

**School of Public Health**

**A cohort study of infant feeding practices and maternal  
breastfeeding problems in a rural area of Sichuan Province,  
PR China**

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**This thesis is presented for the Degree of  
Doctor of Philosophy  
of  
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## **Declaration**

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

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

Signature: .....

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## **Abstract**

### **Introduction**

Breastfeeding has been consistently shown to be the appropriate feeding method for infants. The benefits of breastfeeding for the health of infants and women are well documented. To achieve optimal growth, development and health, the World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life and continued breastfeeding thereafter with appropriate complementary foods.

Breastmilk has been the only source of nutrition for the newborn infants for thousands of years in China. But since the late 1970s, China has experienced a rapid decline in prevalence and duration of breastfeeding. In response to Chinese government's support for the Baby Friendly Hospital Initiative (BFHI) and the introduction of some regulation of the marketing of breastmilk substitutes, increase in the breastfeeding rates has been observed around the country since 1992. However, the exclusive breastfeeding rates to 6 months postpartum are still low in most places and few provinces had achieved the national target of 80% exclusive breastfeeding rate at 4 months by 2000. Despite its negative influence on infants' health, early introduction of complementary foods is a common phenomenon across China. There has been little research exploring the factors that influence the early complementary feeding in China. Experiencing breastfeeding problems, such as cracked and sore nipples, insufficient milk supply and mastitis is common amongst lactating mothers. Very few studies have documented the incidence of mastitis or have determined its influential factors among Chinese mothers.

Information about infant feeding practices in the rural area of Sichuan province is limited. No previous prospective cohort studies on infant feeding practices have been undertaken in Sichuan Province, China. The objectives of this study were to document the use of prelacteal feeds and investigate factors associated with early initiation of breastfeeding among mothers in Jiangyou, Sichuan Province; investigate the prevalence and duration of breastfeeding up to 12 months postpartum; identify determinants of breastfeeding at discharge and discontinuing breastfeeding before 12 months postpartum; examine the incidence of breastfeeding problems mother

experienced within 6 months postpartum; explore determinants of lactation mastitis; document the prevalence of premature introduction of complementary foods and its associated factors.; and recommend possible strategies for improving breastfeeding prevalence in rural areas of Sichuan Province, China.

## **Methods**

A prospective cohort study on infant feeding practices was conducted between March 2010 to December 2011 in Jiangyou, Sichuan Province, China. Jiangyou is a county-level city located 160 km north of the provincial capital city Chengdu. The city of Jiangyou itself is relatively small (approximately 250,000 people) and is surrounded by mountainous areas which suffered extensive earthquake damage in 2008.

From March to November, 2010, mothers who delivered single healthy babies at four hospitals and three township health centres in Jiangyou were invited to participate before discharge. Those mothers agreeing to participate were interviewed face-to-face with structured baseline questionnaires by the principal researcher or trained hospital staff. Then mothers were followed up for a period of twelve months by the principal researcher via telephone. The follow-up intervals were at 1, 3, 6 and 12 months postpartum. The baseline and follow-up questionnaires used in this study were based on questionnaires that had been previously used in breastfeeding cohort studies in China and Australia.

Data were entered and analysed using the Statistical Package for the Social Sciences, version 18. Group comparisons were conducted using chi-square test and Student's t-test between participants and non-participants, remaining participants and drop outs for basic information. Descriptive statistics, Kaplan-Meier analysis, life-table method, logistic regression and Cox regression analysis were used to address each corresponding objective of the study.

The project was approved by the Human Research Ethics Committee of Curtin University, Australia and the local health authorities in China. An information letter, containing the explanation of the project, was given and read to each mother. Informed written consent was obtained before mothers participated in the study. All

the participants were informed that they could withdraw from the study at any time without prejudice.

## **Results**

A total of 723 mothers were invited to participate while they were in hospital and 695 women agreed to participate, yielding a participation rate of 96%. Less than one in ten women initiated breastfeeding within the first hour of delivery and the majority of newborn infants (76%) received breastmilk after 24 hours of birth. The practice of providing prelacteal feeds was prevalent in Jiangyou. Infant formula and plain water were the most common prelacteal feeds. Only 7% of infants received colostrum or breastmilk as their first feed. Delivery at hospital, attendance at antenatal class, and hospital staff's encouragement of early breastfeeding initiation were associated with high rates of breastfeeding initiation within the first hour of life.

Moreover, the breastfeeding rate at discharge was 93.5% in Jiangyou. Mothers who perceived that their partners were supportive for breastfeeding, who received encouragement of breastfeeding from health facility staff and who made decision of breastfeeding before pregnancy were more likely to be breastfeeding at discharge. The 'full breastfeeding' rate at discharge was 36.3%; and early breastfeeding initiation was significantly associated with higher rates of 'full breastfeeding' at discharge.

The median durations of 'any breastfeeding' and 'full breastfeeding' were 8 and 5 months, respectively. Older maternal age, giving birth at township health centres, planning to breastfeed for more than 6 months, introducing solid foods after 6 months postpartum and returning to work when the infants were at least 6 months of age were associated with longer duration of 'any breastfeeding'. Higher maternal education level and return to work early were risk factors of discontinuing fully breastfeeding before the end of six months postpartum.

Approximately nine in ten babies had received complementary foods before they were six months of age. Fruit juice and vegetable juice were the earliest food introduced to infants, followed by yolk. Perceived friends' breastfeeding behaviours,

time of maternal return to work and introduction of infant formula within 6 months were associated with premature complementary feeding.

Insufficient breastmilk was the most common breastfeeding problem experienced by mothers during the first 6 months. The incidence of the first episode of mastitis was 7.4% within 6 months postpartum. Cracked and sore nipples and maternal stress were risk factors of developing lactation mastitis.

### **Conclusions**

This is the first cohort study on infant feeding practices in a rural area of Sichuan Province. The rather disappointing breastfeeding practices in the immediate postpartum period in Jiangyou may have been influenced by the widespread distribution of infant formula that occurred right after the earthquake. It is important to provide education and skill training to maternal health care practitioners in order to improve their practice of assisting mothers in initiating breastfeeding early. ‘Mothers’ perceptions of paternal attitudes towards breastfeeding’ was an important factor associated with breastfeeding initiation at discharge. Future research investigating paternal participation in breastfeeding intervention programs may contribute to better understanding of father’s role in breastfeeding in China. To prevent lactation mastitis, it is important to correct mothers’ positioning and attachment and ensure no nipple pain during feeding before discharge. The failure to exclusive breastfeeding and prolonged breastfeeding showed poor adherence to the WHO recommendations in this study. There are needs to emphasise the benefits of exclusive breastfeeding for the first six months and promote breastfeeding duration of at least two years in the future breastfeeding promotion programs.

## Definitions

The definitions of breastfeeding used in this thesis are from the following sources (Armstrong 1991; Binns et al. 2009; The NSW Centre for Public Health Nutrition 2005; WHO 2003a, 2008).

Other definitions used in this thesis are from academic publications which are cited in the specific definitions.

**Any breastfeeding:** The child has received breastmilk (direct from the breast or expressed) with or without other drink, formula or other infant food.

**Any breastfeeding duration:** The total length of time an infant received any breastmilk at all.

**Baby Friendly Hospital Initiative (BFHI):** An approach to transforming maternity practices as recommended in the joint WHO/United Nations Children's Fund (UNICEF) statement on Protecting, Promoting and Supporting Breastfeeding: the special role of maternity services. The BFHI was launched in 1991 by UNICEF and WHO. Baby friendly hospitals practise the 'Ten steps to successful breastfeeding' (part of the joint statement) and observe the principles and aim of the International Code of Marketing of Breastmilk Substitutes, including not accepting free or low-cost supplies of breastmilk substitutes, feeding bottles, teats and pacifiers. To acquire the 'baby friendly' designation, a hospital must be externally assessed according to an agreed procedure using the Global criteria.

**Bottle feeding:** Feeding an infant from a bottle, whatever is in the bottle, including expressed breastmilk, water and formula, etc.

**Breastfeeding:** It is the same as 'any breastfeeding'. The child receives some breastmilk but can also receive any food or liquid including non-human milk.

**Breastmilk substitute:** Any milk (other than breastmilk) or food being marketed or otherwise represented as a partial or total replacement for breastmilk, whether or not

it is suitable for that purpose. It commonly includes infant formula, cow's milk, and other milks.

**Breastmilk:** Human milk and colostrum.

**Cessation of breastfeeding:** Completely stopping breastfeeding, including suckling.

**Cohort study:** A longitudinal or prospective study in which subsets of a defined population can be identified to assess their exposure to a factor (e.g. breastfeeding) that is hypothesised to influence the probability of an outcome (for example, ovarian cancer).

**Complementary feeding:** This is the practice of giving complementary foods. The process of giving an infant food in addition to breastmilk or infant formula, when either becomes insufficient to satisfy the infant's nutritional requirements. The child receives both breastmilk and solid or semi-solid food or breastmilk substitutes.

**Complementary food:** Any food, whether manufactured or locally prepared, used as a complement to breastmilk or infant formula, when either becomes insufficient to satisfy the nutritional requirement of the infant. Such food is also commonly referred to as weaning food or breastmilk supplement.

**Confidence interval:** The computed range of values that contains the population or 'true' value, estimated by a certain statistic, such as a mean, proportion, or rate, with a given probability, e.g. 95% (Nakagawa & Cuthill 2007).

**Cross-sectional survey:** An investigation in which information is systematically collected, typically to describe the distribution of an attribute (e.g. breastfeeding) as it exists in a particular population at one point in time (Australian Food and Nutrition Monitoring Unit 2001).

**Demand feeding:** The unrestricted pattern of breastfeeding characterised by ad libitum feeding (day and night), facilitated by close contact between mother and infant (Quandt 1986).

**Early initiation of breastfeeding:** Putting newborns to the breast within one hour of birth.

**Exclusive breastfeeding:** Breastfeeding while giving no other food or liquid, not even water, with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines.

**Exclusive breastfeeding duration:** The length of time an infant receives breastmilk only.

**Fruit paste:** Homemade solid food given to infants. Paste made from fresh fruit. The fruits used depend on the season.

**Full breastfeeding:** Exclusive breastfeeding or predominant breastfeeding (or almost exclusive breastfeeding). Breastmilk is the only source of milk given to the infant regardless of supplementation with other fluids such as water and orange juice.

**Incidence:** The number of new occurrences (of health events, risk behaviour or factor) in a population, over a period of time.

**Infant:** Refers to those less than 12 months old. Children are defined as 12 months old or more.

**Median duration of any breastfeeding:** The age in months when 50% of children are no longer breastfed.

**Median duration of full breastfeeding:** The age in months when 50% of children are no longer fully breastfed.

**Maternal mortality ratio (MMR):** Number of maternal deaths during a given time period per 100,000 live births during the same time period (WHO et al. 2012).

**Odds ratio (OR):** An odds ratio is a measure of the strength of association between disease (or problem) and exposure. For a cohort or cross-sectional study, it is the ratio of two odds: the odds of exposed individuals getting a particular disease or problem compared to the odds of an unexposed individual getting that particular disease or problem. For example, the odds of an infant who is not breastfed getting respiratory illness during the first year of life, compared to the odds of an infant breastfed to four months getting respiratory disease during the same period (Last JM 2001).

**Predominant breastfeeding:** An infant's predominant source of nourishment has been breastmilk. However, the infant may also have received water and water-based drinks (sweetened and flavoured water, teas, infusions etc.); fruit juice; oral rehydration solution (ORS); drop and syrup forms of vitamins, minerals and medicines; or ritual fluids (in limited quantities). All other food-based fluids (e.g. fruit juice and sugar water), in particular breastmilk substitutes, and solids are excluded.

**Prelacteal feeding:** The practice of giving prelacteal feeds. It is not recommended because it may interfere with the establishment of breastfeeding, increase the risk of infection and changes to the human microbiome (Gartner et al. 2005; Talayero et al. 2006).

**Prelacteal feeds:** Any feeds given before the onset of lactogenesis II, which is the onset of copious breastmilk secretion that occurs within four days of birth (Neville & Morton 2001). They are given in many cultures and may include plain water, infant formula, glucose, sugar water, or other traditional feeds such as diluted infant cereal with honey, tea, ghee, and herbal preparations.

**Prevalence:** Number of existing cases of a disease or occurrence of an attribute at a particular time, in a defined population that is at risk of experiencing that disease or attribute (Last JM 2001).

**Randomized controlled trial (RCT):** An epidemiologic experimental study in which participants are allocated randomly to receive either an experimental or a

control treatment or intervention. The relative effectiveness of the intervention is assessed by comparing event rates and outcomes in the two groups. Randomized control trials are generally regarded as the most scientifically rigorous method of hypothesis testing available in epidemiology (Last JM 2001).

**Relative risk (RR):** the ratio of the risks of disease or death among the exposed to the risk and among the unexposed. The usage is synonymous with risk ratio. Alternatively, the ratio of the cumulative incidence rate in the exposed to the cumulative incidence rate in the unexposed, that is, the rate ratio (Last JM 2001).

**Rooming-in:** The practice of having infants remain with their mothers on a 24 hour basis.

**Solid foods:** Any nutrient-containing foods (non-drinkable, semi-solid or solid), e.g. dilute infant cereals. Does not include breastmilk or breastmilk substitutes, fruit and vegetable juices, sugar water, etc.

**Timely complementary feeding rate:** Percentage of infants 6-9 months of age who are fed solid or semi-solid complementary foods in addition to breastmilk.

**Timely initiation of breastfeeding:** Same as 'early initiation of breastfeeding'.

**Vegetable paste:** Homemade solid food given to infants. Paste made from fresh vegetables. Typically it includes green leafy vegetables, potatoes, carrots, pumpkin etc.

**Weaning:** The period during which infants are introduced to breastmilk substitutes and/or solid foods with the intention of replacing some or all of the breastmilk in the diet.

**Young child:** A person from the age of more than 12 months up to the age of 3 years (36 months).

## **Abbreviations**

AAP	American Academy of Pediatrics
aOR	Adjusted odds ratio
aHR	Adjusted hazard ratio
BFHI	Baby Friendly Hospital Initiative
CI	Confidence interval
FBF	Full breastfeeding
GDP	Gross domestic product
HR	Hazard ratio
HBV	Hepatitis B virus
IQ	Intelligence quotient
LBW	Low birthweight
OR	Odds ratio
RR	Relative risk
SPSS	Statistical Package for the Social Sciences
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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# Chapter 1 Introduction

This chapter provides a synopsis of the study. This includes the importance of breastfeeding, study design and location, study objectives and significance of the study.

## 1.1 Importance of breastfeeding

Consistent research has shown that breastfeeding is the appropriate feeding method for infants. Both the World Health Organization (WHO) and the American Academy of Pediatrics (AAP) recommend exclusive breastfeeding for the first six months of life and continued breastfeeding thereafter with appropriate complementary foods (Gartner et al. 2005; WHO & UNICEF 2003). The benefits of breastfeeding for improving infants' health are well documented and some of the major advantages are as follows.

- The composition of breastmilk varies from day to day throughout the whole course of lactation. This provides infants with appropriate nutrients which meet their changing needs at different stages of growth (Lawrence 1994). For infants within six months of age, breastmilk can provide them with all the nutrients required (Binns 2003).
- Breastfeeding helps to reduce mortality and morbidity caused by infectious diseases (Arifeen et al. 2001; Gartner et al. 2005; Stuebe & Schwarz 2010). Breastmilk, rich in immunological components, provides both active and passive immunity for infants (Labbok, Clark & Goldman 2004). Strong evidence has shown that breastfed infants are much less likely to experience gastrointestinal and respiratory infections (Ehlayel, Bener & Abdulrahman 2009; Lamberti et al. 2011).
- Breastfeeding may prevent children from developing allergic diseases. Although the association between breastfeeding and allergies remains controversial, a large number of studies have documented that exclusive breastfeeding for at

least 4 to 6 months can decrease the risk of allergy, irrespective of a family history (Anderson, Malley & Snell 2009; Friedman & Zeiger 2005; Tanaka, Miyake & Sasaki 2010; van Odijk et al. 2003). For instance, a prospective cohort study of 4,089 children found that children who had been exclusively breastfed for at least 4 months had a reduced risk of asthma at the age of 4 years (Kull et al. 2004).

- Breastfeeding might lower the risk of overweight and obesity (Armstrong, Reilly & Child Hlth Information 2002; Bergmann et al. 2003; Metzger & McDade 2010; Shields et al. 2006; von Kries et al. 1999), hyperlipidaemia (Freedman et al. 1992; Owen et al. 2008; Owen et al. 2002) , hypertension (Martin, Gunnell & Smith 2005; Owen et al. 2003) and non-insulin-dependent (type 2) diabetes (Owen et al. 2006; Pettitt et al. 1997; Young et al. 2002). However, further studies are needed before any conclusions can be drawn about these long-term effects of breastfeeding.
- Accumulated research evidence has shown that breastfeeding is positively associated with later cognitive and academic outcomes (Anderson, Johnstone & Remley 1999; Horwood, Darlow & Mogridge 2001; Horwood & Fergusson 1998; Mortensen et al. 2002; Oddy et al. 2011). A recent large randomized trial added strong evidence to the effects of breastfeeding on enhanced cognitive developmental scores and better academic performance (Kramer et al. 2008).

