." *Eastern Mediterranean Health Journal* no. 6 (4):701-711.

Ballard, O, and A. L Morrow. 2013. "Human milk composition: nutrients and bioactive factors." *Pediatric Clinics of North America* no. 60 (1):49-74.

Batterjee, M. 2010. *A Fading Art: Understanding breast-feeding in the Middle East*. Saudi Arabia: Modia Batterjee.

Batterjee, M. 2011. Tracking, assessing and monitoring the Global Strategy for Infant and Young Child Feeding: Saudi Arabia. In *IBFAN Asia Conference*

Bertino, E, A Varalda, F Magnetti, P Di Nicola, E Cester, L Occhi, C Perathoner, A Soldi, and G Prandi. 2012. "Is breastfeeding duration influenced by maternal attitude and knowledge? A longitudinal study during the first year of life." *The Journal of Maternal-Fetal and Neonatal Medicine* no. 25 (sup3):32-36.

Binns, C, and K Graham. 2005. Project report of the Perth Infant Feeding Study Mark II (2002–2004). Perth: Curtin University of Technology.

Binns, C, M K Lee, and W Y Low. 2016. "The long-term public health benefits of breastfeeding." *Asia-Pacific Journal of Public Health* no. 28 (1):7-14.

Binns, C W, M L Fraser, A H Lee, and J Scott. 2009. "Defining exclusive breastfeeding in Australia." *Journal of Paediatrics and Child Health* no. 45 (4):174-180.

Bloch, A M, D Mimouni, M Mimouni, and M Gdalevich. 2002. "Does breastfeeding protect against allergic rhinitis during childhood? A meta-analysis of prospective studies." *Acta Paediatrica* no. 91 (3):275-279.

Boccolini, C S, M L Carvalho, M I Oliveira, and A G Vasconcellos. 2011. "Factors associated with breastfeeding in the first hour of life." *Revista de Saude Publica* no. 45 (1):69-78.

Bode, L. 2006. "Recent advances on structure, metabolism, and function of human milk oligosaccharides." *The Journal of Nutrition* no. 136 (8):2127-2130.

Boyd, C A, M A Quigley, and P Brocklehurst. 2007. "Donor breast milk versus infant formula for preterm infants: systematic review and meta-analysis." *Archives of Disease in Childhood-Fetal and Neonatal Edition* no. 92 (3):F169-F175.

Brion, M A, D A Lawlor, A Matijasevich, B Horta, L Anselmi, C L Araújo, A B Menezes, C G Victora, and G D Smith. 2011. "What are the causal effects of breastfeeding on IQ, obesity and blood pressure? Evidence from comparing high-income with middle-income cohorts." *International Journal of Epidemiology* no. 40 (3):670.

Cai, X, T Wardlaw, and D W Brown. 2012. "Global trends in exclusive breastfeeding." *International Breastfeeding Journal* no. 7 (1):12.

Cattaneo, A. 2008. "The benefits of breastfeeding or the harm of formula feeding?" *Journal of Paediatrics and Child Health* no. 44 (1):1-2.

Central Department of Statistics and Information in the KSA [CDSI]. *Annual statistical book. no. 49* 2014. Available from http://www.cdsi.gov.sa/yb49/YearBook.htm.

Chantry, C J, C R Howard, and P Auinger. 2006. "Full breastfeeding duration and associated decrease in respiratory tract infection in US children." *Pediatrics* no. 117 (2):425-432.

Chen, A, and W J Rogan. 2004. "Breastfeeding and the risk of postneonatal death in the United States." *Pediatrics* no. 113 (5):e435-e439.

Chertok, IRA, I Raz, I Shoham, H Haddad, and A Wiznitzer. 2009. "Effects of early breastfeeding on neonatal glucose levels of term infants born to women with gestational diabetes." *Journal of Human Nutrition and Dietetics* no. 22 (2):166-169.

Confidential Enquiry into Maternal and Child Health. 2007. "Diabetes in pregnancy-Are we providing the best care?" *Findings of a National Enquiry: England, Wales and Northern Ireland. CEMACH: London*.

Cooke, M, V Schmied, and A Sheehan. 2007. "An exploration of the relationship between postnatal distress and maternal role attainment, breast feeding problems and breast feeding cessation in Australia." *Midwifery* no. 23 (1):66-76.

Cox, J L, J M Holden, and R Sagovsky. 1987. "Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale." *The British Journal of Psychiatry* no. 150 (6):782-786.

Cox, K N, R C Giglia, and C W Binns. 2015. "The influence of infant feeding attitudes on breastfeeding duration: Evidence from a cohort study in rural Western Australia." *International Breastfeeding Journal* no. 10 (1):1.

Dashti, M, J A Scott, C A Edwards, and M Al-Sughayer. 2010. "Determinants of breastfeeding initiation among mothers in Kuwait." *International Breastfeeding Journal* no. 5 (7):1-9.

De Bortoli, J, and LH Amir. 2015. "Is onset of lactation delayed in women with diabetes in pregnancy? A systematic review." *Diabetic Medicine* no. Early view. doi: 10.1111/dme.12846.

De La Mora, A , D W Russell, C I Dungy, M Losch, and L Dusdieker. 1999. "The Iowa Infant Feeding Attitude Scale: Analysis of reliability and validity." *Journal of Applied Social Psychology* no. 29 (11):2362-2380.

Dewey, K G. 1998. "Growth characteristics of breast-fed compared to formula-fed infants." *Neonatology* no. 74 (2):94-105.

Di Manno, L, J A Macdonald, and T Knight. 2015. "The intergenerational continuity of breastfeeding intention, initiation, and duration: A systematic review." *Birth* no. 42 (1):5-15.

Dibley, M J, U Senarath, and K E Agho. 2010. "Infant and young child feeding indicators across nine East and Southeast Asian countries: an analysis of National Survey Data 2000–2005." *Public Health Nutrition* no. 13 (9):1296-1303.

Dogaru, C M, D Nyffenegger, A M Pescatore, B D Spycher, and C E Kuehni. 2014. "Breastfeeding and childhood asthma: systematic review and meta-analysis." *American Journal of Epidemiology* no. 179 (10):1153-1167.

Donath, S M, and L H Amir. 2008. "Maternal obesity and initiation and duration of breastfeeding: data from the longitudinal study of Australian children." *Maternal and Child Nutrition* no. 4 (3):163-170.

Dòrea, J G. 2009. "Breastfeeding is an essential complement to vaccination." *Acta Paediatrica* no. 98 (8):1244-1250.

Duong, D V, C W Binns, and A H Lee. 2004. "Breast-feeding initiation and exclusive breast-feeding in rural Vietnam." *Public Health Nutrition* no. 7 (06):795-799.

Eastern Mediterranean Regional Office of WHO (EMRO). 2014. "Breastfeeding in the EMRO region ".

El-Gilany, A., E. Shady, and R. Helal. 2011. "Exclusive breastfeeding in Al-Hassa, Saudi Arabia." *Breastfeeding Medicine* no. 6 (4):209-213. doi: 10.1089/bfm.2010.0085.

El Bcheraoui, C, M Basulaiman, M Tuffaha, F Daoud, M Robinson, S Jaber, S Mikhitarian, Z A Memish, M Al Saeedi, and M A AlMazroa. 2014. "Status of the diabetes epidemic in the Kingdom of Saudi Arabia, 2013." *International Journal of Public Health* no. 59 (6):1011-1021.

El Mouzan, M I, P J Foster, A S Al Herbish, A A Al Salloum, A A Al Omer, M M Qurachi, and T Kecojevic. 2010. "Prevalence of overweight and obesity in Saudi children and adolescents." *Annals of Saudi Medicine* no. 30 (3):203.

El Mouzan, M.I., A.A. Al Omar, A.A. Al Salloum, A.S. Al Herbish, and M.M. Qurachi. 2009. "Trends in infant nutrition in Saudi Arabia: compliance with WHO recommendations." *Annals of Saudi Medicine* no. 29 (1):20.