In addition, breastfeeding not only has advantages for infants, but also benefits mothers. Nursing mothers are less likely to suffer haemorrhaging, as the oxytocin released during lactation helps the uterus to contract (Chua et al. 1994; Gartner et al. 2005). Breastfeeding can also delay the return of fertility and increase child spacing between pregnancies (Tommaselli et al. 2000). A number of studies have shown that breastfeeding helps mothers to get back to pre-pregnancy weight faster since lactating mothers burn extra calories when their bodies produce milk (Baker et al. 2008; Dewey, Heinig & Nommsen 1993; Ostbye et al. 2010). Also, breastfeeding can reduce the risk of breast cancer (Beral et al. 2002; Enger et al. 1997; Lee et al. 2003; Stuebe et al. 2009), ovarian cancer (Danforth et al. 2007; Jordan et al. 2010) and might protect mothers against hip fractures and osteoporosis in the

postmenopausal period (Bjornerem et al. 2011; Gur et al. 2003; Huo, Lauderdale & Li 2003).

Finally, but not less importantly, breastfeeding provides economic benefits for both the families and society. It is economically cheaper for a family to breastfeed an infant than feeding the baby formula which costs additional money (Jarosz 1993; Riordan 1997). Moreover, a huge amount of health care costs can be saved as a result of decreased infant and child illness by breastfeeding. A recent study of economic impact of breastfeeding reported that 13 billion US dollar costs might be saved each year if exclusive breastfeeding for six months could be adopted by 90% US families (Bartick & Reinhold 2010).

## **1.2 Study location**

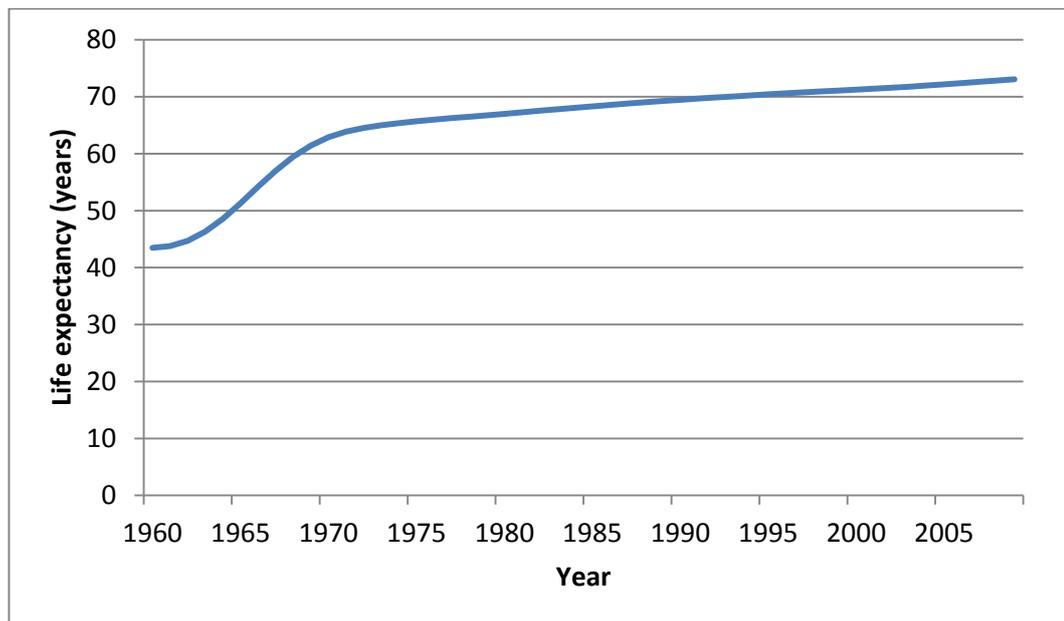
### **1.2.1 Overview of China, Sichuan Province, and Jiangyou**

The People's Republic of China, located in East Asia, was founded in 1949. The New China was under a centrally planned economy system, where no private businesses were allowed, through its first thirty years. During that period, the people's living standard and quality were not incredibly improved. With the implementation of the reform and opening up policy in 1978, China began to transform its economy to a more market-oriented one. Since then, a lot of achievements have been made in economic development. China's average annual Gross Domestic Product (GDP) growth rate reached 9.4 % from 1978 to 2002 (Lin 2004). In 2011, China became the world's second-largest economy, following the United States. However, the per capita GDP of China was only 4,400 USD in 2010, ranking 95th in the world (National Bureau of Statistics of China 2010).

With a vast land area of 9.6 million sq km and a huge population of 1.3 billion, China is facing unbalanced economic development between the east and the west, the urban and rural areas. For example, the per capita GDP in the eastern provinces is more than twice as high as that in the western provinces (van Dijk 2011). There are also disparities in the income between the city and rural areas of China. The per

capita annual income of city residents is more than twice higher than that of people living in rural countryside (National Bureau of Statistics of China 2011). In addition, the Engel coefficient for the proportion of food expenses in the total consumption expenditure of urban residents was 35.7% and 41.1% for the rural residents in 2010 (National Bureau of Statistics of China 2011).

Along with the rapid economic development, China has also made great progress in the area of health care since the second half of the last century. For example, the life expectancy at birth has been lengthened by approximately thirty years since 1960, achieving 74 years in 2009 (Figure 1.1) (The World Bank 2011; WHO 2011). The infant mortality rate declined from 50.2 per thousand live births in 1991 to 13.8 in 2009 (National Bureau of Statistics of China 2010). Meanwhile, accompanied with the improvement of health care, the increase of life expectancy and the changes of lifestyle, the major disease burden has shifted from infectious diseases to vascular diseases and malignant neoplasms (He et al. 2005).

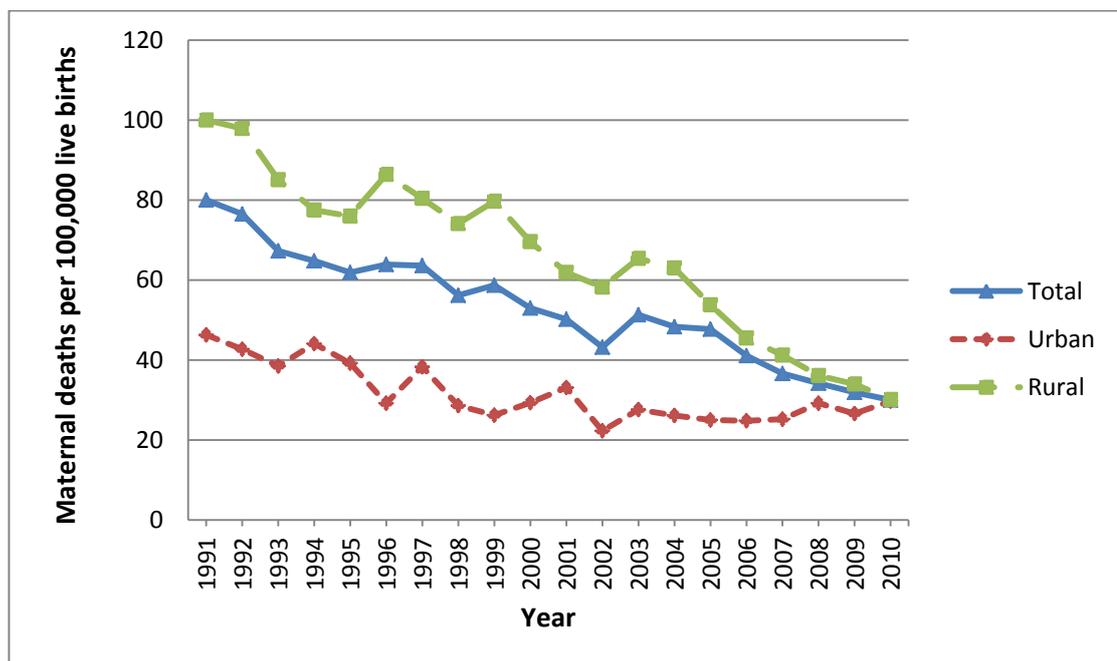


Source: (The World Bank 2011)

**Figure 1.1 Life expectancy at birth in China (1960 – 2009)**

There has been substantial improvement in maternal health in China during the last two decades up to 2010. The maternal mortality ratio (MMR) dropped from 110 per hundred thousand in 1990 (WHO 2011) to 30 per hundred thousand in 2010

(Ministry of Health of People's Republic of China 2011b), one of the fastest reported declines anywhere in the world (Luo, Feng & Shen 2009). This decline in the rate of MMR was faster in rural areas than that in the city. In the early 1990s, the rural MMR was 2.4 times higher than urban MMR, while the gap narrowed down to 1.01 times in 2010 (Figure 1.2). However, there are still large regional differences in MMR across China. Wide variations exist between the eastern, central and western regions, with the highest MMR seen in the west (46.1 per hundred thousand in 2010) and the lowest in the more economically affluent east (17.8 per hundred thousand in 2010) (Zhou et al. 2011). Obstetric haemorrhage is the most common cause of maternal death in China, followed by pregnancy associated hypertension, heart disease during pregnancy, embolism, and puerperal sepsis (Feng et al. 2011). Most of these leading maternal death causes are preventable or curable by adequate prenatal care (Tang, Pan, et al. 2013). Moreover, the MMR of China is still higher than most developed countries, such as Australia with 7 per 100,000 live births and the UK with 12 in 2010 (The World Bank 2011).



Source: (Ministry of Health of People's Republic of China 2011a)

**Figure 1.2 Maternal mortality ratios in China (1991 – 2010)**

Delayed- (after the first twelve weeks of pregnancy) or none-use of prenatal care has been shown to be associated with increased risks of low birthweight, preterm births

and other adverse pregnancy outcomes (Alexander & Korenbrot 1995). In the early 1990s only 20% of pregnant women received their initial prenatal visit within twelve weeks of conception in the early 1990s, and the figure increased to 65% in 2008 (Jing, Lei & Zhang 2012; Wu et al. 2005). At the same time, the proportion of women who received prenatal care also rose from 34% in 1993 to 94% in 2010 (Ministry of Health of People's Republic of China 2011b). Supervised delivery in hospital plays a key role in decreasing maternal mortality (Li et al. 2007) and the rate of hospital delivery rose from 38% in 1993 (Jing, Lei & Zhang 2012) to 98% in 2010 (Ministry of Health of People's Republic of China 2011b).

It was estimated that the mortality of children under 5 years was about 120 per thousand live births in 1970, which declined to about 70 in 1980 (Banister & Hill 2004). During 1991 to 2009, the under-five mortality rate decreased further from 61.0 to 17.2 per thousand live births (Ministry of Health of People's Republic of China 2010). Similarly, the differences in the under-five mortality rate also exist between the urban and rural areas. For instance, the mortality of children under 5 years was 7.6 per thousand live births in urban areas, while the corresponding figure was 21.1 in rural areas in 2009 (Ministry of Health of People's Republic of China 2010).

In China, the 'ever breastfed' rates were over 80% in the 1950s and 1960s, but the rates began to drop when infant formula became more available in the 1970s (Xu et al. 2009). A large cross-sectional study conducted in 20 provinces in 1983 showed that 'any breastfeeding' rates at four and six months had declined to 42.5% and 34.4% in the city and 69.95% and 60.35% in rural areas (Liu 1993). Including the establishment of the Baby Friendly Hospital Initiative (BFHI), the Chinese government began to launch several breastfeeding promotion programs in the early 1990s to address the decline in breastfeeding. Consequently, the breastfeeding rates in China began to rise again. However, the 'exclusive breastfeeding' rates to six months postpartum were still low in most areas and few provinces had achieved the national target of exclusive breastfeeding rate 80% at four months by 2000 (Chen et al. 1997; Luo, Tu & Feng 2004; Wang, Kang & Wang 2000).

Sichuan Province, an area of 485,000 sq km, is located in southwest China with a population of 80.4 million. Known as the “Land of Abundance” since ancient times, Sichuan is rich in agricultural products and is one of China’s major producers of rice and wheat. Sichuan is also famous as the home for giant pandas which are considered to be China’s national treasure. Although the capital of Sichuan, Chengdu, is a rapidly developing city and is the most advanced city in western China, most areas of Sichuan province are less developed with a great proportion of relatively poor farmers. The provincial average GDP per capita was 3,300 USD in 2010 (Sichuan Bureau of Statistics & Sichuan Investigation Team of National Bureau of Statistics 2011), much lower than the national level. In addition, the annual per capita income of farmers was approximately 815 USD (Sichuan Bureau of Statistics & Sichuan Investigation Team of National Bureau of Statistics 2011).

Progress has been seen in the maternal and health care in Sichuan Province, especially in rural areas. The infant mortality in rural areas decreased from 34.0 per thousand in 2001 to 14.3 in 2010 (Sichuan Bureau of Statistics & Sichuan Investigation Team of National Bureau of Statistics 2011; Wu, Jiang, et al. 2011). During the same period, the maternal mortality in rural area declined from 80.5 per hundred thousand to 47.7 per hundred thousand (Wu, Zhao, et al. 2011). In 2010, the overall infant mortality rate in Sichuan was 11.8 per thousand and the maternal mortality was 37.2 per hundred thousand (Sichuan Bureau of Statistics & Sichuan Investigation Team of National Bureau of Statistics 2012). The birth rate was 8.9 per thousand and the death rate was 6.6 per thousand (Sichuan Bureau of Statistics & Sichuan Investigation Team of National Bureau of Statistics 2011).

Jiangyou, a county-level city, is located 160 km north of the provincial capital city Chengdu (Figure 1.3). It has an area of 2,719.3 sq km, with 42% of mountains, 49% of hills and less than 10% of plains. In 2010, the total population of Jiangyou was 880,000. Approximately 621,000 people lived in rural areas, who were mainly involved in agriculture and the remainder lived in the small city of Jiangyou (Jiangyou Bureau of Statistics 2011). Jiangyou is rich in petroleum and natural gas and has some metallurgy, energy and chemical industries. Prior to the founding of the New China in 1949 there was little development in the area.



Source: <http://mapsof.net/map/china-sichuan-location-map>.

**Figure 1.3 Location of Jiangyou, Sichuan Province, People’s Republic of China**

According to Jiangyou Bureau of Statistics, the annual per capita income of city residents in Jiangyou is about 2,300 USD, and the income of the rural farmers is approximately 960 USD per year. The Engel coefficient for the proportion of food expenses in the total consumption expenditure of city residents was 40.7% and for the rural residents was 43.2%. The birth rate was 7.7 per thousand and the death rate was 5.3 per thousand in 2010 (Jiangyou Bureau of Statistics 2011).

Only a few cross-sectional studies on infant feeding practices had been conducted in Sichuan Province by 2010 and none of these surveys strictly followed the WHO definitions on breastfeeding indicators. Based on published data, the rates of breastfeeding in Sichuan fell significantly below ideal levels. For instance, in Chengdu, the capital city of Sichuan Province, the ‘exclusive breastfeeding’ rate at four months was 33.6% and the duration of ‘any breastfeeding’ was 5.5 months in 2008 (Peng et al. 2010). Similarly, less than 60% infants were fully breastfed at six months and the ‘any breastfeeding’ duration was 7.6 months in rural areas of Sichuan between 2005 and 2007 (Yan et al. 2009). In addition, there has been little research

identifying factors associated with breastfeeding outcomes in this area. With regard to breastfeeding problems, such as inverted nipples, engorgement, and mastitis, very few longitudinal studies have attempted to investigate the incidence rates or influential factors in China.

Complementary feeding is recommended after six months of exclusive breastfeeding. However, information on the practice of early complementary feeding prior to six months postpartum is limited in Sichuan Province. According to a recent study in Chengdu, 5.1% of infants aged three months had already received cereals, vegetables or fruit; and more than eight in ten mothers had introduced complementary foods to their infants before six months postpartum (Jiang et al. 2007). Furthermore, no previous studies have investigated the determinants of early complementary feeding in Sichuan.

### **1.2.2 2008 Wenchuan Earthquake (Sichuan Province)**

In May 2008, an 8.0 Richter magnitude scale earthquake hit Sichuan Province, killing at least 69,000 and leaving over 18,000 missing. More than 5 million buildings and houses collapsed, resulting in millions of people becoming homeless. The city of Jianguo itself is relatively small (approximately 260,000 people) and is surrounded by mountainous areas which suffered a lot of earthquake damage. In the area of Jianguo, nearly 400 people died, 10,000 were injured and over 100 people were still missing following the earthquake. In Jianguo many buildings collapsed or became too dangerous to inhabit, making 350,000 people homeless. Despite the rapid reconstruction in the earthquake area, thousands of people in Jianguo still lived in prefabricated and other temporary housing in the next two years following the earthquake. With limited supply of foods and drinks, the earthquake might have served as a major disruption to infant feeding practices (Binns et al. 2012).