Elbur, A I, MA Yousif, A A Albarraq, and M A Abdallah. 2014. "Attitudes of Saudi mothers towards breastfeeding: A cross–sectional survey in Taif Region, Saudi Arabia." *International Journal of Child Health and Nutrition* no. 3 (2):78-83.

Eldeek, B.S., S.O. Tayeb, and S.B. Habiballah. 2012. "Knowledge, attitudes and practice of mothers toward breast feeding at well baby clinic, King Abdulaziz University Hospital." *Journal of American Science* no. 8 (4).

Fairbank, L, S O'Meara, AJ Sowden, MJ Renfrew, and MM Woolridge. 2001. "Promoting the initiation of breast feeding." *Quality in Health Care* no. 10 (2):123-127.

Fida, N.M., and J.Y. Al-Aama. 2003. "Pattern of infant feeding at a university hospital in Western Saudi Arabia." *Saudi Medical Journal* no. 24 (7):725-729.

Foroushani, AR, K Mohammad, M Mahmoodi, and F Siassi. 2010. "Effect of breastfeeding on cognitive performance in a British birth cohort." *Eastern Mediterranean Health Journal* no. 16 (2):20-208.

Ghubash, R, MT Abou-Saleh, and TK Daradkeh. 1997. "The validity of the Arabic Edinburgh Postnatal Depression Scale." *Social Psychiatry and Psychiatric Epidemiology* no. 32 (8):474-476.

Gibson, J, K McKenzie-McHarg, J Shakespeare, J Price, and R Gray. 2009. "A systematic review of studies validating the Edinburgh Postnatal Depression Scale in antepartum and postpartum women." *Acta Psychiatrica Scandinavica* no. 119 (5):350-364.

Giugliani, E RJ. 2004. "Common problems during lactation and their management." *Jornal de Pediatria* no. 80 (5):s147-s154.

Goldman, A S. 2007. "The immune system in human milk and the developing infant." *Breastfeeding Medicine* no. 2 (4):195-204.

Greer, FR, SH Sicherer, and AW Burks. 2008. "American Academy of Pediatrics Section on Allergy and Immunology. Effects of early nutritional interventions on the development of atopic disease in infants and children: the role of maternal dietary restriction, breastfeeding, timing of introduction of complementary foods, and hydrolyzed formulas." *Pediatrics* no. 121 (1):183-91.

Grigoriadis, S, E H VonderPorten, L Mamisashvili, G Tomlinson, C L Dennis, G Koren, M Steiner, P Mousmanis, A Cheung, and K Radford. 2013. "The impact of maternal depression during pregnancy on perinatal outcomes: a systematic review and meta-analysis." *The Journal of Clinical Psychiatry* no. 74 (4):e321-41.

Groer, M W, M W Davis, and J Hemphill. 2002. "Postpartum stress: Current concepts and the possible protective role of breastfeeding." *Journal of Obstetric, Gynecologic, and Neonatal Nursing* no. 31 (4):411-417.

Gunderson, E P, M M Hedderson, V Chiang, Y Crites, D Walton, R A Azevedo, G Fox, C Elmasian, S Young, and N Salvador. 2012. "Lactation intensity and postpartum maternal glucose tolerance and insulin resistance in women with recent GDM The SWIFT cohort." *Diabetes Care* no. 35 (1):50-56.

Guxens, M, M A Mendez, C Moltó-Puigmartí, J Julvez, R García-Esteban, J Forns, M Ferrer, M Vrijheid, M C López-Sabater, and J Sunyer. 2011. "Breastfeeding, long-chain polyunsaturated fatty acids in colostrum, and infant mental development." *Pediatrics* no. 128 (4):e880-e889.

Habeb, A M, M SF Al-Magamsi, I M Eid, M I Ali, A T Hattersley, K Hussain, and S Ellard. 2012. "Incidence, genetics, and clinical phenotype of permanent neonatal diabetes mellitus in Northwest Saudi Arabia." *Pediatric Diabetes* no. 13 (6):499-505.

Habeb, A M, M SF Al-Magamsi, S Halabi, I M Eid, S Shalaby, and O Bakoush. 2011. "High incidence of childhood type 1 diabetes in Al-Madinah, North West Saudi Arabia (2004–2009)." *Pediatric Diabetes* no. 12 (8):676-681.

Hale, T W. 2006. *Medications and mothers' milk*. Texas: Pharmasoft Medical Pub.

Hamdan, A, and H Tamim. 2012. "The relationship between postpartum depression and breastfeeding." *The International Journal of Psychiatry in Medicine* no. 43 (3):243-259.

Hamosh, M, and N Salem. 1998. "Long-chain polyunsaturated fatty acids." *Neonatology* no. 74 (2):106-120.

Hansen, K. 2016. "Breastfeeding: a smart investment in people and in economies." *The Lancet* no. 387 (10017):416.

Hatton, D C, J Harrison-Hohner, S Coste, V Dorato, L B Curet, and D A McCarron. 2005. "Symptoms of postpartum depression and breastfeeding." *Journal of Human Lactation* no. 21 (4):444-449.

Hauck, Y L, J Fenwick, S S Dhaliwal, and J Butt. 2011. "A Western Australian survey of breastfeeding initiation, prevalence and early cessation patterns." *Maternal and Child Health Journal* no. 15 (2):260-268.

Hausman, B L. 2003. *Mother's milk: Breastfeeding controversies in American culture*. New York: Routledge.

Hector, D, and L King. 2005. "Interventions to encourage and support breastfeeding." *New South Wales Public Health Bulletin* no. 16 (4):56-61.

Henderson, J J, S F Evans, J AY Straton, S R Priest, and R Hagan. 2003. "Impact of postnatal depression on breastfeeding duration." *Birth* no. 30 (3):175-180.

Horta, B L, C G Victora, and World Health Organisation [WHO]. 2013. Long-term effects of breastfeeding-a systematic review. World Health Organisation WHO Library Cataloguing-in-Publication Data.

Horwood, LJ, BA Darlow, and N Mogridge. 2001. "Breast milk feeding and cognitive ability at 7–8 years." *Archives of Disease in Childhood-Fetal and Neonatal Edition* no. 84 (1):F23-F27.

Huh, S Y, S L Rifas-Shiman, E M Taveras, E Oken, and M W Gillman. 2011. "Timing of solid food introduction and risk of obesity in preschool-aged children." *Pediatrics* no. 127 (3):e544-e551.

Inam, SN B. 2007. "Anxiety and depression among students of a medical college in Saudi Arabia." *International Journal of Health Sciences* no. 1 (2):295.

Ip, S, M Chung, G Raman, P Chew, N Magula, D DeVine, T Trikalinos, and J Lau. 2007. "Breastfeeding and maternal and infant health outcomes in developed countries." *Evidence Report/Technology Assessment* no. 153:1-186.

Isaacs, E B, B R Fischl, B T Quinn, W K Chong, D G Gadian, and A Lucas. 2010. "Impact of breast milk on intelligence quotient, brain size, and white matter development." *Pediatric Research* no. 67 (4):357-362.

Issaka, A I, K E Agho, A N Page, P L Burns, G J Stevens, and M J Dibley. 2015. "Factors associated with early introduction of formula and/or solid, semi-solid or soft foods in seven francophone West African countries." *Nutrients* no. 7 (2):948-969.

Jackson, K M, and A M Nazar. 2006. "Breastfeeding, the immune response, and long-term health." *Journal of the American Osteopathic Association* no. 106 (4):203-207.

Jacobson, S W, L M Chiodo, and J L Jacobson. 1999. "Breastfeeding effects on intelligence quotient in 4-and 11-year-old children." *Pediatrics* no. 103 (5):e71-e71.

James, DC, and R Lessen. 2009. "Position of the American Dietetic Association: Promoting and supporting breastfeeding." *Journal of the American Dietetic Association* no. 109 (11):1926-1942.

Jensen, R G. 1999. "Lipids in human milk." *Lipids* no. 34 (12):1243-1271.

Karkee, R, A H Lee, V Khanal, and C W Binns. 2014. "Initiation of breastfeeding and factors associated with prelacteal feeds in Central Nepal." *Journal of Human Lactation* no. 30 (3):353-357.

Kendall-Tackett, K. 2007. "A new paradigm for depression in new mothers: the central role of inflammation and how breastfeeding and anti-inflammatory treatments protect maternal mental health." *International Breastfeeding Journal* no. 2 (6):1746-4358.

Khattab, M. S. 2000. "Cross-sectional study of a child health care programme at one family practice centre in Saudi Arabia." *Eastern Mediterranean Health Journal* no. 6:246-259.

Koenig, H G, F Al Zaben, M G Sehlo, D A Khalifa, M S Al Ahwal, N A Qureshi, and A A Al-Habeeb. 2014. "Mental health care in Saudi Arabia: Past, present and future." *Open Journal of Psychiatry* no. 4 (02):113.

Koletzko, B, R Von-Kries, R Closa, J Escribano, S Scaglioni, M Giovannini, J Beyer, H Demmelmair, D Gruszfeld, and A Dobrzanska. 2009. "Lower protein in infant formula is associated with lower weight up to age 2 y: A randomized clinical trial." *The American Journal of Clinical Nutrition* no. 89 (6):1836-1845.

Kordy, M. N., M. A. Ibrahim, F. M. el-Gamal, and A. A. Bahnassy. 1992. "Factors affecting the duration of breastfeeding in a rural population of Saudi Arabia." *Asia-Pacific Journal of Public Health* no. 6 (1):35-9.

Kramer, M S, F Aboud, E Mironova, I Vanilovich, R W Platt, L Matush, S Igumnov, E Fombonne, N Bogdanovich, and T Ducruet. 2008. "Breastfeeding and child cognitive development: new evidence from a large randomized trial." *Archives of General Psychiatry* no. 65 (5):578-584.

Kugyelka, J G, K M Rasmussen, and E A Frongillo. 2004. "Maternal obesity is negatively associated with breastfeeding success among Hispanic but not Black women." *The Journal of Nutrition* no. 134 (7):1746-1753.

Labbok, M H. 2001. "Effects of breastfeeding on the mother." *Pediatric Clinics of North America* no. 48 (1):143-158.

Labbok, M H, D Clark, and A S Goldman. 2004. "Breastfeeding: maintaining an irreplaceable immunological resource." *Nature Reviews Immunology* no. 4 (7):565-572.

Lacey, R. 2011. *Inside the Kingdom*. London: Random House.

Lakati, A, C Binns, and M Stevenson. 2002. "Breast-feeding and the working mother in Nairobi." *Public Health Nutrition* no. 5 (06):715-718.

Landberg, E, Y Huang, M Strömqvist, Y Mechref, L Hansson, A Lundblad, M Novotny, and P Påhlsson. 2000. "Changes in glycosylation of human bile-salt-stimulated lipase during lactation." *Archives of Biochemistry and Biophysics* no. 377 (2):246-254.

Leeson, CPM, M Kattenhorn, JE Deanfield, and A Lucas. 2001. "Duration of breast feeding and arterial distensibility in early adult life: population based study." *British Medical Journal* no. 322 (7287):643-647.

León-Cava, N, C Lutter, J Ross, and L Martin. 2002. *Quantifying the benefits of breastfeeding: A summary of the evidence*. Washington DC: PAHO.

Leung, EY, KY Au, SS Cheng, SY Kok, HK Lui, and WC Wong. 2006. "Practice of breastfeeding and factors that affect breastfeeding in Hong Kong." *Hong Kong Medical Journal* no. 12 (6):432.

Li, R, S B Fein, and L M Grummer-Strawn. 2010. "Do infants fed from bottles lack self-regulation of milk intake compared with directly breastfed infants?" *Pediatrics* no. 125 (6):e1386-e1393.

Li, R., S. Jewell, and L. Grummer-Strawn. 2003. "Maternal obesity and breast-feeding practices." *The American Journal of Clinical Nutrition* no. 77 (4):931-936.

Liu, P, L Qiao, F Xu, M Zhang, Y Wang, and C W Binns. 2013. "Factors associated with breastfeeding duration: A 30-month cohort study in Northwest China." *Journal of Human Lactation* no. 29 (2):253-259.

Lönnerdal, B. 2003. "Nutritional and physiologic significance of human milk proteins." *The American Journal of Clinical Nutrition* no. 77 (6):1537S-1543S.

Madani, K. A., A. A. Al-Nowaisser, and R. H. Khashoggi. 1994. "Breast feeding patterns in Saudi Arabia." *Ecology of Food and Nutrition* no. 31 (3-4):239-245.

Mahfouz, M S, H M Kheir, A A Alnami, A H Al-Asfour, A R Awadh, E A Bahlool, M A Al-Ghawi, S A Al-Hazmi, R M Qadri, and A A Ismail. 2014. "Breastfeeding indicators in

Jazan region, Saudi Arabia." *British Journal of Medicine and Medical Research* no. 4 (11):2229-2237.

Marszalek, J R, and H F Lodish. 2005. "Docosahexaenoic acid, fatty acid-interacting proteins, and neuronal function: breastmilk and fish are good for you." *Annual Review of Cell and Developmental Biology* no. 21:633-657.

Maycock, B, C W Binns, S Dhaliwal, J Tohotoa, Y Hauck, S Burns, and P Howat. 2013. "Education and support for fathers improves breastfeeding rates: A randomized controlled trial." *Journal of Human Lactation* no. 29 (4):484-490.

Mazhari, S, and N Nakhaee. 2007. "Validation of the Edinburgh postnatal depression scale in an Iranian sample." *Archives of Women's Mental Health* no. 10 (6):293-297.

McLaughlin, J R, H A Risch, J Lubinski, P Moller, P Ghadirian, H Lynch, B Karlan, D Fishman, B Rosen, and S L Neuhausen. 2007. "Reproductive risk factors for ovarian cancer in carriers of BRCA1 or BRCA2 mutations: a case-control study." *The Lancet Oncology* no. 8 (1):26-34.

Mead, M N. 2008. "Contaminants in human milk: weighing the risks against the benefits of breastfeeding." *Environmental Health Perspectives* no. 116 (10):A426.

Memish, Z A, C El Bcheraoui, M Tuffaha, M Robinson, F Daoud, S Jaber, S Mikhitarian, M Al Saeedi, M A AlMazroa, and A H Mokdad. 2014. "Obesity and associated factors—Kingdom of Saudi Arabia, 2013." *Preventing Chronic Disease* no. 11 (E174).

Ministry of Education in Saudi Arabia. 2016. Statistics of tertiary education.

Ministry of Finance in Saudi Arabia. 2015. *The national budget* 2015 [cited 07 February 2015]. Available from http://www.mof.gov.sa/english/downloadscenter/pages/budget.aspx.

Ministry of Health in the KSA [MOH]. 2014. "The health statistical year book ".

Moawed, S, and N Al-Shami. 2012. "Factors associated with postpartum depression among Saudi females in Riyadh City." *Journal of American Science* no. 8 (11).

Moran, V H, F Dykes, S Burt, and C Shuck. 2006. "Breastfeeding support for adolescent mothers: Similarities and differences in the approach of midwives and qualified breastfeeding supporters." *International Breastfeeding Journal* no. 1 (1):23.

Mosalli, R, A A Abd El-Azim, M A Qutub, E Zagoot, M Janish, and B A Paes. 2012. "Perceived barriers to the implementation of a baby friendly initiative in Jeddah, Saudi Arabia." *Saudi Medical Journal* no. 33 (8):895-900.

Mosli, H H, LA Banjar, A Ghunaim, H Faruqui, H Alshaikh, M Alsamti, and A Almalki. 2015. "Maternal outcomes of breastmilk feeding in King Abdulaziz University Hospital, Saudi Arabia." *Endocrine Society's 97th Annual Meeting and Expo, March 5–8, 2015 - San Diego*.