## **1.3 Study design**

A longitudinal cohort study of infant feeding was undertaken in Jianguo, Sichuan Province, PR China. Mothers who delivered single healthy babies in four major

hospitals and three randomly selected township health centres of Jiangyou were invited to participate. The definition of healthy babies used in this study was those who spend less than 4 days in the newborn intensive care unit and without any apparent diseases. The mothers were informed about the purposes of the study and asked to sign a consent form before participation. Participants were interviewed face-to-face before discharge by the principal researcher or a research assistant. Follow-up interviews were carried out by principal researcher via telephone at 1, 3, 6 and 12 months postpartum. The baseline and follow-up questionnaires used in this study were based on questionnaires that have been previously used in Curtin University sponsored studies of infant feeding (Qiu, Yun, et al. 2008; Scott et al. 2001; Xu et al. 2006).

#### **1.4 Objectives of the study**

The overall aim of the study was to examine infant feeding practices and factors that influenced infant feeding to 12 months postpartum in Jiangyou, Sichuan Province. This included investigating breastfeeding problems mothers experienced within 6 months postpartum. The specific objectives of the study were as follows.

1. To examine the prelacteal feeds and investigate factors associated with early initiation of breastfeeding among mothers in Jiangyou, Sichuan Province.
2. To investigate the prevalence and duration of breastfeeding up to 12 months postpartum.
3. To identify determinants of breastfeeding at discharge and discontinuing breastfeeding before 12 months postpartum.
4. To determine the prevalence of premature introduction of complementary foods and investigate factors associated with the introduction of complementary foods before 6 months postpartum.
5. To examine the incidence of breastfeeding problems mothers experienced within 6 months postpartum.
6. To explore determinants of lactation mastitis within 6 months postpartum.
7. To recommend possible strategies for improving breastfeeding prevalence in rural areas of Sichuan Province.

## **1.5 Significance of the study**

Information about infant feeding practices in the rural area of Sichuan Province was limited. No previous prospective cohort studies about infant feeding practices have been conducted in Sichuan Province, China. This study will provide information on infant feeding practices in a representative rural area of Sichuan Province. The location of the study adjacent to an area of major earthquake damage will provide information on practices and perceptions following a period of major disruption. Understanding the practices of complementary feeding in the rural area and identifying influential factors leading to early introduction of complementary food will assist health care professionals in Sichuan Province to develop future health promotion programs in the rural area. Information about the incidence of breastfeeding problems experienced by mothers in the rural area of China will provide a cornerstone for future research in the field.

## **1.6 Scope of the study**

This research was undertaken in only one rural area of Sichuan Province because of limited resources and time for a PhD study. Seven health care institutions, including four hospitals and three township health centres, were selected as research sites. The four hospitals chosen are the four main hospitals in Jiangyou, while the three township health centres were randomly selected from over 40 township health centres scattered around Jiangyou.

The WHO recommends infants to be breastfed for at least 24 months. However, the participants in this study were followed up for a period of 12 months due to the time limitation. In addition, to avoid too many lost to follow-up, the follow-up questionnaire used at 12 months postpartum was a simplified one, consisting of 6 short questions.

A large number of factors have been found to be associated with breastfeeding initiation and duration, but the present study merely focused on factors which were more applicable for Chinese women living in rural areas. For instance, the proportion of rural women smoking or drinking alcohol during pregnancy is very low in China; thus, factors regarding maternal smoking and drinking alcohol were not included in multivariate analysis when assessing factors associated with breastfeeding initiation and duration.

## **1.7 Outline of the thesis**

This thesis consists of six chapters. Chapter one provides a brief introduction of breastfeeding and an overview of the study location. The first chapter also includes the study design, objectives, significance and scope of the study.

Chapter two reviews the pertinent literature on the topic of the study. It provides a review on both the past situation and current changes of infant feeding practices in China. The factors associated with breastfeeding outcomes, complementary feeds and mastitis are also illustrated in each section of the second chapter.

Chapter three presents the methodology used in the study, which includes the information of study instruments, ethical considerations, sample size calculation, and the procedures of data collection, cleaning and analysis.

Chapter four provides the detailed results of the study. It also encompasses discussions by comparing the results with other available studies.

Chapter five gives further discussions, particularly on the main points of findings from the study.

Chapter six concludes the main findings of this study and makes recommendations for future research and better clinical practice. A summary of limitations of the study is also included in this last chapter.

Ethics approval letters, consent form, questionnaires, publications and other relevant documents are enclosed in the Appendices.

To summarise, breastfeeding is widely recognised as the ideal feeding method, with short- and long-term health benefits for both infant and mother. In China, an increase in the rates of breastfeeding, especially ‘any breastfeeding’, has been observed in both urban and rural areas. However, no previous prospective studies on infant feeding practices have been conducted in rural areas of Sichuan Province. According to published cross-sectional surveys, the breastfeeding rates in Sichuan Province fell significantly below the national target. The overall aim of the cohort study was to examine infant feeding practices and factors that influenced infant feeding to twelve months postpartum in Jiangyou, Sichuan Province. This included investigating breastfeeding problems mothers experienced within six months postpartum.

## Chapter 2 Literature review

This chapter provides an extensive literature review related to the topic of the study. The infant feeding history in ancient China and changes in breastfeeding rates across China in recent decades are described in chronological order. The practice of giving prelacteal feeds, early initiation of breastfeeding within the first hour of birth in China and factors associated with breastfeeding outcomes were then reviewed. Complementary feeding practice and breastfeeding problems, including mastitis, experienced by mothers during the first 6 months are also presented.

### 2.1 Infant feeding history in ancient China

Breastfeeding by the mother was the norm in ancient times of China. On the rare occasions when the mother had died or was unable to produce breastmilk a ‘wet nurse’ usually nursed the infant. Lactation usually ceased when the child reached two years old and he/she could then live totally on solid foods and liquids. Milk of animals and thin cereal preparations were recommended in traditional Chinese medical works as substitute foods for infants if a mother’s breastmilk was insufficient and the family could not afford a ‘wet nurse’ (Ping-Chen 1995).

There were extensive documentations of infant feeding in ancient China. As early as the Song dynasty (A.D. 960–A.D. 1279), the procedures, regularity, posture, and other details of breastfeeding were elaborately recorded in literatures (Ping-Chen 1995). Sun Simiao (孙思邈) stated in the book “*Bei Ji Qian Jin Yao Fang*” (*Essential Prescriptions Worth a Thousand in Gold for Every Emergency*) (备急千金要方) that an infant should be fed on demand for the first two months, seven to eight times per day, and that regular feeding could be adopted after then at every three to four hours (Qiu 2008). Another famous paediatrician Zeng Shirong (曾世荣) in the Yuan dynasty (A.D. 1279- A.D. 1368) presented in an essay titled “*Huo You Kou Yi*” (活幼口议) (*Discussion on the Art of Raising an Infant*) that breastfeeding at regular intervals was very important for children’s good health and development. It was also recommended in Zeng’s book that breastfeeding should not be ceased too early to

protect the child from illness. At the same time, the anonymous book named “Xiao Er Wei Sheng Zong Wei Lun Fang” (*Complete Book of Paediatrics*) (小儿卫生总微论方) described that the mother should place the child’s head to rest on her arm when nursing a child, so that the child’s mouth is at the same level with the breast. Moreover, the nursing mother should remove her breast from the child’s mouth when she wants to go to bed to avoid the danger of suffocation (Ping-Chen 1995).

Great emphasis was given to the quality of breastmilk by ancient Chinese physicians. It was described by Sun Simiao in his book titled ‘*Essential Prescriptions Worth a Thousand in Gold for Every Emergency*’ that breastmilk was from women’s xueqi (血气) (blood and vital energy). It was believed that the quality of breastmilk directly relied on a woman’s health and emotion. The “bad” milk would have a negative impact on the health and well-being of the child. Thus, a variety of strict rules were set for nursing women in the aspects of diet, activities and emotions. However, the mechanism through which the nursing mother’s emotion or physical state would cause illness of the infant was not clearly presented (Gartner & Stone 1994).

In ancient China, hiring a wet nurse became fashionable among families with high social status during the Ming and Qing dynasties, A.D. 1400 to A.D. 1900 (Qiu 2008). The criteria for selecting a wet nurse were rigid which included a woman’s health condition, personality and appearance (Ping-Chen 1995). Pu Yi, the last Chinese emperor, was breastfed by a wet nurse, Mrs Wang Jiao, until he was nine years of age. According to Pu Yi’s autobiography, ‘From Emperor to Citizen’, Mrs Wang Jiao was chosen from twenty candidates because of her pleasant appearance and copious breastmilk. As an emperor’s wet nurse, Mrs Wang Jiao was not allowed to go back home or care for her own daughter. As a result, her daughter died at three years of age of malnutrition. The wet nurse was not informed of her daughter’s death in case it caused her sadness (Aisin-Gioro 1989).

Traditional Chinese medical works recommended milk of animals and thin cereal as substitute foods for infants if a mother’s breastmilk was insufficient and the family could not afford a wet nurse. Feeding children with the milk of domesticated animal had been practiced in China for a long time. Goat’s, cow’s and sow’s milk were the

most frequently used breastmilk substitutes. Thin cereal, a gruel made from crushed or finely ground cereal cooked in water, was the other choice when animal milk was unavailable (Ping-Chen 1995).

The appropriate starting time and the right types of solid foods given to an infant were also discussed in ancient paediatric writings. Ge Hong (葛洪), a physician from the Jin dynasty (A.D. 265 – A.D. 420), stated in “Zhou Hou Bei Ji Fang” (肘后备急方) (*Handbook of Prescriptions for Emergency*) that an infant should be fed with a thick drink made from ground grains three days after birth to activate his/her digestive function. In the Sui dynasty (A.D. 581 – A.D. 618), the purpose of feeding solid foods started to move from stimulating digestion to providing infants with additional foods and proper nutrients. The different amounts of food that an infant could consume after one month after birth were given by physicians. An experienced paediatrician Qian Yi (钱乙), from the Song dynasty (A.D. 960 – A.D. 1279), believed that six months old was a good time to commence supplementary foods which needed to be soft, plain and easily digestible (Ping-Chen 1995).

In ancient China, women breastfed for a relatively prolonged duration and tended to wean rather late. Breastfeeding was usually stopped when the child reached two years old and he/she could live totally on solid foods. In some situations where the mother thought her breastmilk was not enough or became pregnant again, breastfeeding might be ceased prior to the age of two (Ping-Chen 1995).

## **2.2 Changes in breastfeeding in modern China**

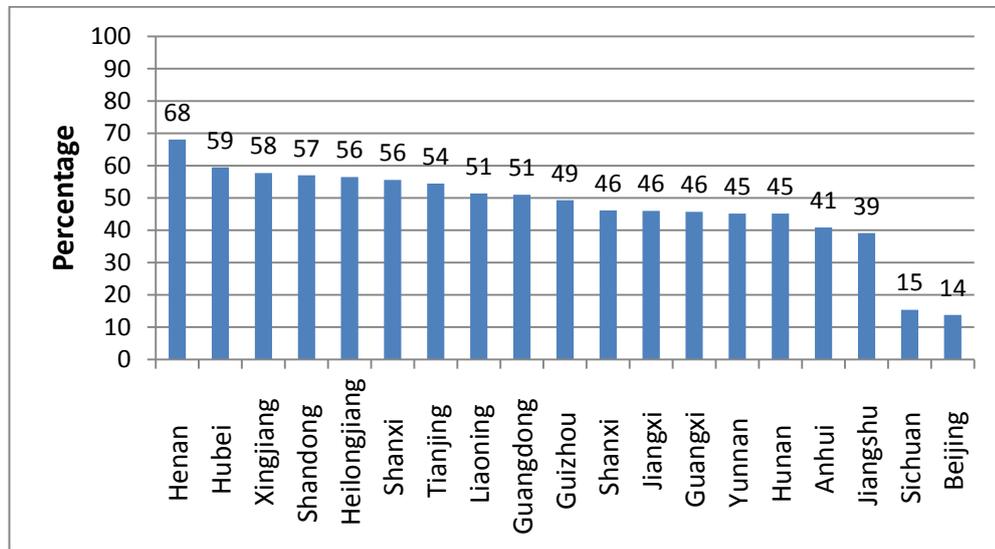
The breastfeeding rates were high in western countries before the industrial revolution (Riordan & Countryman 1980). It is believed that breastfeeding practice was adversely influenced by the industrial revolution through the invention and marketing of infant formula combined with the employment of women working outside the home (Galanakis 1999). In the early 1970s, the breastfeeding rates of many developed countries reached their lowest points. For instance, the breastfeeding rate was low at 22% in the United States in 1972 (Wright 2001). After that, a steady increase in the prevalence of breastfeeding has been seen in western

countries resulting from the implementation of policies, programs and campaigns of breastfeeding (Riordan & Countryman 1980). Among a large number of developing countries, however, the rates of breastfeeding suffered rapid declines when infant formula became more available in the 1970s.

In China, almost all infants were ever breastfed in the 1930s, and the median duration of breastfeeding was twelve months (Zhao et al. 2003). Since the late 1970s, China had experienced a rapid decline in the prevalence and duration of breastfeeding, especially in urban areas. For instance, a retrospective study of infant feeding practices in Beijing documented that in the 1950s, the 'ever breastfeeding' rate was about 81% in the city. Whilst a survey of over 2,000 infants in 1982 showed that only 22% of the infants in urban areas of Beijing were breastfed at the time of interview (Liu & Wang 1995). A similar tendency of breastfeeding was also observed in other big cities of China. The median duration of breastfeeding in Shanghai dropped from approximately 12 months in the 1950s to 10 months in the 1980s (Tu 1989). In Chengdu, which is located in the less economically developed southwest of China, the percentage of infants aged 0 – 6 months who were breastfed at the time of interview was only 16.3% in the city according to an investigation in 1984. In contrast, its surrounding suburban areas, breastfeeding was still the main feeding pattern, with the corresponding percentage at 68% (Qian 1985).

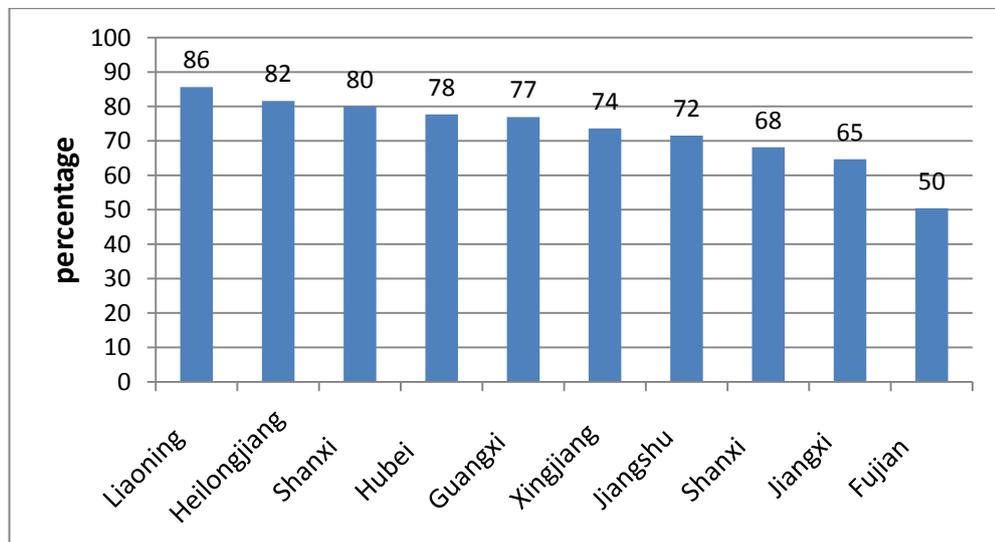
Westernisation, including infant food marketing, was believed to be the main reason accounting for the drop in the support for breastfeeding around China (Zhao et al. 2003). Based on the results of a national survey undertaken between 1983 and 1986 in 20 provinces with approximately 90,000 infants, the proportion of infants breastfed at 6 months was 34.4% in urban areas compared to 60.3% in rural areas. The percentages of infants aged 0 – 6 months who were breastfed at the time of interview in urban and rural areas during 1983 and 1986 are shown in Figures 2.1 and 2.2, respectively. The largest percentage in urban areas was seen in Henan Province at about 68%, and the smallest one was in Beijing with 14% (Figure 2.1). In rural areas, Liaoning Province had the largest percentage at 86%, while the smallest one was seen in Fujian Province with 50% (Figure 2.2). In the study, a higher proportion of working women and a greater availability of milk substitutes in the city

were reported to be the main factors contributing to the disparities in breastfeeding rates between urban and rural areas (Yun et al. 1989).



Source: (Yun et al. 1989)

**Figure 2.1 Percentages of infants aged 0 – 6 months who were breastfed at the time of interview in urban areas of China (1983 – 1986)**



Source: (Yun et al. 1989)

**Figure 2.2 Percentages of infants aged 0 – 6 months who were breastfed at the time of interview in rural areas of China (1983 – 1986)**

To promote the practice of breastfeeding and to increase the breastfeeding rates worldwide, the WHO and UNICEF launched the BFHI in 1991. By September 2000,

there were more than 15,000 facilities awarded Baby Friendly status in 140 countries (Struble & Aomari 2003). Progress of breastfeeding had been witnessed around the world during the 1990s. Based on a report of the United Nations Secretary-General in 2001, the rate of 'exclusive breastfeeding' for the first four months of life increased from 42% to 46% during 1990 and 2000. Timely complementary feeding (at 6 – 9 months) increased by 15%. In addition, the proportion of infants breastfed at one year of age improved from 79% to 81%. The Latin America and Caribbean region achieved the biggest improvements with an increase of 13% in the rate of 'exclusive breastfeeding' in the first four months (Annan 2001).