Mubarak, F A. 2004. "Urban growth boundary policy and residential suburbanization: Riyadh, Saudi Arabia." *Habitat International* no. 28 (4):567-591.

Nascimento, M B, and H Issler. 2003. "Breastfeeding: making the difference in the development, health and nutrition of term and preterm newborns." *Revista do Hospital das Clínicas* no. 58 (1):49-60.

National Health and Medical Research Council of Australia [NHMRC]. 2012. *Infant feeding guidelines: Information for health workers*. Canberra: National Health and Medical Research Council.

Nayeri, F, M Shariat, H Dalili, F Raji, and A Karimi. 2015. "Breastfeeding status and effective factors in 21-27 months Iranian infants." *Open Journal of Pediatrics* no. 5 (02):156.

Nommsen-Rivers, L A, C J Chantry, J M Peerson, R J Cohen, and K G Dewey. 2010. "Delayed onset of lactogenesis among first-time mothers is related to maternal obesity

and factors associated with ineffective breastfeeding." *The American Journal of Clinical Nutrition* no. 92 (3):574-584.

Oddy, W H. 2001. "Breastfeeding protects against illness and infection in infants and children: a review of the evidence." *Breastfeeding Review* no. 9 (2):11.

Oddy, W H, G E Kendall, J Li, P Jacoby, M Robinson, N H de Klerk, S R Silburn, S R Zubrick, L I Landau, and F J Stanley. 2010. "The long-term effects of breastfeeding on child and adolescent mental health: a pregnancy cohort study followed for 14 years." *The Journal of Pediatrics* no. 156 (4):568-574.

Olang, B, A Heidarzadeh, B Strandvik, and A Yngve. 2012. "Reasons given by mothers for discontinuing breastfeeding in Iran." *International Breastfeeding Journal* no. 7 (7).

Orshan, S A. 2008. *Maternity, newborn, and women's health nursing: Comprehensive care across the lifespan*. Philadelphia: Lippincott Williams & Wilkins.

Ortiz, J, K McGilligan, and P Kelly. 2004. "Duration of breast milk expression among working mothers enrolled in an employer-sponsored lactation program." *Pediatric Nursing* no. 30 (2):111-119.

Owen, C G, R M Martin, P H Whincup, G D Smith, and D G Cook. 2006. "Does breastfeeding influence risk of type 2 diabetes in later life? A quantitative analysis of published evidence." *The American Journal of Clinical Nutrition* no. 84 (5):1043-1054.

Picciano, M F. 2001. "Nutrient composition of human milk." *Pediatric Clinics of North America* no. 48 (1):53-67.

Presidency of Meteorology and Environmental Protection in the KSA. 2015. *Statistics of weather conditions*. CDSI 2015 [cited 04 February 2015]. Available from http://www.cdsi.gov.sa/showsection.aspx?lid=26&id=318.

Queenan, JT. 2004. "Contraception and breastfeeding." *Clinical Obstetrics and Gynecology* no. 47 (3):734-739.

Rea, MF, SI Venancio, JC Martines, and F Savage. 1999. "Counselling on breastfeeding: Assessing knowledge and skills." *Bulletin-World Health Organization* no. 77:492-498.

Robertson, E, S Grace, T Wallington, and D E Stewart. 2004. "Antenatal risk factors for postpartum depression: A synthesis of recent literature." *General Hospital Psychiatry* no. 26 (4):289-295.

Rollins, N C, N Bhandari, N Hajeebhoy, S Horton, C K Lutter, J C Martines, E G Piwoz, L M Richter, C G Victora, and The Lancet Breastfeeding Series Group. 2016. "Why invest, and what it will take to improve breastfeeding practices?" *The Lancet* no. 387 (10017):491-504.

Rooney, B L, and C W Schauberger. 2002. "Excess pregnancy weight gain and long-term obesity: One decade later." *Obstetrics & Gynecology* no. 100 (2):245-252.

Saarinen, KM, K Juntunen-Backman, AL Järvenpää, P Klemetti, P Kuitunen, L Lope, M Renlund, M Siivola, O Vaarala, and E Savilahti. 2002. "Breast-feeding and the development of cows' milk protein allergy." In *Short and long term effects of breast feeding on child health*, edited by KF Michaelsen B Koletzko, O Hernell, 121-130. New York: Kluwer Academic Publishers.

Sadauskaitė-Kuehne, V, J Ludvigsson, Ž Padaiga, E Jašinskienė, and U Samuelsson. 2004. "Longer breastfeeding is an independent protective factor against development of type 1 diabetes mellitus in childhood." *Diabetes/Metabolism Research and Reviews* no. 20 (2):150-157.

Saied, H, A Mohamed, A Suliman, and W Al Anazi. 2013. "Breastfeeding knowledge, attitude and barriers among Saudi women in Riyadh." *Journal of Natural Sciences Research* no. 3 (12):6-13.

Salem, L Y, and M M Al Madani. 2015. "Pregnant and lactating mothers' attitudes and practice of the en teps to successful breastfeeding at King Fahd Hospital of University (KFHU)–Khobar, Saudi Arabia: Appraisal of Baby Friendly Hospital Initiatives." *Journal of Education and Practice* no. 6 (11):9-18.

Saudi Geographic Survey. *Digital information and maps of Saudi Arabia* 2015 [cited 4 February 2015. Available from http://www.sgs.org.sa/Arabic/Products/digitalinfo/Pages/digitalmaps.aspx.

Savarimuthu, RJS, P Ezhilarasu, H Charles, B Antonisamy, S Kurian, and KS Jacob. 2010. "Post-partum depression in the community: A qualitative study from rural South India." *International Journal of Social Psychiatry* no. 56 (1):94-102.

Schack-Nielsen, L, A Larnkjær, and K F Michaelsen. 2005. "Long term effects of breastfeeding on the infant and mother." In *Early nutrition and its later consequences: New opportunities*, edited by **B Koletzko**, 16-23. Dordrecht: Springer Netherlands.

Scott, J A, C W Binns, K I Graham, and W H Oddy. 2009. "Predictors of the early introduction of solid foods in infants: results of a cohort study." *BMC Pediatrics* no. 9 (1):1.

Scott, J A, C W Binns, and W H Oddy. 2007. "Predictors of delayed onset of lactation." *Maternal and Child Nutrition* no. 3 (3):186-193.

Scott, J A, Y Y Kwok, K Synnott, J Bogue, S Amarri, E Norin, A Gil, and C A Edwards. 2015. "A comparison of maternal attitudes to breastfeeding in public and the association with breastfeeding duration in four European countries: results of a cohort study." *Birth* no. 42 (1):78-85.

Serenius, F., A. R. Swailem, A. W. Edressee, and Y. Hofvander. 1988. "Patterns of breastfeeding and weaning in Saudi Arabia." *Acta Paediatrica Scandinavica*:121-129.

Shahbar, A. 2014. *Factors associated with breastfeeding in Western of Saudi Arabia* Massey University Palmerston North, New Zealand.

Shawky, S., and B. A. Abalkhail. 2003. "Maternal factors associated with the duration of breast feeding in Jeddah, Saudi Arabia." *Paediatric and Perinatal Epidemiology* no. 17 (1):91-96. doi: 10.1046/j.1365-3016.2003.00468.x.

Singh, B. 2010. "Knowledge, attitude and practice of breastfeeding–A case study." *European Journal of Scientific Research* no. 40 (3):404-422.

Singh, J, A S Daar, and P A Singer. 2010. "Shared principles of ethics for infant and young child nutrition in the developing world." *BMC Public Health* no. 10 (1):1.

Singhal, A, and J Lanigan. 2007. "Breastfeeding, early growth and later obesity." *Obesity Reviews* no. 8 (s1):51-54.

Smith, J P, M D Dunstone, and M E Elliott-Rudder. 2008. Voldemort'and health professional knowledge of breastfeeding: do journal titles and abstracts accurately convey findings on differential health outcomes for formula fed infants. ACERH Working Paper.