In the early 1990s, to address the decline in breastfeeding, the Chinese government launched several breastfeeding promotion programs including the adoption of the BFHI in 1992 (Xu et al. 2009). By 2005, more than 6,000 hospitals had been granted "Baby Friendly" status in China, which constituted nearly 40% of total hospitals across the country (UNICEF 2005). In response to Chinese government's support for the BFHI and the introduction of some regulation of the marketing of breastmilk substitutes, an increase in the rates of breastfeeding, especially 'any breastfeeding', has been observed in many studies around the country since 1992. The improvements in breastfeeding rates are presented as follows.

A national survey in 1992 which covered 29 provinces, autonomous regions and municipalities with a sample size of more than 560,000 showed that the proportion of infants breastfed within the first 3 months of life was 66% (33% in the city and 69% in rural areas) ('[Major results of the sampling survey on the general conditions of Chinese children]' 1993). In 1998, 6 years after the implementation of the BFHI in China, data collected at 40 sites of the Chinese Food and Nutrition Surveillance System revealed that the 'exclusive breastfeeding' rates of infants under 4 months were 53.7% in the city and 71.5% in rural areas ('exclusive breastfeeding' was defined as feeding with breastmilk only, with or without plain water, 24 hours prior to the investigation) (Fu et al. 2000). Although the definition of 'exclusive breastfeeding' used in the study was not in accordance with the one given by the WHO, compared with the results of national survey in 1992 ('[Major results of the sampling survey on the general conditions of Chinese children]' 1993), it can be concluded that there had been obvious improvements in the breastfeeding practices.

In Beijing, 90.5% of infants under 4 months were breastfed in 2002 (Zhao et al. 2006). But the corresponding figure was low at 58.2% in 1992 (Jiang, Cai & Yang 1996). Although not rather encouraging, the ‘any breastfeeding’ rate at 4 months postpartum in Shanghai climbed to 56.8% in 2002 (Hu et al. 2004). This was good progress considering that the rate was once 12.7% in the same area in 1991 (‘Breastfeeding rate has dropped to 12.7% in Shanghai’ 1992). Similarly, a breastfeeding survey in the city of Wuhan, Hubei Province, witnessed an increase of ‘any breastfeeding’ rate from 38.4% to 60.4% at 4 months postpartum from 1994 to 1997 (Chen, Zhou & Yao 2000). Furthermore, in urban areas of Guangdong Province, 67.5% of 1095 infants were breastfed at 4 months of life in 2004. This was 3.5% higher than the ‘any breastfeeding’ rate at 4 months observed ten years ago in the same research location (Ma et al. 2007).

Besides the improvements seen in big cities, progress in ‘any breastfeeding’ rates was also observed in most rural areas of China. A survey with more than 20,000 infants and young children aged 0–24 months in 105 economically poor counties in 1998 showed that 98.22% children had ever been breastfed (Wang, Wang & Kang 2005). Based on another cross-sectional study with a large sample size ( $n = 14,077$ ) in 45 counties of western China, there were 96.5% of infants under 6 months old who had ever been breastfed in 2005, a slight increase of 0.9% since 2001 (Kang et al. 2007). A more recent cross-sectional study of 187 infants in 20 villages across 5 provinces found that ‘any breastfeeding’ rate at 6 months was 73.7%. However, the representativeness of this study should be considered when interpreting the results because of its small sample size (Jia et al. 2007).

The WHO recommends that infants be exclusively breastfed for the first six months of life to achieve optimal growth, development and health (WHO & UNICEF 2003). Although extensive progress in the prevalence of ‘any breastfeeding’ has been achieved around China, the rates of ‘exclusive breastfeeding’ were still not promising. Few provinces had achieved the national target of ‘exclusive breastfeeding’ rate of 80% at four months by 2000 (Xu et al. 2009). For example, only 40% of infants in Jinan, Shandong Province, were exclusively breastfed at two months of birth and the proportion was 35% among infants aged under 4 months

(Zhao et al. 2003). Also, in Guangdong Province, the 'exclusive breastfeeding' rate at 4 months and 6 months were 36.3% and 11.5%, respectively. It was believed that the concept of 'exclusive breastfeeding' was hard to be accepted by parents in Guangdong Province (Ma et al. 2007). A cross-sectional survey undertaken in 105 rural counties from across China documented a 'full breastfeeding' rate of 24.4% at 4 months postpartum in 1998 (Wang, Wang & Kang 2005). More recently, in the rural areas of western China, only 33.4% of the infants under 6 months old were fully breastfed, with 11.4% exclusively breastfed and 22.0% predominantly breastfed in 2005 (Kang et al. 2007).

Some studies published in Chinese journals reported higher rates of 'exclusive breastfeeding' (Chen et al. 1997; Fang et al. 2009; Wang & Zhang 2000). For instance, a cross-sectional survey of 1,527 infants conducted in Chengdu, the capital city of Sichuan Province, revealed that the 'exclusive breastfeeding' rate at 6 months was 54.4% between 1994 and 1995 (Chen et al. 1997). A few years later, the 'exclusive breastfeeding' rate was 76.0% with 44.4% in the city and 91.2% in rural areas in Hubei Province (Wang & Zhang 2000). The reported 'exclusive breastfeeding' rate in two counties of Shaanxi Province was 65.5% for the first 4 months in 2005 (Fang & Yan 2007).

It should be pointed out that comparisons between studies regarding the prevalence of 'exclusive breastfeeding' are difficult, because not all research follows the standard definitions of exclusive breastfeeding recommended by the WHO. Furthermore, the recall period, which is important for the reliability of 'exclusive breastfeeding', always differs between studies (Bland et al. 2003; Cupul-Uicab et al. 2009; Li, Scanlon & Serdula 2005).

According to Zhao et al., there are mainly two reasons for the apparent discrepancies in 'exclusive breastfeeding' rates around China. The first possible reason is that in many studies, health workers who reported the rates of 'exclusive breastfeeding' were the same group of people who educated mothers earlier and who also could benefit from reporting progress. The other reason is that the definitions of 'exclusive breastfeeding' used in different studies vary from each other. The majority of studies documented current 'exclusive breastfeeding' at time of interview, but it is possible

that feeding practices change back and forth for the same infant (Aarts et al. 2000; Zhao et al. 2003). For example, in a survey in 1998, ‘exclusive breastfeeding’ was defined as feeding with breastmilk only 24 hours prior to the investigation, with or without plain water (Fu et al. 2000). By this definition, the reported ‘exclusive breastfeeding’ rate would be probably higher than the real rate.

Recall bias has been one of the major concerns of retrospective data, especially when the information is recalled over a relatively long period (Haaga 1988). As a matter of fact, the majority of studies of infant feeding practices conducted in China were cross-sectional studies. High reliability of maternal recall in ‘any breastfeeding’ initiation and duration has been consistently reported in different populations (Cupul-Uicab et al. 2009; Li, Scanlon & Serdula 2005). However, when collecting data on the duration of ‘exclusive breastfeeding’ in cross-sectional studies, maternal recall usually cannot precisely reflect the feeding practices since birth (Bland et al. 2003; Cupul-Uicab et al. 2009).

As a matter of fact, only a few cohort studies following the WHO definitions on breastfeeding indicators have been carried out in some parts of China. The results of these prospective studies should be given more weight than other studies when evaluating breastfeeding practices in China.

In a cohort study conducted during 2003 and 2004 in Xinjiang Uygur Autonomous Region, 92.2% infants were initiated with breastfeeding at discharge and the rate of ‘any breastfeeding’ was 73.0% at 6 months. Only 6.2% of infants were exclusively breastfed for the first six months of life (Xu, Binns, Wu, et al. 2007).

In Zhejiang Province, a prospective study undertaken during 2004 and 2005 found that ‘any breastfeeding’ rates were high on discharge at over 96% regardless whether it was in city, suburban and rural areas. At six months postpartum, the corresponding rates of ‘any breastfeeding’ fell to 62.8%, 76.9% and 83.6%, respectively (Qiu, Yun, et al. 2008). The study also showed that the ‘exclusive breastfeeding’ rates were low at 50.3% on discharge with the rates of 38%, 63.4% and 61% in the city, suburban and rural areas, respectively (Qiu et al. 2009). By six months after birth, the rates had declined to 0.2%, 0.5% and 7.2%, respectively (Qiu, Yun, et al. 2008).

As can be seen above, the ‘exclusive breastfeeding’ rates documented by these two cohort studies varied widely from most other studies of infant feeding in China. To allow accurate evaluation and effective comparisons, consistency in using standardised definitions of infant feeding indicators is important. In addition, further prospective research is needed to precisely record and better understand the breastfeeding patterns around China.

With respect to breastfeeding duration, the most encouraging result documented recently was from a cross-sectional survey with 1,655 young children in Tibet where the median duration of breastfeeding was 26 months in 1999 (Dang et al. 2005). However, in most parts of China, the median duration of breastfeeding is not nearly as long and only a few studies undertaken within the last decade have reported a median duration of more than one year (Fang et al. 2009). In Xinjiang Uygur Autonomous Region, the average duration of ‘exclusive breastfeeding’, ‘full breastfeeding’ and ‘any breastfeeding’ were 1.8, 2.8 and 5.3 months, respectively, between 2003 and 2004 (Xu, Binns, Wu, et al. 2007). Similarly, the durations of ‘any breastfeeding’ and ‘exclusive breastfeeding’ in Guangdong Province were 6.1 months and 3.6 months, respectively (Ma et al. 2007). During the same period of time, one study carried out in 45 counties of western China even found a decline in breastfeeding duration. The proportion of infants breastfed for at least one year decreased from 73.1% in 2001 to 64.9% in 2005. In the same survey, 17.9% of infants breastfed for at least two years in 2001 and the corresponding figure declined to 9.7% in 2005 (Kang et al. 2007). More recently, a survey with a large sample size in 7 remote and poor counties of China documented a prevalence of 32.2% of ‘any breastfeeding’ at 1 year postpartum (Zhou et al. 2012).

To sum up, improvements in breastfeeding rates have been achieved in both urban and rural areas of China during the recent two decades. However, the practices of ‘exclusive breastfeeding’ for the first 6 months and prolonged duration of breastfeeding for at least 2 years are still significantly below ideal levels across the country. In addition, the majority of studies conducted to date were cross-sectional surveys with a lack of well-defined breastfeeding definitions. To well document and

further improve breastfeeding practices in China, additional prospective cohort studies using the WHO definitions on breastfeeding are required.

## **2.3 Prelacteal feeds in China**

Prelacteal feeds are defined as any feeds given before the onset of lactogenesis II, which is the start of abundant breastmilk secretion that occurs within four days of birth (Neville & Morton 2001). By definition, infants who receive prelacteal feeds are not exclusively breastfed (Armstrong 1991). Prelacteal feeds are given in many cultures and might include plain water, infant formula, glucose, sugar water, or other traditional feeds such as diluted infant cereal with honey, tea, ghee, and herbal preparations (Chandrashekar et al. 2007; El-Gilany, Sarraf & Al-Wehady 2012). In China, infant formula and plain water are the most common prelacteal feeds (Qiu et al. 2007; Tang, Hewitt & Yu 2012).

Colostrum, the secretion produced in the first few days after giving birth, is an ideal first food for newborn infants. It supplies complete nutrition to meet the unique requirements of neonates. Furthermore, the specific immunological factors of colostrum help to protect infants against illness. However, in some traditional cultures, there continues to be a belief that colostrum is detrimental to infants and should be discarded (Lefebvre & Voorhoeve 1999; Tang, Hewitt & Yu 2012).

### **2.3.1 Disadvantages of prelacteal feeds**

#### *Interference with the establishment of breastfeeding*

The use of bottles before the first breastfeed can lead to interference with the natural processes of breastfeeding. A regular pattern of suckling by the infant is a critical stimulus in the development of adequate breastmilk supply. Providing infants with feeds other than breastmilk reduces the amount of time the infant suckles the breast, and further delays breastfeeding, and may lead to insufficient milk production (National Health and Medical Research Council 2003; Tang, Hewitt & Yu 2012).

#### *Adverse effects on breastfeeding outcomes*

Qiu et al. found that babies who had colostrum or breastmilk as their first meal were more likely to be breastfed at discharge than those who had other foods (Qiu et al. 2007). It has been found in several studies that the use of prelacteal feeds or the brief

exposure of supplements in the early postpartum period can reduce the duration of breastfeeding (National Health and Medical Research Council 2003; Scott, Binns, Oddy, et al. 2006). For example, one retrospective cohort study undertaken in Anshan, Liaoning Province measured the effect of giving breastmilk substitutes as prelacteal feeds on breastfeeding rate at one month postpartum. The results showed that infants received breastmilk substitutes as first feeds were less likely to be breastfed at one month after birth (Chi-square = 15.43,  $p < 0.01$ ) (Song 2008).

#### *Increase the risk of infection*

Aside from the adverse effects prelacteal feeds have on breastfeeding outcomes, prelacteal feeds increase the risk of perinatal morbidity and mortality (Duong, Binns & Lee 2004; Qiu et al. 2007). Neonatal mortality is higher in developing countries when prelacteal feeds are given. Unsafe water when coupled with a decreased intake of the protective components in breastmilk places infants at greater risk of infection and prelacteal feeds unless carefully prepared could result in the ingestion of infectious pathogens (Edmond et al. 2006; Tang, Hewitt & Yu 2012).

#### *Change the human microbiome*

Prelacteal feeding may act negatively on the immature gastrointestinal tract and expose infants to pathogenic micro-organisms (Hossain et al. 1995; Penders et al. 2006). A randomised trial found that the group of neonates receiving colostrum feeding had a significantly lower rate of intestinal bacteria colonisation compared with the group receiving glucose water feeding during their first 3 days of life (Ojofeitimi & Elegbe 1982).

### **2.3.2 Prevalence of prelacteal feeds in China**

According to ancient Chinese literature, there were no recommendations that colostrum was harmful or inadequate for the newborn infants (Gartner & Stone 1994). In modern China, attitudes towards colostrum have changed over time. In 1992, the majority of mothers (83.6%) living in a rural community in Shandong Province threw colostrum away for they thought it was 'dirty' (Han & Jin 1993). A study from Shimian, Sichuan Province in 1993, showed that less than 40% of

mothers considered feeding colostrum to their infant (Luo et al. 1994). Based on a survey in Inner Mongolia in 2000, around six in ten family members with children less than two years old agreed that colostrum should be given to infants (Yang, Yang & Wang 2002). More recent studies from Jiangxi Province and Jinan in Shandong Province found that 85% of mothers knew colostrum should be fed to newborns and more than 90% mothers gave colostrum to their newborn infants, respectively (Fan, Chen & Wang 2008; Zhao et al. 2003). A national survey conducted in 31 provinces, autonomous regions and municipalities in 2002, found that 86.6% newborns were fed with colostrum (Lai et al. 2006). Generally the rate of colostrum feeding in China appears to be increasing, however many areas still fall significantly below ideal levels (Tang, Hewitt & Yu 2012).

The tradition of providing prelacteal feeds is a long-held practice throughout many regions of China. In Zoucheng, a rural area of Shandong Province, for example, the old custom of feeding infants with Chinese rhubarb water before initiating breastfeeding, as a result of the belief it cleans the gastrointestinal tract, still remains as part of present infant feeding practices (Han & Jin 1993). Similarly, the Tibetans in the Tibetan Autonomous Region of China have the custom of feeding newborns with tsamba paste (a combination of hulless-barley noodles and Tibet butter tea) prior to breastfeeding initiation. In Tibetan culture such a custom is believed to develop strength in newborns (Guo et al. 2008; Tang, Hewitt & Yu 2012).

Generally, the proportion of infants receiving colostrum increased after 1992 when the Chinese government began to implement the BFHI (Han & Jin 1993; Lai et al. 2006). However, the prelacteal feeding rates remained high (26%–97%) in China during the last ten years (Huang et al. 2007; Lai et al. 2006; Qiu et al. 2007; Sun et al. 2009; Tang, Hewitt & Yu 2012; Xu, Binns, Yu, et al. 2007a; Zhao et al. 2003). The highest prelacteal feed rate was reported by Sun et al. with 97% newborns receiving fluids other than breastmilk as their first feeds in the city of Tianjin (Sun et al. 2009). Infant formula, plain water and sugar water were the main prelacteal feeds used in several provinces of China (Han & Jin 1993; Ou et al. 1995; Shen, Fang & Luo 2002; Zhang et al. 1995).

## **2.4 Early initiation of breastfeeding**

### **2.4.1 Benefits of early breastfeeding initiation**

Early initiation of breastfeeding is defined as putting the newborn to breast within one hour of birth (WHO 2008). Newborn infants being breastfed within the first hour of life is recommended by the WHO and is in accordance with step four of the BFHI (WHO & UNICEF 1989).

Infants who commence breastfeeding within one hour of life are more likely to avoid prelacteal feeds and thereby have less chance of being exposed to pathogenic microorganisms (Hossain et al. 1995; Penders et al. 2006). A study by Badruddin et al. reported a higher frequency of diarrhoea in infants with delayed initiation of breastfeeding compared to those who received breastmilk within one hour of life (Badruddin et al. 1991). Breastmilk contains growth factors that promote colonisation with enteric bacteria that inhibit enteropathogens. Delaying breastfeeding impedes the establishment of a commensal enteric microflora changing the human microbiome that is essential for immune function and health (Goldman 2000; Jordan et al. 2010). A trial showed that 22% of neonatal deaths could be prevented if breastfeeding is initiated within the first hour of birth (Edmond et al. 2006). Also, skin-to-skin contact and early suckling are beneficial for better mother-baby bonding (Bystrova et al. 2009; Tang, Binns, et al. 2013).

Initiation of breastfeeding soon after childbirth may increase the breastfeeding prevalence at discharge (Buxton et al. 1991) and prolong breastfeeding duration (Hossain et al. 1995; Moore, Anderson & Bergman 2007; Murray, Ricketts & Dellaport 2007). A prospective study in rural Egypt showed that mothers who started breastfeeding earlier were less likely to stop breastfeeding their infants during the first 47 weeks postpartum. Also, infants who started breastmilk intake within 2 hours of life were most likely to be exclusively breastfed during the first 11 weeks of life (Hossain et al. 1995). An association between early initiation and longer duration of breastfeeding has been seen in a retrospective study conducted in Japan. Commencement of breastfeeding within 120 minutes postpartum was found to be associated with the proportion of mothers fully breastfeeding their infants up to four

months (aOR 2.45, 95% CI 1.21 to 4.95) (Nakao et al. 2008). Although a prospective study of 1,242 breastfeeding mother-infant pairs in Hong Kong revealed no association between breastfeeding initiation within 1 hour of birth and breastfeeding duration, researchers found that mothers who experienced all six Baby-Friendly practices (including early breastfeeding initiation) were less likely to stop breastfeeding (Tarrant et al. 2011).

Despite all of these advantages of early initiation of breastfeeding, many mothers defer breastfeeding initiation until the second postpartum day or later, especially in some developing countries. For instance, only 3% of mothers initiated breastfeeding within one hour of labour in Greece and almost 90% of newborn infants were fed with breastmilk substitute one or more times during the first two days of life (Theofilogiannakou et al. 2006). Likewise, in a rural area of Egypt, among 152 neonates who were initiated with breastfeeding, 36% began consuming breastmilk within 2 hours, 37% were between 2 and 5 hours, and 27% after 5 hours. The mean and median ages at breastfeeding initiation were 9.5 and 2 hours, respectively (Hossain et al. 1995).

The early breastfeeding initiation rates are not very encouraging in many parts of world. For instance, a national survey in Vietnam reported that 45.6% of babies were breastfed within one hour after birth (Dibley, Senarath & Agho 2010). The corresponding rates were 43.6% (Dibley, Senarath & Agho 2010), 35.4%–72.7% (Chandrashekhar et al. 2007; Pandey et al. 2010) and 23.5% (Patel et al. 2010) in Philippines, Nepal and India, respectively. In Nagasaki, Japan, 36% commenced breastfeeding within half an hour and 21% initiated within 31 to 120 minutes (Nakao et al. 2008). The highest rates of early initiation of breastfeeding were observed in Africa and Latin America: for example, 54.2% in Sudan (Haroun, Mahfouz & BY 2008), 52.4%–77% in Ethiopia, 70% in Zambia, 74% in Bolivia (Setegn, Gerbaba & Belachew 2011) and 43% in Brazil (Boccolini et al. 2011).

#### **2.4.2 Prevalence of early breastfeeding initiation in China**

Initiating breastfeeding within the first hour of birth is not common in China. The highest rate of initiation within one hour of birth was documented in a study from Jiaxing, a rural area of Zhejiang Province, with almost 80% of mothers initiating breastfeeding within half an hour of birth (Ji 2000). On the contrary, the prevalence of early breastfeeding initiation observed in other studies was quite low. For instance, a study conducted in Shaanxi Province in 2000 showed that less than 3% of mothers initiated breastfeeding within 12 hours postpartum and 80% of mothers started between 24 and 72 hours. The average time to commence breastfeeding was 52.8 hours (standard deviation (SD) 24.6) and no infants had their first breastfeed within half an hour of birth. The earliest time of breastfeeding initiation was within three hours of birth, and the latest was 124 hours after delivery. It is a traditional belief that breastfeeding should not be initiated until the breasts become engorged (Shen, Fang & Luo 2002).

Similarly, a study in Zhengzhou, Henan Province found that no neonates began consuming breastmilk during the first 12 hours of life. All 400 mothers initiated breastfeeding between 12 and 72 hours postpartum (Fu 2006). Another study carried out in Shanxi Province yielded similar results. Mothers or direct relatives of 614 infants under 6 months of age were asked about breastfeeding practice. Only 1% of infants had their first breastmilk within 12 hours of birth with the majority (84%) receiving their first breastfeed between 24 and 72 hours (Zhang et al. 1995). Delayed breastfeeding initiation was also observed in Shandong Province where eight in ten rural mothers did not initiate breastfeeding within 24 hours postpartum (Han & Jin 1993). The average time of initiating breastfeeding was found to be 50 hours (urban) and 60 hours (rural) in Changde, Hunan Province. The study also showed that not a single infant born was fed with breastmilk within one hour after birth. Feeding neonates with herbal tea within three days postpartum to 'relieve internal heat' was reported to be the main reason for delayed breastfeeding initiation (Ou et al. 1995; Tang, Hewitt & Yu 2012).

Earlier breastfeeding initiation was reported in Heilongjiang (Jiang & Li 2008), Jilin (Xia & Gao 2007), Liaoning Provinces (Song 2008) in the north-eastern China and

Fujian Province (He et al. 1994) in the southeast of China. The percentage of mothers initiating breastfeeding within half an hour of birth was between 51% and 57% in these four provinces. Mothers who had postpartum examinations at the Maternal and Child Health Care Hospital of Heilongjiang Province were asked about their breastfeeding practice and associated factors. The results revealed that 57% of mothers initiated breastfeeding within 30 minutes of birth. Univariate analysis demonstrated that the 'exclusive breastfeeding' rate at 42 days was higher in neonates who commenced breastfeeding earlier (Jiang & Li 2008). Similar results were found in a study conducted in the same hospital two years later (Zhang & Yang 2009). A prospective study on breastfeeding in Changchun, Jilin Province found around 60% mothers initiated breastfeeding within half an hour of birth and 26% between half an hour and 12 hours. In addition, there was a significant association between the timing of breastfeeding initiation and 'full breastfeeding' rates at four months postpartum. The infants initiating breastfeeding within 30 minutes had the highest 'full breastfeeding' rates at four months (Xia & Gao 2007). Similarly, approximately half of infants received their first breastmilk within half an hour of birth in Fujian and Liaoning Provinces (He et al. 1994; Song 2008; Tang, Hewitt & Yu 2012).

### **2.4.3 Factors associated with early initiation of breastfeeding**

According to the literature, early initiation of breastfeeding was associated with numerous factors relating to the mother, the baby and to the practices of health providers. To review determinants of early breastfeeding initiation, factors are broadly categorised as socio-demographic, biomedical and health-service related factors.

#### **Socio-demographic factors**

##### *Maternal Age*

It is consistently found in the majority of the previous studies that maternal age is not related to early initiation of breastfeeding (El-Gilany, Sarraf & Al-Wehady 2012; Hossain et al. 1995; Mahrshahi et al. 2010; Nakao et al. 2008; Theofilogiannakou et

al. 2006; Vieira et al. 2010). For example, no association between maternal age at delivery and breastfeeding within the first hour of life was found in a recent cross-sectional study in Brazil (Vieira et al. 2010). However, Holman et al. reported that younger mothers tended to start breastfeeding slightly earlier in rural Bangladesh (Holman & Grimes 2001).

### *Education*

No significant association was found between maternal education and initiation of breastfeeding within one hour of birth in most research (El-Gilany, Sarraf & Al-Wehady 2012; Hossain et al. 1995; Mahrshahi et al. 2010; Ogunlesi 2010; Vieira et al. 2010). However, a national survey in India found that mothers with secondary education or above were more likely to have higher prevalence of early breastfeeding initiation than those with less education after controlling for potential confounders, such as baby's gender, marital status and husband's education. (OR 0.79, 95% CI 0.66 to 0.94) (Patel et al. 2010). Also, the prevalence of initiating breastfeeding was higher among mothers with college or university education in Athens, Greece (OR 1.36, 95% CI 1.02 to 1.81) (Theofiliannakou et al. 2006). In the aspect of father's education, no research had found an association between the level of father's education and early breastfeeding initiation (Mahrshahi et al. 2010; Patel et al. 2010; Theofiliannakou et al. 2006).

### *Social economic status*

Several researchers have documented the relationship between social economic status and early breastfeeding initiation. For instance, Mahrshahi et al. (2010) found that mothers from richer households were less likely to commence breastfeeding after one hour of delivery compared with those from poorer families (OR 0.37, 95% CI 0.23 to 0.59). However, the socioeconomic level was found to be not related to early breastfeeding initiation in a Greece study (Theofiliannakou et al. 2006) and a Brazilian study (Vieira et al. 2010).

## **Biomedical factors**

### *Parity*

The association of parity with early breastfeeding initiation is inconsistent. Most studies found no difference between primiparous and multiparous women for early initiation of breastfeeding (Mihirshahi et al. 2010; Nakao et al. 2008; Patel et al. 2010; Setegn, Gerbaba & Belachew 2011; Vieira et al. 2010). However, in a cross-sectional study of Saudi Arabia, parity was found to be independently associated with starting breastfeeding within one hour of birth. In this study, multiparous women were more likely to initiate breastfeeding early compared to primiparous mothers (El-Gilany, Sarraf & Al-Wehady 2012).

### *Gestational age*

Gestational age has been reported by several studies to be associated with breastfeeding initiation within one hour of birth (Nakao et al. 2008; Vieira et al. 2010). For example, a retrospective cohort study in Japan found that mothers with a premature delivery (gestational age of 36 weeks or less) started first breastfeeding significantly later than their respective controls (Nakao et al. 2008). Similarly, a cross-sectional study (with 1309 mother-child pairs) conducted in Brazil identified full term pregnancy (prevalence ratio = 1.43, 95% CI, 1.10 to 1.41) as a protective factor of early initiation of breastfeeding (Vieira et al. 2010).

### *Method of delivery*

Caesarean delivery was found to be negatively associated with early breastfeeding initiation in many studies (Chien & Tai 2007; Rowe-Murray & Fisher 2002; Vieira et al. 2010). The establishment of breastfeeding in the hospital may be interfered by caesarean sections, as the early contact between the mother who delivered by caesarean section and her baby is likely to be more difficult than the mother who gave birth vaginally (Scott & Binns 1999). According to Qiu et al., besides the limited movements after surgery, Chinese mothers with caesarean section also worry that the baby will be influenced by the medicines through the breastmilk (Qiu et al. 2009). In contrast, a prospective study undertaken in Greece showed that the method of delivery was not related to the initiation of breastfeeding within the first hour of life (Theofiliogiannakou et al. 2006).

### **Health-service related factor**

To achieve successful breastfeeding, the WHO states that all pregnant women should be informed about the benefits of breastfeeding as well as early initiation during antenatal education (WHO & UNICEF 2009). However, only a few studies have investigated the association between attendance at antenatal classes and early breastfeeding initiation (Hossain et al. 1995; Ogunlesi 2010). For example, a study in Brazil found that the rate of breastfeeding initiation within the first hour of life was higher among mothers who had received prenatal education with guidance on the benefits of breastfeeding compared with those who did not (prevalence ratio = 1.23, 95% CI, 1.11 to 1.41) (Vieira et al. 2010).

### **Other factors associated with early breastfeeding initiation**

Several other factors have also been found to be associated with early initiation of breastfeeding. For instance, lack of clinic-based antenatal care and delivery outside health facilities were found to be associated with delayed breastfeeding initiation (Ogunlesi 2010). Similarly, a longer duration of labour (> 8 hours) was found to be related with later breastfeeding initiation ( $\geq 6$  hours) (Hossain et al. 1995).

In conclusion, there were consistent positive associations between early breastfeeding initiation within one hour and full term pregnancy, vaginal delivery and attendance at antenatal classes. However, evidence for the associations between early breastfeeding initiation and parity and family income was inconclusive. In addition, no association was observed for maternal age and level of education in the majority of published studies.

## **2.5 Factors associated with breastfeeding at discharge**

Factors that have been reported to be associated with breastfeeding at discharge are categorised and discussed below.

### **Socio-demographic factors**

#### *Maternal Age*

Internationally, maternal age at the time of birth has been repeatedly reported to be associated with breastfeeding at discharge. Older women are more likely to be breastfeeding at discharge than younger women (Grjibovski et al. 2005; Kambale 2011; Scott et al. 2001). For instance, according to a study in Australia, a 30 years old mother was 1.5 times more likely to be breastfeeding at discharge compared to a 20 years old mother (OR 1.51, 95% CI 1.00 to 2.29) (Scott et al. 2001). Similarly, in their study of 1,399 mothers, Grjibovski et al. reported that mother's age was positively associated with the rate of breastfeeding at discharge (Grjibovski et al. 2005).

There is also evidence suggesting that maternal age is associated with the prevalence of breastfeeding. For example, a large population-based retrospective cohort study in Canada indicated that older women had higher odds of 'exclusive breastfeeding' than younger women at discharge (OR 1.26, 95% CI 1.23 to 1.30 for ten years increments) (McDonald et al. 2012).

On the contrary, a national survey in Italy found no association between maternal age and breastfeeding at discharge (Riva et al. 1999). Jones et al. in a US national survey also failed to detect an association between maternal age and the rate of breastfeeding at discharge (Jones et al. 2011).

Only a few studies investigated determinants of breastfeeding at discharge among Chinese population (Li et al. 2004; Qiu et al. 2007). These available studies, however, show conflicting results about the relationship between mother's age and breastfeeding at discharge. Research carried out among Chinese women living in Australia found that there was no association between maternal age and

breastfeeding at discharge for mothers who had given birth in Australia. For women who gave birth in their home countries, older mothers were less likely to be breastfeeding at discharge than younger mothers (OR 0.80, 95% CI 0.71 to 0.90) (Li et al. 2004). In addition, a cohort study in Zhejiang Province found a significantly lower likelihood of 'exclusive breastfeeding' at discharge among mothers older than 24 years old (Qiu et al. 2009). However, the results of another prospective study among Chinese women in Xinjiang Uygur Autonomous Region indicated no association between maternal age at birth and breastfeeding at discharge (Xu, Binns, Yu, et al. 2007a).

### *Education*

Maternal education level has been consistently reported to be associated with breastfeeding at discharge. The rates of breastfeeding at discharge were found to be higher among mothers with a higher education level. For example, a recent national survey in the United States revealed that maternal education was independently positively associated with breastfeeding at discharge (Jones et al. 2011). Chuang et al. also found that women having university education were more likely to commence breastfeeding compared with women with junior high school education after adjusting for potential confounders (OR 3.43, 95% CI 3.04 to 3.88) (Chuang et al. 2010).

However, some studies have found no association between maternal education and breastfeeding at discharge (Kambale 2011; Riva et al. 1999; Scott et al. 2001). For instance, a cohort study in China revealed no statistically significant differences in breastfeeding rates at discharge among groups of mothers with different educational years (Xu, Binns, Yu, et al. 2007a). Differences in breastfeeding promotion strategies between areas may partly explain the conflicting findings for the association between the level of education and breastfeeding at discharge.

### *Social economic status*

The social economic status is usually measured by family income. Many studies in developed societies have found that women with higher family income are more likely to initiate breastfeeding (Riva et al. 1999; Scott & Binns 1999). For example, the results of a national survey in Italy indicated a positive association between

higher social class and higher breastfeeding initiation rate before discharge (OR 2.35, 95% CI 1.10 to 5.18) (Riva et al. 1999). However, the relationship sometimes reverses in less developed societies. Women in developing countries may consider feeding infant with infant formula more fashionable and ‘westernised’ (Rogers, Emmett & Golding 1997).

No association between family income and breastfeeding at discharge are also reported by some investigators (Kambale 2011; Li et al. 2004). For instance, Kambale found that women with higher family income was not more likely to initiate breastfeeding (Kambale 2011). Similarly, a study on Chinese mothers living in Perth, Australia also failed to find an association between family income and the rate of breastfeeding initiation before discharge (Li et al. 2004).

#### *Maternal employment*

The association between mother’s employment (return to employment) and breastfeeding rate at discharge has been evaluated by many researchers, but the results are not conclusive (Dennis 2002; Scott & Binns 1999).