Smith, J P, and L H Ingham. 2001. "Breastfeeding and the measurement of economic progress." *Journal of Australian Political Economy* no. 47:51-72.

Smith, J P, J F Thompson, and D A Ellwood. 2002. "Hospital system costs of artificial infant feeding: estimates for the Australian Capital Territory." *Australian and New Zealand Journal of Public Health* no. 26 (6):543-551.

Smith, JP. 2013. "“Lost milk?” counting the economic value of breast milk in gross domestic product." *Journal of Human Lactation* no. 29 (4):537-546.

Snell-Bergeon, J K, and D Dabelea. 2010. "The infant of the diabetic mother: Metabolic imprinting." In *Diabetes in women,* edited by A Tsatsoulis, 359-375. Totowa, NJ: Humana Press.

Sobel, H L, M A Silvestre, J V Mantaring III, Y E Oliveros, and S Nyunt-U. 2011. "Immediate newborn care practices delay thermoregulation and breastfeeding initiation." *Acta Paediatrica* no. 100 (8):1127-1133.

Steinkraus, K, and P Waldor. 2007. "Extend breastfeeding's benefits." *Mothering* (144):80-87.

Stuebe, A. M., J. W. Rich-Edwards, W. C. Willett, J. E. Manson, and K. B. Michels. 2005. "Duration of lactation and incidence of type 2 diabetes." *JAMA* no. 294 (20):2601-2610. doi: 10.1001/jama.294.20.2601.

Tang, L, C W Binns, A H Lee, X Pan, S Chen, and C Yu. 2013. "Low prevalence of breastfeeding initiation within the first hour of life in a rural area of Sichuan Province, China." *Birth* no. 40 (2):134-142.

Tarrant, M, D YT Fong, K M Wu, I LY Lee, E MY Wong, A Sham, C Lam, and J E Dodgson. 2010. "Breastfeeding and weaning practices among Hong Kong mothers: A prospective study." *BMC Pregnancy and Childbirth* no. 10 (1):27.

Taylor, J S, M Nothnagle, and S R Magee. 2010. "Breastfeeding and diabetes." In *Diabetes in women*, edited by A Tsatsoulis, 415-433. Totowa, NJ, USA: Humana Press.

The Saudi Ministerial Council. 2011. A Royal decree about the code of marketing of breastmilk substitutes Riyadh: Government of Saudi Arabia.

The United Nations Educational Scientific and Cultural Organization (UNESCO). 2016. Countries profiles: Saudi Arabia.

Turcksin, R, S Bel, S Galjaard, and R Devlieger. 2014. "Maternal obesity and breastfeeding intention, initiation, intensity and duration: A systematic review." *Maternal & Child Nutrition* no. 10 (2):166-183.

United Nations Children's Fund [UNICEF]. 2009. Overview of breastfeeding patterns.

United Nations Children's Fund [UNICEF]. 2014. "Infant and young child feeding (2009-2013)." *Statistics and Monitoring, Division of Policy and Practice. UNICEF. New York.*

United Nations Children's Fund [UNICEF], and United Nations Population Fund [UNFPA]. 2011. Egypt Demographic and Health Survey: Breastfeeding Status in Egypt 1-6, http://www.unicef.org/egypt/Eng_Breast-feeding-brochure_21Mar11.pdf.

United Natios Children's Fund [UNICEF], and World Health Organization [WHO]. 2009. Baby-Friendly hospital initiative, revised, updated and expanded for integrated care. Section 1: Background and implementation. 2009. Original BFHI Guidelines developed 1992.

Van de Perre, P. 2003. "Transfer of antibody via mother's milk." *Vaccine* no. 21 (24):3374-3376.

Victora, C G, R Bahl, A JD Barros, G VA França, S Horton, J Krasevec, S Murch, MJ Sankar, N Walker, and N C Rollins. 2016. "Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect." *The Lancet* no. 387 (10017):475-490.

Wahabi, H A, S A Esmaeil, A Fayed, and R A Alzeidan. 2013. "Gestational diabetes mellitus: Maternal and perinatal outcomes in King Khalid University Hospital, Saudi Arabia." *The Journal of the Egyptian Public Health Association* no. 88 (2):104-108.

Walker, A. 2010. "Breast milk as the gold standard for protective nutrients." *The Journal of Pediatrics* no. 156 (2):S3-S7.

Weimer, J P. 2001. The economic benefits of breastfeeding: A review and analysis. United States Department of Agriculture, Economic Research Service.

Weindling, A M. 2009. Offspring of diabetic pregnancy: Short-term outcomes. Paper read at Seminars in Fetal and Neonatal Medicine.

Wheeler, T T, A J Hodgkinson, C G Prosser, and S R Davis. 2007. "Immune components of colostrum and milk—A historical perspective." *Journal of Mammary Gland Biology and Neoplasia* no. 12 (4):237-247.

Wojcicki, J M. 2011. "Maternal prepregnancy body mass index and initiation and duration of breastfeeding: A review of the literature." *Journal of Women's Health* no. 20 (3):341-347.

World Health Organisation [WHO]. 2000. "Effect of breastfeeding on infant and child mortality due to infectious diseases in less developed countries: a pooled analysis. WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality." *Lancet* no. 355 (9202):451-455.

World Health Organisation [WHO]. 2008. "Indicators for assessing infant and young child feeding practices: part 1: definitions: conclusions of a consensus meeting held 6-8 November 2007 in Washington DC, USA."

World Health Organisation [WHO]. 2009. *Infant and young child feeding: Model chapter for textbooks for medical students and allied health professionals*. Geneva: World Health Organization.

World Health Organisation [WHO]. 2011. "Exclusive breastfeeding for six months best for babies everywhere." *WHO statement* no. 15.

World Health Organisation [WHO]. 2015. *Obesity and overweight* 2015a [cited 4 March 2015]. Available from http://www.who.int/mediacentre/factsheets/fs311/en/.

World Health Organisation [WHO]. 2015b. "Saudi Arabia Country profile- Nutrition section." *Nutrition Landscape Information System*.

World Health Organization [WHO], and International Diabetes Federation [IDF]. 2006. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: A report of a WHO/IDF consultation. WHO Geneva.

World Health Organization [WHO], and United Nations Children's Fund [UNICEF]. 2007. Planning guide for national implementation of the Global Strategy for Infant and Young Child Feeding. *WHO Library Cataloguing-in-Publication Data*: 46, http://apps.who.int/iris/handle/10665/43619.

Xu, F, C Binns, A Lee, Y Wang, and B Xu. 2007. "Introduction of complementary foods to infants within the first six months postpartum in Xinjiang, PR China." *Asia Pacific Journal of Clinical Nutrition* no. 16 (Suppl 1):462-466.

Yount, K M, and S M Smith. 2012. Gender and postpartum depression in Arab Middle Eastern women. Paper read at Women's Studies International Forum.

Yusuff, A M, L Tang, C W Binns, and A H Lee. 2015. "Antenatal depressive symptoms and breastfeeding: A prospective cohort study." *Breastfeeding Medicine* no. 10 (6):300-304.

Appendices

Appendix 1 Letters of ethics approval

Curtin University

Memorandum

To	Professor Colin Binns, Public Health
From	Professor Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 120/2013**
Date	15 August 2013
Copy	Dr Roslyn Giglia Public Health Mr Daifellah A M Al Juaid Public Health

Office of Research and Development
Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for providing the additional information for the project titled "*Breastfeeding in Western Saudi Arabia: A prospective cohort study*". 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 120/2013.** *Please quote this number in any future correspondence*.
- Approval of this project is for a period of four years **15-08-2013** to **15-08-2017**.
- Your approval has the following conditions:
  i) Annual progress reports on the project must be submitted to the Ethics Office.
- **It is your responsibility, as the researcher, to meet the conditions outlined above and to retain the necessary records demonstrating that these have been completed.**

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 **Progress Report** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development annually.

Our website https://research.curtin.edu.au/guides/ethics/non_low_risk_hrec_forms.cfm contains all other relevant forms including:

- Completion Report (to be completed when a project has ceased)
- Amendment Request (to be completed at any time changes/amendments occur)
- Adverse Event Notification Form (If a serious or unexpected adverse event occurs)

Yours sincerely

Professor Stephan Millett
Chair Human Research Ethics Committee

KINGDOM OF SAUDI ARABIA
Ministry of Health
Directorate of Health Affairs – Jeddah

To His Excellency the Director of Maternity and Children Hospital

Peace and Blessing of Allah be upon you

We inform you that the Researcher / AL JUAID DAIFELLAH A. M. will perform a search №. (00121)

entitled : **" BREASTFEEDING IN WESTERN SAUDI ARABIA "**

After reviewing the research study methodology by Scientific Committee and Scientific Research Ethics Committee registered with the National Ethics and Medical Committee (№. H-02-J-002) it was found to perform the search.

I hope to facilitate the Researcher task to perform the research taking into account the following:

1 - Any change in the research plan it must obtain a research approval from Researches department.

2 - Service not to be affected in the utilities concerned.

3 - Maintaining the rights of persons subject to search and privacy.

4 - Using the information for scientific research purposes only.

Note this approval is valid for six months from the date written

Thanks for your cooperation.

My Regards.

Assistant Director of Health Affairs for Planning and Development
in Jeddah Governorate
Signed
Dr. Osamah O. Dafar

№.: 46758/302/47 J Date: 24.06.2013

ص.ب ٧٠٣ الطائف ٢١٩٤٤ المملكة العربية السعودية - تليفون ٠٢ / ٧٤٢٨١١١ فاكس ٠٢ / ٧٤٢٩١١١ تحويلة (١٠٠)
P.O. Box 703 Taif 21944 - Saudi Arabia - Tel: 02/7428111- Fax:02/ 7429111 - Ext (100)

وزارة الصحة
Ministry of Health

King Abdul Aziz Specialistl
Taif- Saudi Arabia

ETHICS COMMITTEE

6 October 2013

Daifellah A M Al juaid
Lecturer, Taif University.

Research Title: Breastfeeding in Western Saudi Arabia :A Prospective Cohort Study

We would like to inform you that your ethics committee application has been reviewed and found to be in compliance with the Hospital research policy and procedures, And your research has been approved to be conducted in king Abdul Aziz Specialist hospital.

Chairman of Ethics Committee

Dr. Abdallah Eid

Appendix 2 Information sheet

Curtin University
School of Public Health

Infant Feeding in Western Saudi Arabia: A prospective cohort study

Participant Information Sheet

Congratulations on the birth of your new baby. My name is Daifellah Al Juaid and I am a Curtin University student investigating how mothers feed their babies, the difficulties in feeding their babies and what may affect infant feeding methods in Western Saudi Arabia. I am interested to know more about how you are feeding your baby and to invite you to take part in a study looking at infant feeding practices in Western Saudi Arabia. This study is part of my research for the Doctorate Degree at Curtin University, Australia with support from Taif University.

What will the study do?

The study will investigate how you felt in the last days of your pregnancy and after you gave birth to your infant. I would also like to find out your preferred feeding methods, your health status and the health of your new baby. The findings from this research will help us to plan and provide better health programs for the mothers and their babies in the Western region of Saudi Arabia.

It is important for you to understand why the study is being done and what it will involve before you take part. Please take time to read the following information carefully before making your decision. Please ask the research staff to explain anything that you do not clearly understand or if you want more information about the study.

Can I take part in this study?

As a part of this project 600 mothers in Western Saudi Arabia are being asked about their experiences and opinions about feeding babies. If you:

- Usually live in the Western Saudi Arabia area and are a Saudi citizen
- Have had a normal pregnancy
- Are over 18 years of age
- Have a baby without any serious illness,

you are eligible to take part.

It is up to you to decide if you want to take part in this study or not.

What do I need to do?

If you do decide to take part, you will be asked to sign a consent form and you will be given a copy of this signed information and consent form to keep. You will also be asked to complete a questionnaire at birth (now), at 6, 16 and 26 weeks after birth. A female interviewer will contact you by telephone to take your answers. If you do not know the answers on questions regarding diabetes, your weight and height, I will request it from your hospital record with your permission on the consent form. 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 affecting your rights or your medical care. 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.

Will my information be kept confidential?

The study information you provide will be kept separate from your personal details, and only the study researchers will have access to it. All questionnaires will be stored securely for seven years at Taif University. The data files and other electronic work will also be stored for five years with secure password protection. If you have any questions about how the information will be used, please ask the female interviewer or contact me on 0504709015.

What will happen with the results of this study?

The results of this research will be published as a PhD thesis, as well as articles in professional journals. No individual names or personal details will be used in any published work. If you would like a final copy of the results of the study, then please contact me directly.

What if I have questions about the study?

This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 120/2013). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. 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 9223 or by emailing hrec@curtin.edu.au.

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

Appendix 3 Consent form

Curtin University
School of Public Health

Infant feeding in Western Saudi Arabia: A prospective cohort study

Consent Form

- I agree to participate in this research and understand that participation is voluntary and I can change my mind and withdraw at anytime. I am over 18 years of age.
- I confirm that I have read and understood the participant information and the consent form. Any questions I have asked have been answered to my satisfaction.
- I authorise the researcher to obtain data related to diabetes and obesity (weight and height) about me from the hospital and health centre.
- I understand that all information provided is treated as confidential.
- I agree that research gathered for this study may be published provided that names or any other information that may identify me is not used.

Name of participant _____ Signature _____

Telephone number _____ Date _____

Address:_____

I, the undersigned have discussed the nature and purpose of the study and the possible risks and benefits of participation with the participant and/or legally authorised representative. I believe that the participant and/or his/her representative has been fully informed, using language which is understandable and appropriate, and has understood this explanation.

_____ _____
Name of Researcher/Person obtaining consent Date

_____
Signature

Revocation of Consent
I hereby WITHDRAW my consent to participate in the research project described above and understand that such withdrawal will not make any difference to my medical care or my relationship with my doctor or other staff.

_____ _____
Name of participant Date

_____
Signature

This Revocation of Consent should be forwarded to:
Daifellah A M Al juaid
Taif University
P.O. Box 2425 Taif 21974

Appendix 4 Questionnaires

Dear Mother,
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. 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)
Dr. Roslyn Giglia (Co-Supervisor)
Daifellah A M Al juaid (researcher)
Telephone: +966504709015
Email: d.aljuaid@student.curtin.edu.au

Interview Date: _____/_____/_____ Interviewer Code: _____

Mother's name: _____ Mother's Code: _____

Tel: (home) _____ (mobile) _____

Address: _____

Baby's Date of Birth: ___/_____/_____ Baby's gender? Male 1 Female 2

A) Breastfeeding questionnaire

1. 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

		at birth	6 weeks	16 weeks	26 weeks
I	**Bottle-feeding with infant formula:**				
II	**Breastfeeding:**				
III	**breastfeeding + bottle-feeding:**				

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

		at birth	6 weeks	16 weeks	26 weeks
a	mothers' do not have enough milk				
b	mothers go back to work or study				
c	baby's father disapproves				
d	formula milk is better				
e	mothers want to continue smoking				
f	mothers play a lot of sport				
g	grandmother suggests bottle feeding				
h	friends or relative suggest bottle-feeding				
i	health workers (doctors, nurses) suggest bottle-feeding				
j	mother finds breastfeeding too painful				
k	other (please specify):_____				

	pre-pregnancy	at birth	26 weeks
3. What was your weight (kg)?			
4. What was your height (cm)?			
5. What was your baby's weight (kg)?			