A study of breastfeeding in Australia showed that maternal employment was not associated with breastfeeding at discharge regardless of maternal age, parity, the method of delivery (Scott et al. 2001). However, more recent investigations indicated that the intention to return to employment or maternal employment was negatively associated with breastfeeding at discharge (Chuang et al. 2010; Pechlivani et al. 2005). For example, a large population-based prospective longitudinal study in Taiwan designed to estimate specifically the association between maternal employment and breastfeeding practices showed that an early maternal return to work within one month postpartum was negatively related with the initiation of breastfeeding by discharge (Chuang et al. 2010). It was also reported by Pechlivani et al. that unemployed mothers had a significantly higher rate of ‘exclusive breastfeeding’ at discharge compared with their employed counterparts (Pechlivani et al. 2005).

Kambale, using data drawn from a national survey in Italy, however, found a positive relationship between employment status and breastfeeding at discharge. Bias in data

collection or management, interaction with maternal education or part-time employment of most working mothers were considered as possible explanations for this finding (Kambale 2011).

### **Biomedical factors**

#### *Parity*

Scott et al. have reported that primiparous mothers were more likely to be breastfeeding at discharge in comparison to multiparous mothers (Scott et al. 2001). Conversely, others have found no association between birth order and breastfeeding at discharge (Dashti et al. 2010; Grjibovski et al. 2005; Riva et al. 1999).

There are a few studies among Chinese mothers which explore the association between parity and breastfeeding at discharge. For example, a cohort study in Xinjiang Uygur Autonomous Region failed to find the relationship between birth order and breastfeeding rate at discharge (Xu, Binns, Yu, et al. 2007a). However, a study combining two cohorts in Hong Kong indicated that multiparous women were less likely to initiate breastfeeding by discharge from the hospital than primiparous women (OR 0.71, 95% CI 0.64 to 0.78) (Leung, Ho & Lam 2002). Similarly, a longitudinal study in Taiwan showed that mothers with two (OR 0.84, 95% CI 0.77 to 0.91) or more children (OR 0.70, 95% CI 0.62, 0.79) were less likely to commence breastfeeding compared with those women giving birth to their first baby (Chuang et al. 2010).

#### *Method of delivery*

The effect of delivery method on breastfeeding rate at discharge has been widely explored. It was once found that caesarean section was a risk factor for not breastfeeding at discharge (Nolan & Goel 1995; PerezEscamilla, MaulenRadovan & Dewey 1996). However, the majority of recent studies have found no differences between women with caesarean-section delivery and those with vaginal delivery in the rate of breastfeeding at discharge (Kambale 2011; Kohlhuber et al. 2008; Scott et al. 2001).

On the contrary, the results of association between method of delivery and breastfeeding at discharge in studies among Chinese mothers were not consistent. Several studies reported that mothers with caesarean sections were not less likely to initiate breastfeeding before discharge compared with mothers with vaginal delivery (Leung, Ho & Lam 2002; Li et al. 2004; Xu, Binns, Yu, et al. 2007a). However, a study carried out among Chinese in Taiwan found that the rate of breastfeeding at discharge was significantly lower among mothers with caesarean section than those with normal spontaneous delivery (OR 0.74, 95% CI, 0.68 to 0.81) (Chuang et al. 2010).

### *Smoking*

Maternal smoking has been shown to be both strongly and negatively associated with the initiation of breastfeeding before discharge. A population-based study in Canada found that women who smoked were half as likely as non-smokers to initiate breastfeeding (Yang et al. 2004). Also, researchers who carried out a study in a rural area of US reported that mothers who smoked were twice as likely as those who did not smoke to not to commence breastfeeding (Bailey & Wright 2011). Moreover, according to a national survey in US, children who lived in a home with the presence of a tobacco smoker were significantly less likely to have been breastfed, compared with children who did not (Jones et al. 2011).

Probably because the female smoking prevalence has been low in China (Qian et al. 2010), few studies of breastfeeding among Chinese mothers have examined the association between mother's smoking and breastfeeding initiation. A study in Hong Kong found that maternal smoking was a significant barrier to initiate breastfeeding (OR 0.35, 95% CI 0.25 to 0.50) (Leung, Ho & Lam 2002).

China is the world's largest producer and consumer of tobacco. The smoking prevalence of men has remained high around the country (Qian et al. 2010). A cohort study in Xinjiang indicated that paternal smoking was negatively associated with breastfeeding practices. The rate of 'exclusive breastfeeding' in the paternal smoking group was significantly lower than in the paternal non-smoking group at discharge (Xu et al. 2010).

## **Psychosocial factors**

### *Prenatal intentions*

Research has shown that the timing of decision to breastfeed is related to the rate of breastfeeding at discharge. Based on a study in Australia, women who chose to breastfeed prior to pregnancy were more likely to be breastfeeding at discharge than those who made the decision during the pregnancy or after the delivery (OR 3.27, 95% CI 1.72 to 6.04) (Scott, Binns & Aroni 1997). However, a previous study of breastfeeding among Chinese mothers failed to find the association between when feeding method decision was made and breastfeeding at discharge (Qiu et al. 2007).

### *Paternal attitudes toward breastfeeding*

Numerous studies have reported that father's attitude toward breastfeeding is one of the major factors associated with breastfeeding at discharge in western societies (Arora et al. 2000; Cohen, Lange & Slusser 2002; Dashti et al. 2010; Li et al. 2004). For example, a prospective cohort study undertaken in southern Germany showed that the paternal negative attitude towards breastfeeding was the major factor reducing the rate of breastfeeding at discharge (Kohlhuber et al. 2008). Similarly, Scott et al. found that mothers were more likely to initiate breastfeeding if they perceived positive support for breastfeeding from their partners, regardless of maternal age, education level and parity (Scott et al. 2001). Furthermore, a randomised controlled trial (RCT) in America showed that breastfeeding was initiated by a significantly larger proportion of women among the group whose partners attended a breastfeeding promotion antenatal class than the control group (Wolfberg et al. 2004).

In the limited studies of Chinese women about paternal attitude toward breastfeeding, the results were inconsistent (Li et al. 2004; Qiu et al. 2007). Qiu et al. reported that in urban Hangzhou, paternal attitude toward breastfeeding was not related to breastfeeding at discharge (Qiu et al. 2007). A cross-sectional survey of Chinese Australians carried out in Australia found that father's preference for breastfeeding was positively associated with the initiation of breastfeeding among Chinese mothers who gave birth in Australia. For those who gave birth in the mother's home country, no significant association between paternal attitude and breastfeeding initiation was

detected (Li et al. 2004). Another cross-sectional study in a rural area of Taiwan showed that the perceived support of breastfeeding from fathers was positively associated with breastfeeding at discharge (Chang & Chan 2003).

#### *Breastfeeding support from maternal grandmother*

Only a few studies have assessed the association between maternal grandmother's attitude toward breastfeeding and breastfeeding at discharge. It is therefore not possible to make a conclusion. For example, a study with 1,618 women in Australia showed that women who received breastfeeding support from their own mothers were at least two times more likely to be breastfeeding at discharge than women who did not (OR 2.16, 95% CI 1.15 to 4.03) (Scott et al. 2001). Conversely, a prospective cohort study in China found that grandmother's feeding preference was not associated with breastfeeding at discharge (Qiu et al. 2007). Also, a study of breastfeeding among Chinese Australian mothers failed to detect an association between maternal grandmother's feeding preference and the initiation of breastfeeding (Li et al. 2004).

### **Health service-related factors**

#### *Antenatal classes*

The effects of antenatal classes on the initiation of breastfeeding are inconsistent. Previous intervention studies have shown that prenatal breastfeeding education programs can exert a positive influence on breastfeeding at discharge (Fairbank et al. 2000). Similarly, a recent large population-based retrospective cohort study also demonstrated that women who did not attend prenatal classes were less likely to be exclusively breastfeeding at discharge than those who did (OR 0.80, 95% CI 0.76 to 0.83). However, little information on the contents of prenatal classes was given (McDonald et al. 2012).

However, many researchers failed to detect an association between antenatal classes and breastfeeding at discharge. For instance, using the data drawn from a national survey in Italy, a researcher found that there were no differences between mothers who had attended antenatal classes and mothers who had not for the rate of breastfeeding at discharge (Kambale 2011). As few studies have stated the contents

regarding breastfeeding education in prenatal classes, it is not possible to conclude if the prenatal classes in different studies are comparable. The conflicting results of previous studies may be attributed to the diverse emphases that the antenatal classes have put on the importance of breastfeeding.

### *Rooming-in*

Keeping mothers and newborns together 24 hours a day after birth is recommended by the WHO and is in accordance with the Step Seven of the BFHI (WHO & UNICEF 2007). A large quantity of studies have shown that rooming-in is positively associated with successful breastfeeding initiation (WHO 1998b). For instance, a prospective cohort study in Germany found that infants who stayed 24 hours a day with their mothers were nearly four times more likely to be exclusively breastfed at discharge than those infants who spent less time in the maternity ward with their mothers (OR 3.72, 95% CI 2.31 to 5.97) (Pechlivani et al. 2005). Rooming-in allows for early mother-infant contact and demand feeding, that is related to higher rates of breastfeeding at discharge (Dennis 2002; Scott & Binns 1999).

### *Health care professional's support of breastfeeding*

The results of breastfeeding studies concerning the impact of health care professional on breastfeeding at discharge are inconsistent (Dennis 2002). A case-control study aiming at determining the association between mothers' choice of breastfeeding and different sources of support found that receiving breastfeeding guidance from doctors, nurses or nutritionists were not related to maternal decision on how to feed their babies (Giugliani, Caiaffa, et al. 1994). However, a study of Chinese mothers in Australia demonstrated that 'any breastfeeding' rate at discharge was higher among women who perceived doctor's support of breastfeeding than those who did not think their doctors were supportive of breastfeeding (Li et al. 2004).

Generally, older, better educated, unemployed, non-smoking mothers, and/or those with social supports for breastfeeding were more likely to be lactating at discharge. However, making the breastfeeding decision during pregnancy or after delivery was inversely associated with breastfeeding at discharge. Caesarean section had once been a risk factor for not commencing breastfeeding, but it became not significant according to recent studies. Furthermore, infants from wealthy families were more

likely to be breastfed at discharge in developed countries whereas the relationship sometimes reversed in less developed societies. For Chinese mothers, however, the limited results concerning factors associated with breastfeeding at discharge suggested conflicting evidence.

## 2.6 Factors associated with breastfeeding duration

According to the literature, breastfeeding duration is associated with a number of factors relating to the mother, the baby and to the practices of health service providers. To review determinants of breastfeeding duration, factors are broadly categorised as socio-demographic, biomedical, psychosocial and health-service related factors.

### Socio-demographic factors

#### *Maternal Age*

Maternal age has been shown repeatedly to be positively associated with breastfeeding duration in diverse cultures. Generally, older mothers are less likely to cease breastfeeding early compared with younger mothers (Scott & Binns 1999). For example, in an Australian cohort study, Scott et al. reported that mothers aged between 20 and 29 were more likely to discontinue breastfeeding before 12 months postpartum than those aged over 29 (HR 1.55, 95% CI 1.21 to 1.98) (Scott, Binns, Oddy, et al. 2006). In addition, according to a longitudinal study in Germany, mothers aged below 25 and aged between 25 and 34 were 3.31 times (OR 3.31, 95% CI 2.16 to 5.06) and 1.45 times (OR 1.45, 95% CI 1.16 to 1.83) more likely to stop exclusively and fully breastfeeding before 4 months compared with mothers aged above 34 (Kohlhuber et al. 2008).

Studies carried out in Chinese societies have reported similar results (Qiu, Binns, Zhao, Lee, et al. 2010; Tarrant et al. 2010). A prospective cohort study of breastfeeding in Zhejiang Province showed an inverse association between maternal age and cessation of 'any breastfeeding'. Mothers who were under 25 years old (HR 1.52, 95% CI 1.05 to 2.19) and mothers who were between 25 and 29 (HR 1.71, 95% CI 1.09 to 2.70) were more likely to cease 'any breastfeeding' within 180 days after birth than mothers aged above 29 (Qiu, Binns, Zhao, Lee, et al. 2010). Although no differences among age groups for discontinuing breastfeeding beyond 3 months were indicated in a cohort study of 1,417 mother-infant pairs in Hong Kong, Tarrant et al. found a significantly larger proportion of younger mothers (< 25 years) wean before 1 month postpartum compared with older mothers (Tarrant et al. 2010).

With regard to the duration of ‘exclusive breastfeeding’, both of the prospective cohort studies in Xinjiang Region and Zhejiang Province found no relationship between ‘exclusive breastfeeding’ within 6 months and maternal age (Qiu, Binns, Zhao, Lee, et al. 2010; Xu, Binns, Zheng, et al. 2007).

### *Education*

Numerous studies have identified maternal education as a factor strongly associated with the duration of breastfeeding. Mothers with higher education level are more likely to breastfeed for a longer duration (Amin, Hablas & Al Qader 2011; Grjibovski et al. 2005; Kimani-Murage et al. 2011; Kohlhuber et al. 2008; Ladomenou, Kafatos & Galanakis 2007; Riva et al. 1999; Scott et al. 2001).

Likewise, several studies in Chinese populations showed positive association between the education level attained by the mother and the duration of breastfeeding. For instance, researchers found in a study among Chinese mothers in Taiwan that mothers with university degree or higher degree were less likely to cease breastfeeding than mothers with an education level of junior high school or lower (OR 0.66, 95% CI 0.63 to 0.69) (Chuang et al. 2010). Tarrant et al. also reported a significantly higher proportion of mothers breastfeeding beyond one month among those with a university degree or higher (Tarrant et al. 2010). In contrast, one study conducted in a rural area of Taiwan found a negative association between maternal education level and breastfeeding duration. Mothers with higher education level were more likely to discontinue breastfeeding before infants were 4 months old (Chang & Chan 2003).

However, previous cohort studies in the mainland of China failed to identify an association between maternal education and breastfeeding duration. A breastfeeding cohort study in Zhejiang Province found that, after adjusting for potential confounders such as maternal age, employment and parity, education level was neither associated with ‘any breastfeeding’ up to 6 months nor with ‘exclusive breastfeeding’ within 6 months (Qiu, Binns, Zhao, Lee, et al. 2010). Similarly, years of education was not related with ‘exclusive breastfeeding’ within 6 months based on the results of a cohort study in Xinjiang (Xu, Binns, Zheng, et al. 2007).

### *Social economic status*

There is strong evidence in Western societies that higher income is associated with longer breastfeeding duration (McLeod, Pullon & Cookson 2002; Meedya, Fahy & Kable 2010). In China, however, researchers have not found such an association. A cohort study of 1,417 mother-infant pairs in Hong Kong revealed that monthly family income was not associated with 'any breastfeeding' beyond either 1 month or 3 months (Tarrant et al. 2010). In addition, according to a breastfeeding cohort study conducted in Zhejiang Province, maternal salary was not associated with 'any breastfeeding' or 'exclusive breastfeeding' up to six months (Qiu, Binns, Zhao, Lee, et al. 2010). Similar results were reported in a study in Xinjiang Region where family annual income was not related with discontinuing of 'exclusive breastfeeding' before six months (Xu, Binns, Zheng, et al. 2007).

### *Return to employment*

Internationally, return to employment has been consistently identified as a risk factor associated with prolonged duration of breastfeeding. A cohort study of 587 women in Australia found that early return to work was negatively associated with breastfeeding duration. Mothers who returned to work before infants were 6 months old were less likely to be fully breastfeeding at 6 months or to continue breastfeeding up to 12 months, as were mothers who returned to employment between 6 and 12 months (Scott, Binns, Oddy, et al. 2006). Also, it was reported by Amin et al. from a cross-sectional study in Saudi Arabia that the proportion of mothers who exclusively breastfed in the first 6 months was significantly higher among those who were housewives than those who were employed (Amin, Hablas & Al Qader 2011). Studies, the relationship between maternal return to work and breastfeeding duration in Chinese populations, also showed that an early maternal return to work, especially within 6 months postpartum, was negatively related with breastfeeding duration (Chuang et al. 2010; Qiu, Binns, Zhao, Lee, et al. 2010).

## **Biomedical factors**

### *Parity*

Several studies have found that primiparous women are more likely to breastfeed for a longer period. For instance, a cohort study of 1,399 mothers in Russia exploring determinants of breastfeeding initiation and duration showed that ‘no previous deliveries’ was a protective factor for longer breastfeeding duration (OR 0.74, 95% CI 0.62 to 0.90) (Grjibovski et al. 2005). However, other researchers have found that the median breastfeeding duration of multiparous mothers was significantly longer than primiparous mothers. Piper and Parks analysed the data of a US national survey and found that each increase in parity of one birth resulted in a 1.7 times greater likelihood of continuing breastfeeding for more than six months (OR 1.69, 95% CI 1.07 to 2.68) (Piper & Parks 1996). Parity was also shown to contribute to longer ‘exclusive breastfeeding’ in a cross-sectional survey of 641 mothers in Saudi Arabia (OR 1.15, 95% CI 1.01 to 1.30) (Amin, Hablas & Al Qader 2011).