6. Do you have diabetes?

		pre-pregnancy		at birth		26 weeks	
a	yes						
b	no						
c	do not know						

7. If you have diabetes, what kind of treatment do you use to manage it?

		pre-pregnancy	at birth	26 weeks
a	special diet and exercises			
b	tablets			
c	insulin injections			

8. How many times in a week do you intake these foods in your regular diet?

		during pregnancy	at birth	6 weeks	16 weeks	26 weeks
a	meat					
b	chicken					
c	fish					
d	rice					
e	meat curry					
f	chicken curry					
g	fried potatoes					
h	brown bread					
i	pasta béchamel					
j	pizza					
k	full cream milk					
l	fast food					
m	soft drink					
n	fruits					
o	vegetables					
p	other (please specify): _____					

9. Have you received any of the following supplements?

		during pregnancy	at birth	6 weeks	16 weeks	26 weeks
a	vitamin D					
b	iron					
c	multivitamin (please name if possible)					
d	iodine					

10. How were you feeding your baby in the PAST 24 HOURS? (please choose only one):

		at birth	6 weeks	16 weeks	26 weeks
a	breast milk only (no other fluids or solids)				
b	formula only – name: _____				
c	formula and breast milk				
d	cow's milk only				
e	Water				
f	Juice				
g	fruits (type):_____				
h	vegetables (type) :_____				
i	Cerelac				
j	Wheat				
k	canned infant food				
l	infant formula & cow's milk				
m	breast-feeding & cow's milk				

n	solids & breast-feeding with or without cow's milk				
o	infant formula with or without cow's milk				
p	other (please specify): _____				

11. Why did you decide to breastfeed? You can give more than one answer. Please number them from most important to the least important, with the most important reason starting from1:

		at birth	6 weeks	16 weeks	26 weeks
a	the baby's father wanted me to breastfeed				
b	Islam recommends breastfeeding				
c	traditions recommend breastfeeding				
d	breast milk is better for the baby				
e	breastfed babies are more intelligent and healthier				
f	breastfeeding helps me lose weight				
g	my mother advised me to breastfeed				
h	other people advised 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	other (please specify): _____				

12. Why did you use bottle-feeding? You can give more than one answer. Please number them from most important to the least important, with the most important reason starting from1:

		at birth	6 weeks	16 weeks	26 weeks
a	did not have enough breast milk				
b	needed to go back to work or study				
c	baby's father disapproved breastfeeding				
d	breastfeeding is restrictive				
e	formula milk is better				
f	formula makes the baby grow bigger				
g	wanted to continue smoking				
h	I played a lot of sport				
i	my mother or mother-in-law suggested bottle-feeding				
j	friends or relatives suggested bottle-feeding				
k	health professionals (doctors, nurses) suggested bottle-feeding				
l	other (please specify):_____				

13. 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?

		at birth	6 weeks		16 weeks		26 weeks	
		received?	received?	age	received?	age	received?	age
a	honey							
b	infant formula/ animal milk							
c	glucose water							
d	animal margarine							
e	pomegranate or any other fruit juice							
f	anise							
g	fruits (type)							
h	vegetable (type)							
i	any kind of cereal							
j	baby tea							
k	mashed food with water							
l	other food (please specify): _____							

	at birth	6 weeks	16 weeks	26 weeks
14. Number of diarrhoeal episodes the baby had since we last spoke (passing watery stools more than 3 times a day and each episode lasting for more than 2 days)				
15. Did you seek treatment? (yes or no)				
16. If yes, from who?				
17. How many times has your baby been hospitalised due to an acute respiratory infection since we last spoke?				
18. Did you seek treatment? (yes or no)				
19. If yes, from who?				

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

		at birth	6 weeks	16 weeks	26 weeks
a	animal milk				
b	traditional herbs				
c	meat soup				
d	None				
e	others (please specify): _____				
f	not applicable (did not breastfeed)				

21. What infant-feeding difficulties you have experienced since birth or since we last spoke?

		at birth	6 weeks	16 weeks	26 weeks
a	Engorgement				
b	sore or painful nipples				
c	flat or inverted nipples				
d	mastitis				
e	breast congestion				
f	Not enough breastmilk				
g	Fever				
h	None				
i	other (please specify): _____				

22. What was the type of birth delivery?
    a) Vaginal
    b) Caesarean, reason: _____

23. When did you **first** decide how you were going to feed your last baby
    a) before I became pregnant
    b) early in my pregnancy
    c) late in my pregnancy
    d) during labor
    e) after my baby was born

24. How long after the birth it was before you put your new baby to the breast?
    a) immediately after birth (< 1 hour)
    b) within 4 hours
    c) 4-24 hours
    d) the next day
    e) other (please specify): _____

25. Have you received any formula from hospital **before** discharge?
    a) yes, formula type: _____
    b) no

26. Have you received any formula from hospital **at** discharge?
    a) yes, formula type: _____
    b) no

27. Have you seen any advertisement about infant formula?
    a) yes, formula type: _____
    b) no

28. If yes, where have you seen the advertisement?
    a) TV
    b) internet
    c) newspaper
    d) magazine
    e) commercial catalogue
    f) clinic
    g) pharmacy
    h) street
    i) do not remember

29. What was the **first** feed given to the baby? _____

30. How old was your baby when you **first** introduced him/her to formula? _____

31. What was the **first** solid food given to your baby? _____

32. How old was the baby when you first gave her/him **water**? _____

33. How old was the baby when you first gave him/ her **juice**? _____

34. How old was your baby when you first gave your baby **solid** food? _____

35. For how long did you breastfeed your baby? (WEEKS)_____

36. In general, do you think you had enough help and information about feeding your baby from hospital staff?
    a) yes
    b) no

37. Before you had your baby, did you receive any of the following on how to feed your new baby?
    a) pamphlets or booklets on breastfeeding
    b) lectures or classes on breastfeeding
    c) demonstrations on how to breastfeed
    d) video or TV show on how to breastfeed
    e) individual consultation or discussion
    f) none
    g) other (please specify): _____

38. Did any of the following people support or encourage you with breastfeeding?
    a) the baby's father
    b) your mother
    c) your mother-in-law
    d) your doctor
    e) nurse
    f) other (please specify): _____

39. How many children do you have (including this baby)? _____

40. If you have more than one child, how did you feed your **previous** child?
    a) breastfeeding only
    b) bottle-feeding only
    c) breast +bottle-feeding

41. Did your mother breastfeed any of her children?
    a) yes
    b) no
    c) do not know

42. Did the baby's **father** have any preference for how you fed your baby?
    a) yes, he prefers bottle-feeding
    b) yes, he prefers breastfeeding
    c) he does not mind how I feed our baby
    d) never really discussed the matter with him

43. Did your **mother** have any preference for how you fed your baby?
    a) yes, she prefers bottle-feeding
    b) yes, she prefers breastfeeding
    c) she does not mind how I feed my baby
    d) never really discussed the matter with her

44. Before you became pregnant, did you smoke cigarettes?
    a) yes
    b) no

45. If yes, how many cigarettes did you smoke a day before you became pregnant? _____

46. While you were pregnant, did you smoke cigarettes?
    a) yes
    b) no

47. If yes, how many cigarettes did you smoke a day when you were pregnant? _____

48. Did the baby's father smoke before you were pregnant?
    a) yes
    b) no

49. Did the baby's father smoke while you were pregnant?
    a) yes
    b) no

B) Demographic information

50. In which district do you live? _____

51. What is your age (years)? _____

52. What is the highest level of education you have completed?
    a) primary school
    b) intermediate school
    c) high school
    d) bachelor degree
    e) masters
    f) PhD
    g) other (please specify): _____

53. What is your marital status?
    a) married
    b) divorced
    c) separated
    d) widowed

54. If you are married, how many wives does your husband currently have (including you)? _____

55. Do you live in;
    a) a rented place? (rent amount):_____
    b) your own place?
    c) governmental or company housing

56. Do you live in
    a) a nuclear family?
    b) an extended family?

57. Number of people living in your house (including you): _____

58. Do you get any help in doing housework and looking after your child/ children?
    a) yes
    b) no

59. If yes, people who help to look after your child/ children include;
    a) child's / children's father
    b) child's / children's grandmother (mother's side)
    c) child's / children's grandmother (father's side)
    d) another member of the family (which member):_____
    e) baby sitter
    f) maid
    g) child care services
    h) other (please specify): _____