However, many studies also found similar breastfeeding durations between primiparous and multiparous women (Riva et al. 1999; Scott, Binns, Oddy, et al. 2006). No previous cohort studies undertaken in China have reported an association between parity and the duration of breastfeeding (Chuang et al. 2010; Qiu, Binns, Zhao, Lee, et al. 2010; Tarrant et al. 2010).

### *Gender*

In the majority of Western studies, baby’s gender has been found not to be associated with breastfeeding duration (Grjibovski et al. 2005; Scott, Binns, Oddy, et al. 2006). While a retrospective cohort study of 318 women conducted in Japan found that the proportion of mothers who continued ‘full breastfeeding’ at four months was significantly higher in infant girls than in infant boys. It was suggested that mothers may think that infant boys need more nutrition than infant girls and may give infant boys infant formula earlier (Nakao et al. 2008). Similarly, a significant shorter duration of breastfeeding was observed among male babies compared to female babies in a cohort study of urban poor infants in Brazil (Martines, Ashworth & Kirkwood 1989). On the contrary, it was reported in a community-based household survey in rural China that girls were breastfed for a significantly shorter duration than boys because of the common traditional belief of son preference in rural farming areas (Graham, Larsen & Xu 1998).

However, two recent cohort studies in Xinjiang Region and Zhejiang Province reported no differences between infant boys and girls for either ‘any breastfeeding’ or ‘exclusive breastfeeding’ duration (Qiu, Binns, Zhao, Lee, et al. 2010; Xu, Binns, Zheng, et al. 2007). Similarly, previous research among Chinese mothers in Australia and Taiwan found no association between baby’s gender and breastfeeding duration (Chang & Chan 2003; Li et al. 2004).

#### *Method of delivery*

In general, most recent studies have failed to find an association between methods of delivery and breastfeeding duration (Grijibovski et al. 2005; Kambale 2011; Riva et al. 1999; Scott, Binns, Oddy, et al. 2006). It was suggested that a caesarean delivery might have no lasting influence on breastfeeding once breastfeeding is established (Scott & Binns 1999). However, Kohlhuber et al. found in a study in Germany that babies who were delivered by caesarean section were more likely to have shorter breastfeeding duration (< 4 months) than those who were delivered by vaginal delivery (OR 1.69, 95% CI 1.36 to 2.10) (Kohlhuber et al. 2008). Furthermore, based on the results of studies in Chinese populations, caesarean section has not been shown to be a risk factor associated with the duration of either ‘exclusive breastfeeding’ or ‘any breastfeeding’ (Chang & Chan 2003; Qiu, Binns, Zhao, Lee, et al. 2010; Xu, Binns, Zheng, et al. 2007).

### **Psychosocial factors**

#### *Intended breastfeeding duration*

A few studies have investigated the association between maternal intended breastfeeding duration and actual duration (Quarles et al. 1994; Scott & Binns 1999). According to available published results, intended breastfeeding duration has been found to be strongly associated with actual duration. For example, Scott et al. reported that mothers who intended to breastfeed for four or more months had significant longer breastfeeding duration than those who intended to breastfeed for a shorter period (OR 4.18, 95% CI 2.81 to 6.22) (Scott et al. 2001). In addition, it was found in a study in US that intended duration was the strongest predictor of the actual breastfeeding duration after adjusting for potentially confounding demographic

factors (Quarles et al. 1994). The association between intended duration and actual duration can be explained with the theory of reasoned action which states that individual intention to perform an action is an immediate determinant of that action (Scott & Binns 1999). However, no previous studies have assessed the impact of maternal intended breastfeeding duration on actual duration in a Chinese environment.

#### *Paternal attitude toward breastfeeding*

Several investigators have found positive association between paternal preference for breastfeeding and longer duration of breastfeeding. For instance, a recent prospective cohort study in Germany showed that mothers whose partners had negative attitude toward breastfeeding were about 2 times (OR 2.36, 95% CI 1.58 to 3.52) more likely to stop breastfeeding before 4 months compared to those whose partners had positive attitude (Kohlhuber et al. 2008). Also, Scott et al. found in a cohort study among Australian women that father's feeding preference for breastfeeding was a protective factor associated with fully breastfeeding to 6 months (Scott, Binns, Oddy, et al. 2006).

Among Chinese mothers, however, the association between paternal attitude towards breastfeeding and breastfeeding duration is inconsistent. According to the results of a survey conducted among mandarin-speaking Chinese mothers living in Perth, Western Australia, the father's preferred infant feeding method was not associated with breastfeeding duration (Li et al. 2004). In addition, a cohort study conducted in Xinjiang, China failed to identify paternal feeding preference as a factor associated with 'exclusive breastfeeding' duration to six months (Xu, Binns, Zheng, et al. 2007). Likewise, Tarrant et al. found in Hong Kong that mothers whose husbands preferred breastfeeding were less likely to wean before one month (OR 0.71, 95% CI 0.51 to 0.98). While it was shown in the same study that fathers' feeding preference was not correlated with breastfeeding beyond 3 months postpartum (Tarrant et al. 2010).

#### **Complementary feeds**

The majority of researchers followed the definition given by the WHO which defined complementary feeding as the period during which other foods or liquids are

provided along with breastmilk (WHO 1998a). It has been widely reported that the premature introduction of complementary foods and fluids may lead to an early cessation of breastfeeding (WHO 1998a). For instance, a cohort study of breastfeeding carried out among infants from low income families in Brazil found that infants who were introduced to complementary food were more likely to wean before 6 months of birth (Martines, Ashworth & Kirkwood 1989). Similarly, Qiu et al. documented in a cohort study in Zhejiang Province, China that introduction of complementary food within 3 months was a risk factor of discontinuing breastfeeding before 6 months (HR 1.46, 95% CI 1.07 to 1.98) (Qiu, Binns, Zhao, Lee, et al. 2010). Furthermore, one experimental study which randomly assigned exclusively breastfed infants to receive complementary foods at different ages found that once complementary foods were introduced, nursing frequency declined spontaneously (WHO 1998a). As a result of less suckling, the production of breastmilk decreases. This may explain the negative association between premature introduction of complementary feeds and breastfeeding duration.

## **2.7 Early introduction of complementary foods**

### **2.7.1 Disadvantages of early introduction of complementary foods**

#### *Earlier cessation of breastfeeding*

A number of studies have identified that the premature introduction of complementary foods may lead to an earlier cessation of breastfeeding (*see Section 2.6 Factors associated with breastfeeding duration–complementary feeds p47*).

#### *Increased rates of morbidity and mortality*

There has been consistent evidence that exclusively breastfeeding within the first 6 months of life protects infants against infections and reduces mortality (WHO 2001). In addition, early introduction of complementary foods increases the risk of infants' exposure to microbial contaminated foods and fluids, especially in developing countries (Lamberti et al. 2011). It has been found that infants who were not exclusively breastfed were significantly more likely to die from diarrhoea or pneumonia compared to exclusively breastfed infants of the same age (Arifeen et al. 2001). Kalanda et al. conducted a cohort study in a rural area of Malawi and found a significant association between early complementary feeding and increased risk for respiratory infection, eye infection and malaria (Kalanda, Verhoeff & Brabin 2006). A recent systematic review using random effects meta-analyses showed a lower risk of diarrhoea morbidity among exclusive breastfeeding infants in comparisons to predominant, partial and not breastfeeding infants of 0-5 months old (Lamberti et al. 2011).

#### *Poorer infant growth and higher risk of obesity in later life*

Early introduction of complementary foods may initially cause malnutrition and poorer infant growth due to infection by contaminated foods and/or decreased breastmilk intake (Romulus-Nieuwelink et al. 2011). In the longer term, early introduction of complementary foods may lay the foundations for obesity in later life. A cohort study of 307 children followed from birth to 10 years of age showed a strong evidence of delayed introduction of solid foods and reduced risk of being obese at age of 10 years, after controlling for socioeconomic status, birthweight and breastfeeding duration (OR 0.90, 95% CI 0.84 to 0.97) (Seach et al. 2010). In

addition, Haisma et al. suggested that complementary feeding with cow's milk increases sleeping metabolic rate and minimal observable energy expenditure in breastfed infants. This altered early energy metabolism may be related with the development of obesity later in life (Haisma et al. 2005).

#### *Possible negative impact on the development of eating behaviours*

Recently, Shim et al. found an association between infant feeding practices and the development of picky eating behaviours in early childhood. Infants who were introduced to complementary foods before 6 months of age had a significantly higher occurrence of picky eating behaviour during preschool, while infants who were exclusively breastfed for 6 months were more likely to consume a diverse variety of foods (Shim, Kim & Mathai 2011).

### **2.7.2 Prevalence of early introduction of complementary foods**

Although the ideal six-month duration of exclusive breastfeeding has been emphasised by the WHO since 2001 (WHO 2001), the rates of premature introduction of complementary foods are still high, particularly in developing countries. A survey of 830 mothers in Liban documented a proportion of 36.5% infants who were introduced to solid foods before 4 months of age (Batal, Boulghourjian & Akik 2010). In a poor rural Malawian community, more than 40% infants were found to have received complementary foods by 2 months, with the mean age of introduction complementary foods at 3.4 months (Kalanda, Verhoeff & Brabin 2006).

Previous studies of infant feeding in China have shown that the early introduction of complementary foods was a common phenomenon across the country (Chen & Hu 1998; He & Zhai 2001; Jiang et al. 2007; Luo, Tu & Feng 2004; Qiu, Yun, et al. 2008; Wang, Kang & Wang 2000; Xu, Binns, Lee, et al. 2007a; Zhang, Wan & Pu 1998). A cross-sectional survey of 2,067 children aged from 4 to 6 months in poor rural areas of China showed that 16.4% of children were introduced to cereal foods before 4 months old and about 40% of infants were being fed with complementary foods at 6 months old (He & Zhai 2001). In another population-based survey

conducted in 105 counties of rural China, about 27% infants were introduced to complementary foods before the age of 4 months (Wang, Wang & Kang 2005). In a recent cross-sectional study in Chengdu, 5.1% of infants were fed with cereal foods, vegetables and fruits at 3 months old; more than 80% of infants were fed with complementary foods at 6 months old (Jiang et al. 2007).

Traditional beliefs about complementary feeding are still being commonly practiced in China. For example, it is a traditional feeding practice to introduce rice flour to infants after 1 month old in Kunming, a southwest city of China (Chen & Hu 1998). In some parts of Sichuan, feeding infants with egg yolk after 3 months of age is considered beneficial for the infants' health (Jiang et al. 2007). The median time of commencing complementary feeding in Tibet was at about 1 month after birth. Zamba, a traditional Tibetan food made of barley powder and butter tea and believed to be able to make infants strong, was the earliest food introduced in that area (Dang et al. 2005).

The too-early introduction of unmodified cow's milk and milk product is a risk factor for developing iron deficiency anaemia. Therefore, unmodified cow's milk should only be introduced after one year of age (Michaelsen et al. 2000; Xu, Binns, Lee, et al. 2007a). However, in China, many infants received cow's milk earlier than the recommended timing. A cohort study in Xinjiang Region showed that 3.7% of infants were fed with cow's milk in their first 15 days of life, and this figure increased to 25.9% at 6 months (Xu, Binns, Lee, et al. 2007b).

Although the WHO's recommendation for the introduction of complementary foods at 6 months has been adopted by the Chinese Health Ministry, some recent Chinese literature still suggests that complementary foods should be introduced between 4 and 6 months (Lin et al. 2008; Wang 2005). The main reason given was that breastmilk could not meet all the nutritional requirements of infants after 4 months. This may reflect a traditional belief about infant feeding in China and it is consistent with earlier policies of WHO and UNICEF (WHO 1995).

### **2.7.3 Factors associated with early introduction of complementary foods**

Younger maternal age (Dratva, Merten & Ackermann-Liebrich 2006; Rebhan et al. 2009), lower maternal education level (Kimani-Murage et al. 2011; Rebhan et al. 2009), higher income (Duong, Binns & Lee 2005), unmarried status (Kimani-Murage et al. 2011), infant boys (Kimani-Murage et al. 2011), living independently (Duong, Binns & Lee 2005) and maternal smoking (Rebhan et al. 2009) have been reported as risk factors associated with the early introduction of complementary foods.

There has been little research exploring the factors that influence the early introduction of complementary foods in China. A study in Xinjiang, China found that infants living in rural areas were more likely to have cow's milk than urban infants before six months. Factors shown associated with early introduction of solid foods were living in an urban area, having a birthweight below 2500g or above 4000g, delivery by caesarean section, higher family income, an older mother and longer years of maternal education (Xu, Binns, Lee, et al. 2007a).

To sum up, the early introduction of complementary feeding prior to 6 months of age may shorten breastfeeding duration, expose the infant to increased rates of morbidity and mortality, and initially cause poor infant growth. According to published research, it is almost universal practice across China to give infants complementary foods before the age of 6 months. Nevertheless, only a few studies have identified the factors associated with early introduction of complementary feeding in this country.

## **2.8 Breastfeeding problems**

### **2.8.1 Overview**

Experiencing breastfeeding problems, such as inverted nipples, breast pain, sore nipples, engorgement, insufficient milk supply and mastitis, is common amongst breastfeeding mothers (Amir et al. 2007; Binns & Scott 2002; Kearney, Cronenwett & Barrett 1990).

The incidence of insufficient milk among lactating mothers varies from study to study. In a retrospective survey in the United States aiming to explore whether ethnicity is associated with milk supply, 28.6% of African-American mothers and 29.7% of Caucasian mothers reported they had insufficient breastmilk (Hill & Aldag 1993). Up to 80% of mothers in a longitudinal study reported that their milk supply was insufficient at some stage during the first four months after delivery. In the same study, lack of confidence in breastfeeding, delayed onset of milk production, maternal education, multiparity, sore nipples, early introduction of formula to the previous child and mother breastfed as a child were found to be associated with perceived insufficient milk in a low-income urban population (Segura-Millan, Dewey & Perez-Escamilla 1994). Insufficient milk supply can be either a real phenomenon that the mother's milk supply is inadequate or a mistaken perception of the mother. No matter whether the insufficiency is real or not, insufficient milk supply has been reported by mothers as the major reason for early termination of breastfeeding (Hill 1992). Haggkvist et al. reported a positive association between breastfeeding problems, including mastitis, sore nipples, etc., and a higher risk of cessation of full breastfeeding before one month postpartum (Haggkvist et al. 2010).

A study of 556 mothers in Perth, Australia found that 82.6% reported experiencing breastfeeding problems before discharge and that breast related problems, namely sore or cracked nipples and engorgement, were the most common ones during the establishment stage of breastfeeding (Binns & Scott 2002). However, very few longitudinal studies have attempted to document the incidence of breastfeeding problems in China.

## **2.8.2 Mastitis**

Mastitis is defined as an inflammation condition of the breast tissue (Brodrribb 2004; WHO 2000). Although mastitis can occur in both lactating and non-lactating mothers, this research will focus on mastitis in lactating mothers, which is also called lactation mastitis (WHO 2000). Mastitis is clinically characterised by a tender, hot, swollen, wedge-shaped area of the breast in conjunction with flu-like symptoms, such as fever and malaise (Academy of Breastfeeding Medicine Protocol Committee 2008; Spencer 2008). In some cases mastitis may progress to breast abscess or septicaemia (Osterman & Rahm 2000). Treatment of mastitis includes bed rest, moist heat to the affected area, increased fluid intake, and removal of additional milk from the affected breast after a feeding (Prachniak 2002; Walker 2008). Mothers are treated with antibiotics if infective mastitis is suspected (Walker 2008).

Mastitis is most common during the second and third week postpartum, with the majority of the cases occurring in the first 3 months after delivery (Brodrribb 2004; WHO 2000). The reported incidence rates of lactation mastitis vary widely from 2.5% to 33%, depending on the methodology used (Amir et al. 2007; Dennis 2002; Foxman et al. 2002; Jonsson & Pulkkinen 1994; Kinlay, O'Connell & Kinlay 2001; Kinlay, O'Connell & Kinlay 1998; Marshall, Hepper & Zirbel 1975; Riordan & Nichols 1990). In a recent longitudinal study relying on self-reporting by breastfeeding mothers in Glasgow, 18% women experienced at least one episode of mastitis within 26 weeks postpartum (Scott et al. 2008). Another cohort study conducted in Australia showed that 206 out of 1,193 women (17.3%) experienced mastitis at 6 months postpartum (Amir et al. 2007). Limited information is available about the incidence of lactation mastitis among Chinese populations.

### **Risk factors**

It is a consistent finding in the literature that cracked and sore nipples are risk factors for mastitis (Fetherston 1998; Foxman et al. 2002; Jonsson & Pulkkinen 1994; Kinlay, O'Connell & Kinlay 2001). For example, a cohort study of 350 mothers conducted in New Zealand showed that sore nipples in the first month were independently associated with the occurrence of mastitis within the first year postpartum (RR 2.07, 95% CI 1.17 to 3.66) (Vogel, Hutchison & Mitchell 1999b).