60. What is your occupation? _____

61. What is your husband's occupation? _____

62. Approximately, how much the **monthly** income of your family in Saudi Riyal (SR)?
    a) less than SR 3,000
    b) 3,001- 6,000
    c) 6,001- 9,000
    d) 9,001- 12,000
    e) 12,001- 15,000
    f) 15,001- 18,000
    g) 18, 001- 20,000
    h) more than SR 20,000

C) Iowa scale

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 disagree				**Strongly agree**	**at birth**	**26 weeks**
1. The benefits of breastfeeding last only as long as the baby is breast-fed	1	2	3	4	5		
2. Formula feeding is more convenient than breastfeeding	1	2	3	4	5		
3. Breastfeeding increase mother infant bonding	1	2	3	4	5		
4. Breast milk is lacking in iron	1	2	3	4	5		
5. Formula fed babies are more likely to be overfed than breastfed babies	1	2	3	4	5		
6. Formula feeding is the better choice if the mother plans to go back to work	1	2	3	4	5		
7. Mothers who formula feed miss one of the great joys of motherhood	1	2	3	4	5		
8. Women should not breastfeed in public places such as restaurants	1	2	3	4	5		
9 Breastfed babies are healthier than formula fed babies	1	2	3	4	5		
10. Breastfed babies are more likely to be overfed than formula fed babies	1	2	3	4	5		
11. Fathers feel left out if a mother breast-feeds	1	2	3	4	5		
12. Breast milk is the ideal food for babies	1	2	3	4	5		
13. Breast milk is more easily digested than formula	1	2	3	4	5		
14. Formula is as healthy for an infant as breast milk	1	2	3	4	5		
15. Breastfeeding is more convenient than formula	1	2	3	4	5		
16. Breast milk is cheaper than formula	1	2	3	4	5		
17. A mother who occasionally smokes should not breastfeed her baby	1	2	3	4	5		

D) EPDS

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.

	at birth	26 weeks
1. I have been able to laugh and see the funny side of things:		
A s 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:		
A s 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		
Yes, some of the time		
Not very often		
No, never		
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		
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, most of the time		
Yes, quite often		
Not very often		
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. T he thought of harming myself has occurred to me:		
Yes, quite often		
Sometimes		
Hardly ever		
Never		

Thank you very much for your participation.

Interviewer signature: _____

Appendix 5 List of publication

A- Published papers:

Al Juaid, D. A., C. W. Binns, and R. C. Giglia. (2014). Breastfeeding in Saudi Arabia: A review. *International breastfeeding journal*. 9(1): 1-9.

B- Under publication:

1. Breastfeeding initiation, intensity and duration in Western Saudi Arabia: Findings from a prospective cohort study.
2. The impact of maternal obesity, type 2 diabetes and postnatal depression on breastfeeding in the western region of Saudi Arabia.
3. The need for assessment of the role of maternal attitudes toward breastfeeding in determining infant feeding practices in Saudi Arabia.
4. Socio-demographic factors affecting breastfeeding in Western Saudi Arabia.

Appendix 6 Additional tables from results:

Reasons for choosing breastfeeding at discharge (2nd choice).

Reasons	N	%
Breastmilk is better	109	18.9
Fewer infection	73	12.6
Breastfed baby intelligent and healthy	65	11.2
Mother-infant bonding	40	6.9
To lose weight	38	6.6
Father choice	36	6.2
It is a natural way	34	5.9
Islam recommends it	25	4.3
Traditions recommend it	20	3.5
My mother advice	15	2.6
Other people advice	9	1.6
It is convenient	4	0.7
Missing	110	19.0
Total	578	100.0

Reasons for choosing breastfeeding **at discharge** (3rd choice).

Reasons	N	%
Fewer infection	71	12.3
Breastmilk is better	63	10.9
Mother-infant bonding	62	10.7
Breastfed baby intelligent and healthy	52	9.0
To lose weight	35	6.1
It is a natural way	30	5.2
Islam recommends it	29	5.0
Other people advice	24	4.2
It is convenient	24	4.2
My mother advice	21	3.6
Traditions recommend it	17	2.9
Father choice	15	2.6
Other	2	0.3
Missing	133	23.0
Total	578	100.0

Appendix 7 Reasons for choosing breastfeeding at 26 weeks postpartum (2nd choice).

Reasons	N	%
Breastmilk is better	66	11.4
Breastfed baby intelligent and healthy	54	9.3
Fewer infection	41	7.1
Traditions recommend it	27	4.7
Islam recommends it	25	4.3
Father choice	15	2.6
It is a natural way	13	2.2
To lose weight	12	2.1
Other people advice	5	0.9
Mother-infant bonding	4	0.7
It is convenient	3	0.5
My mother advice	2	0.3
Missing (mainly not breastfeeding)	311	53.8
Total	578	100.0

Reasons for choosing breastfeeding **at 26 weeks postpartum** (3rd choice).

Reasons	N	%
Fewer infection	66	11.4
Mother-infant bonding	54	9.3
My mother advice	41	7.1
To lose weight	27	4.7
Islam recommends it	25	4.3
It is convenient	15	2.6
It is a natural way	13	2.2
Breastmilk is better	12	2.1
Breastfed baby intelligent and healthy	5	0.9
Other people advice	4	0.7
Traditions recommend it	3	0.5
Father choice	2	0.3
Missing (mainly not breastfeeding)	340	58.8
Total	578	100.0

Appendix 8 Reasons for choosing bottle-feeding at discharge (2nd choice).

Reasons	N	%
To go back to work or study	47	8.1
Breastfeeding is restrictive	43	7.4
Insufficient breastmilk	24	4.2
Other	20	3.5
It is the way baby feed in Saudi Arabia	16	2.8
Formula is better	15	2.6
Formula helps baby grow bigger	14	2.4
To play sports	7	1.2
Health professional suggest it	4	0.7
To continue smoking	2	0.3
Father disapproves breastfeeding	1	0.2
Missing (or not applicable, not bottle-feeding)	385	66.6
Total	578	100.0

Reasons for choosing bottle-feeding **at discharge** (3rd choice).

Reasons	N	%
Breastfeeding is restrictive	36	6.2
To play sports	20	3.5
It is the way baby feed in Saudi Arabia	15	2.6
Formula is better	14	2.4
Formula helps baby grow bigger	13	2.2
Insufficient breastmilk	9	1.6
Health professional suggest it	7	1.2
To go back to work or study	4	0.7
My mother suggests it	4	0.7
Other	4	0.7
Father disapproves breastfeeding	3	0.5
Missing (or not applicable, i.e. not bottle-feeding)	449	77.7
Total	578	100.0

Appendix 9 Reasons for choosing bottle-feeding at 26 weeks postpartum (2nd choice).

Reasons	N	%
Breastfeeding is restrictive	158	27.3
To go back to work or study	66	11.4
Other	40	6.9
Formula is better	28	4.8
Insufficient breastmilk	27	4.7
It is the way baby feed in Saudi Arabia	25	4.3
To play sports	21	3.6
Formula helps baby grow bigger	18	3.1
Health professional suggest it	11	1.9
Father disapproves breastfeeding	9	1.6
My mother suggests it	5	0.9
Friends suggest it	5	0.9
Missing	165	28.5
Total	578	100.0

Reasons for choosing bottle-feeding **at 26 weeks postpartum** (3rd choice).

Reasons	N	%
Breastfeeding is restrictive	55	9.5
Formula helps baby grow bigger	53	9.2
To play sports	37	6.4
It is the way baby feed in Saudi Arabia	32	5.5
Formula is better	26	4.5
Other	22	3.8
To go back to work or study	11	1.9
My mother suggests it	11	1.9
Insufficient breastmilk	10	1.7
Father disapproves breastfeeding	6	1.0
Friends suggest it	3	0.5
To continue smoking	1	0.2
Missing	311	53.8
Total	578	100.0