Another study carried out in Australia with combined data from a RCT and a survey revealed that women who experienced cracked nipples while breastfeeding within the first six months after delivery were more likely to have mastitis compared to women who had no presence of a cracked nipple (OR 1.71, 95% CI 1.14 to 2.56) (Amir et al. 2007). The association between cracked and sore nipples and mastitis is in accordance with the hypothesis that a break in the skin may provide a portal of entry for pathogenic organisms, which then lead to infection (Vogel, Hutchison & Mitchell 1999b).

Other potential predictive factors include past history of mastitis (Foxman et al. 2002; Jonsson & Pulkkinen 1994; Kinlay, O'Connell & Kinlay 2001), engorgement (Riordan & Nichols 1990), infant attachment difficulties (Fetherston 1998), restriction from a tight bra (Fetherston 1998), use of creams on nipples (Foxman et al. 2002; Kinlay, O'Connell & Kinlay 2001), use of a manual breast pump (Foxman et al. 2002), change in the number of feedings (Riordan & Nichols 1990), maternal stress and fatigue (Fetherston 1998; Osterman & Rahm 2000; Riordan & Nichols 1990).

In addition, maternal smoking has been found in some studies to be a protective factor of lactation mastitis. For instance, Kinlay et al. found a negative association between maternal smoking and mastitis (HR 0.47, 95% CI 0.26 to 0.87) (Kinlay, O'Connell & Kinlay 2001). Also, Vogel et al. reported a significantly lower incidence rate of mastitis among women who smoked during pregnancy than women who did not smoke (RR 0.19, 95% CI 0.04 to 0.85). This finding was explained by the hypothesis that mastitis is more likely to happen among mothers with copious breastmilk supply, while smoking women are less likely to have ample milk supply (Vogel, Hutchison & Mitchell 1999b).

### **Association between mastitis and breastfeeding duration**

The results of association between mastitis and breastfeeding duration are inconsistent. The majority of studies failed to find significant differences between incidence of mastitis and breastfeeding duration (Foxman et al. 2002).

However, some studies identified mastitis as one of the risk factors for stopping breastfeeding. For example, a prospective cohort study which was designed to examine factors associated with the duration of breastfeeding showed that mastitis, increased the risk of weaning before 12 weeks postpartum (Schwartz et al. 2002). Moreover, in a prospective study which linked mastitis with poorer breastfeeding outcomes, 18% of the women who had stopped breastfeeding by 3 months nominated mastitis as the reason for stopping (Fetherston 1998).

On the contrary, several studies showed a longer duration of breastfeeding associated with mastitis (Scott et al. 2008; Vogel, Hutchison & Mitchell 1999a). For instance, Scott et al. found in a prospective study in Glasgow that women who had an episode of mastitis were significantly more likely to be breastfeeding at 26 weeks compared to those who did not suffer mastitis (Scott et al. 2008). Another cohort study of breastfeeding in New Zealand revealed that self-reported mastitis was associated with a reduced risk for shorter duration of breastfeeding after controlling for potential confounders (RR 0.67, 95% CI 0.48 to 0.94) (Vogel, Hutchison & Mitchell 1999a). As explained by the researchers, it is possible that mothers with an abundant milk supply are at a higher risk of mastitis. As most of the mastitis occurred in the first month in that study, the researchers assumed that mothers who had already experienced mastitis were still likely to continue breastfeeding for longer duration (Vogel, Hutchison & Mitchell 1999a).

## **2.9 Summary of potential factors associated with infant feeding practices and mastitis**

Based on the literature review, factors which are associated with the objectives of this study and that relate to infant feeding and infant care are presented in Table 2.1. Factors are broadly classified into groups of socio-demographic, biomedical, health service-related and other factors. These factors will be considered in the research design, questionnaire design and analysis of the data from this study.

**Table 2.1 Summary of potential determinants and confounders of infant feeding practices and mastitis**

Outcome	Potential determinants and confounders
Early breastfeeding initiation within one hour	<p><i>Socio-demographic factors:</i> maternal age, maternal education, social economic status.</p> <p><i>Biomedical factors:</i> parity, gestational age, method of delivery.</p> <p><i>Health-service related factors:</i> antenatal classes, place of delivery.</p>
Breastfeeding at discharge	<p><i>Socio-demographic factors:</i> maternal age, maternal education, maternal employment, social economic status.</p> <p><i>Biomedical factors:</i> parity, method of delivery.</p> <p><i>Psychosocial factors:</i> time of deciding feeding method, paternal attitudes toward breastfeeding, maternal grandmother's attitudes toward breastfeeding.</p> <p><i>Health-service related factors:</i> antenatal classes, rooming-in, health care professional's support of breastfeeding.</p>
Breastfeeding duration	<p><i>Socio-demographic factors:</i> maternal age, maternal education, maternal occupation (return to employment), social economic status.</p> <p><i>Biomedical factors:</i> baby's gender, parity, method of delivery.</p> <p><i>Psychosocial factors:</i> intended breastfeeding duration, paternal attitudes toward breastfeeding.</p> <p><i>Other:</i> complementary feeds.</p>
Early introduction of complementary foods	<p><i>Socio-demographic factors:</i> maternal age, maternal education, social economic status, marital status, family size.</p> <p><i>Biomedical factors:</i> baby's gender, baby's birthweight, method of delivery.</p>
Mastitis	Cracked and sore nipples, a history of mastitis, engorgement, maternal stress and fatigue, restriction from a tight bra, change in the number of feedings.

## **Chapter 3 Methodology**

This chapter describes the methodology used in the study, which involves the study instruments, the procedures used for the data collection and the methods of data cleaning, analysis and storage. In addition, this chapter explains the ethical considerations related to the study.

### **3.1 Overview**

A prospective cohort study of 695 women was conducted in Jiangyou, Sichuan Province over the period from March 2010 to December 2011. This study design was adopted to enable an accurate maternal recall of infant feeding practices and breastfeeding problems. Jiangyou, a county-level city, is located 160 km to the north of Chengdu. It has a population of approximately 883,000. Seven health care institutions of Jiangyou, including four hospitals and three township health centres, were chosen as research sites for the study. These four hospitals were Jiangyou People's Hospital, Jiangyou Maternal and Child Care Hospital, Changgang General Hospital and 903 Hospital. The three township health centres were Sanhe Township Health Centre, Houba Township Health Centre and Qinglian Township Health Centre.

Women who delivered at those seven health care institutes were invited to participate before discharge. Those mothers agreeing to participate were interviewed face-to-face with structured baseline questionnaires by the principal researcher or trained hospital staff. Mothers were then followed up for a period of twelve months by the principal researcher via telephone. The follow-up intervals were at 1, 3, 6 and 12 months postpartum.

### **3.2 Study instruments**

The baseline and follow-up questionnaires used in the study were based on questionnaires that had been previously used in breastfeeding cohort studies in China and Australia (Qiu, Yun, et al. 2008; Scott et al. 2001; Xu et al. 2006).

The baseline interviews took approximately 20 minutes (Appendix 4). The baseline questionnaire was composed of 7 sections as below:

- a. Socio-demographic information: maternal age, education, occupation, marital status, family monthly income, partner's occupation, partner's education, family size.
- b. Biomedical information: delivery method, parity, gestation weeks, infant gender, birthweight.
- c. Lifestyle information: smoking, tea drinking, alcohol drinking habit before and during pregnancy, dietary supplements and Chinese medicine taken during pregnancy.
- d. Health service-related information: early infant-to-breast contact, demand feeding, antenatal education, and encouragement of breastfeeding provided by hospital maternity staff provide.
- e. Psychosocial information: maternal attitudes and beliefs about breastfeeding, partner's feeding preference, maternal grandmother's feeding preference, maternal grandmother having breastfed, friends' feeding practices, timing of making feeding decision, intended breastfeeding duration.
- f. Infant feeding information: first feed, current feeding method, feeding times per 24 hours.
- g. Maternal breastfeeding problems: insufficient breastmilk, inverted nipples, cracked and sore nipples, engorgement, mastitis.

The follow-up questionnaire used at 1, 3 and 6 months postpartum was the same as the baseline questionnaire (Appendix 5). Detailed questions were asked about infant feeding practices and breastfeeding problems experienced by the women during the first six months postpartum. However, the follow-up questionnaire used at 12 months postpartum was a simpler one consisting of 6 short questions (Appendix 6). It mainly aimed at collecting the time of weaning.

### **3.3 Ethical considerations**

The project was approved by the Human Research Ethics Committee of Curtin University, Australia and the local health authorities in China (Appendix 1). An information letter, which included a detailed description and explanation of the project, was given to each mother. The letter was read out to each woman to save them from embarrassment if they cannot read. Mothers were informed that participating in the study was fully voluntary and that they could reject or withdraw from the study at any time without negative outcomes for their health care and medical treatment. Signed informed consent was obtained before mothers participated in the study. Copies of the information letter and consent form are in Appendix 2 and Appendix 3, respectively.

Care was taken to ensure that confidentiality was maintained throughout the study. Each mother was assigned an identification number linked with her name and phone number. The participants' names and phone numbers were used only for the purpose of following them up. The identifiable questionnaires with participants' names were used until the follow-up questionnaires had been collected. When data was entered into a computer software, only an identification number was employed. The information including the name, phone number and identification number of each participant was kept confidentially in an office of Curtin University. All original questionnaires were stored in a locked office at Jiangyou People's Hospital after the data collection.

### **3.4 Sample size**

The study was planned to recruit 670 women who delivered at seven health institutes in Jiangyou. It was estimated that about 6,800 babies would be born in Jiangyou in 2010. A sample of 670 women who gave birth during March—November 2010 in Jiangyou would be recruited, accounting for approximately 10% of babies born in Jiangyou in 2010.

It was assumed that the prevalence of ‘any breastfeeding’ would be 70% at six months. With its 95% confidence intervals of 66% to 74%, a sample of 504 mothers was derived using the following formula:

$$n = \frac{u_{\alpha}^2 \pi(1 - \pi)}{\delta^2}$$

where: n is the sample size;

$u_{\alpha} = 1.96$ , is the area under normal curve corresponding to the alpha level 0.05;

$\pi = 0.7$ , is the estimated prevalence of ‘any breastfeeding’; and

$\delta = 0.04$ , is acceptable margin of error for the prevalence being estimated.

Since the sample size exceeded 5% of the total number of babies born in 2010 ( $6,800 * 0.05 = 340$ ), the following correction formula were used to calculate the final sample size.

$$n_c = n/[1+(n-1)/N]$$

where:  $n_c$  is the new sample size;  $n = 504$

$N = 6,800$ , is the estimated number of babies born in Jiangyou in 2010,  
thus  $n_c = 469$ .

A total of 670 mothers were planned to be included considering a 10% non-response rate and a 20% drop-out rate. Finally 695 mothers were recruited, and during the course of the twelve-month follow-up, 195 (28%) lost to follow-up or dropped out of the study, leaving 500 mothers remained in this cohort at the end of 12 months postpartum.

## **3.5 Data collection**

### **3.5.1 Recruitment of sample**

The study sample was recruited from four hospitals and three township health centres in Jiangyou from March to November 2010. In China, township health centres are state-owned health care institutions, which provide primary health services to people living in rural areas (Liu, Wang & Lu 2010). Generally, township health centres are not comparable with hospitals in terms of staff's professional skills, working environment, medical equipment, etc. In order to reflect the overall infant feeding practices of Jiangyou, both hospitals and township health centres were included into the study. The four main hospitals of Jiangyou were included in this study. However, there were over 40 township health centres scattered around Jiangyou. Considering the limited time and resources for a PhD study, only three township health centres were randomly selected using a random number table.

Mothers who resided in Jiangyou and delivered single healthy babies in one of the seven medical institutions during the study period were invited to participate before discharge. 'Healthy babies' used in this study was defined as those who spent less than 4 days in the newborn intensive care unit. The principal researcher visited one hospital and one township health centre every other day, respectively. Women who met the selection criteria aforementioned and were going to be discharged within 24 hours were invited to participate on ward. The recruitment work in other five health institutions was done with the assistance of five local maternity doctors and nurses. These five hospital staff were trained as research assistants by the principal researcher before the commencement of data collection. They assisted in conducting the baseline interviews four days a week. These five research sites were also visited by the principal researcher at least once a week to monitor data collection quality. The recruitment stopped when the planned required sample size had been reached.

### **3.5.2 Baseline interviews**

After being explained about this study, mothers who agreed to participate were requested to sign the consent form. They then were interviewed face-to-face with the structured baseline questionnaire by the principal researcher or a research assistant. Meanwhile, the answers were written down by the interviewers after each question. During the interviews, attention was given not to influence the mother towards selecting any specific feeding method. If the interview was interrupted before all questions were asked (e.g. baby cried, mother had visitors, etc.), the interviewer would come to the ward again later and carried on with the rest of interview. At the end of each baseline interview, mothers were asked to provide a time range of a day that would be convenient for the first follow-up interview at 1 month.

### **3.5.3 Follow-up interviews**

The follow-up interviews were carried out at intervals of 1, 3, 6 and 12 months postpartum over telephone. Interviews at 1, 3 and 6 months postpartum usually took 10 to 20 minutes, depending on the infants' feeding methods and mothers' experience of breastfeeding problems. The follow-up interviews at 12 months postpartum lasted about 2 minutes, because the main purpose of this interview was to record the weaning time. The participants were phoned within five days of the planned interview day. Mothers who could not be contacted at the first attempt were contacted at least five times at different times. All the follow-up interviews were conducted by the principal researcher. The follow-up interviews aimed to record infants' feeding practices and mothers' breastfeeding problems, thus no suggestions or recommendations were provided to mothers in relation to infant feeding.

In the study, validated and reliable questionnaires which had been previously used in breastfeeding cohort studies in China (Qiu, Yun, et al. 2008; Xu, Binns, Wu, et al. 2007) were adopted to collect detailed information on infant feeding practices and breastfeeding problems. All the interviewers had been trained and a standardised procedure of data collection was implemented throughout the research, ensuring that mothers' answers were not influenced by the preferences of interviewers and the real

situations of infant feeding were documented. Furthermore, the maternal recall errors were minimized by following up mothers at 1, 3, 6 and 12 months postpartum.

### **3.6 Data cleaning and data analysis**

Data was coded and entered into Statistical Package for the Social Sciences (version 18.0) by the same principal researcher to avoid between-coder variation (SPSS Inc. 2010). Data cleaning was performed prior to data analysis. Frequencies were examined for all variables to identify coding and data entry errors. When a variable was found to have out-of-range values, the corresponding original questionnaires were reviewed to ensure the correction of data entry.

Chi-square tests were used to compare between participants and non-participants, remaining participants and drop outs for basic information. Descriptive statistics and cross-tabulations were carried out for socio-demographic and biomedical variables to describe the sample characteristics. Normally distributed continuous variables were summarised in terms of mean and standard deviation; while median and interquartile ranges were used if the assumption of normality was violated. Categorical variables were described using counts and percentages. Chi-square test was employed to determine the association between group variables and categorical outcomes. Student's t-test and one-way analysis of variance were used to evaluate the association between categorical variables and continuous outcomes that were normally distributed; while Wilcoxon rank-sum test was used when the distributions of continuous outcome variables were not normal.

Descriptive statistics were used to depict the rate of breastfeeding and the prevalence of 'full breastfeeding' at discharge. Kaplan-Meier analysis was employed to examine the duration of 'any breastfeeding' and 'full breastfeeding'. Life-table analysis was applied to investigate the rates of 'any breastfeeding' and 'full breastfeeding' at each month up to 12 months postpartum. The cumulative probability of initiating complementary feeding before 6 months and the incidence of mastitis were also examined using life-table method.

To identify factors associated with early breastfeeding initiation, variables reported in literature to be predictors of early breastfeeding initiation were investigated using univariate logistic regression. Then adjusted odds ratios (aOR) were estimated by multivariate logistic regression model (using backward stepwise procedure). All the potential predictors were initially included into the model. Variables with the largest p value were removed one at a time. The p values for removing and keeping variables in the model were 0.10 and 0.05, respectively. The procedure terminated when no variables could be dropped from the model. Similar statistical analysis methods were applied to examine factors associated with other outcome variables (i.e. 'any breastfeeding' at discharge and 'full breastfeeding' at discharge).

Since there were censored data, which refers to data from those cases where breastfeeding continued beyond the end of the study period (12 months postpartum) or in the few cases where the subject dropped out of the study, the survival analysis was conducted. The log-rank test was used to examine whether or not the risk of discontinuing breastfeeding varied across categories for an independent variable; multivariate Cox regression analysis was then implemented to estimate the adjusted hazard ratio (aHR) of each risk factor for ceasing breastfeeding event stepwisely. Therefore, the relationship between the risk of stopping breastfeeding and potential associated factors was evaluated, taking into account the length of follow-up for each subject. The proportional hazards model was also used to investigate the influences of explanatory variables or risk factors on other time-to-event outcomes (i.e. cessation of 'full breastfeeding' before 6 months postpartum, early introduction of complementary foods and mastitis).

## **Chapter 4 Results**

This chapter is divided into six sections: 1) Descriptive results; 2) Early initiation of breastfeeding and prelacteal feeds; 3) Breastfeeding at discharge; 4) Breastfeeding duration; 5) Early introduction of complementary foods; 6) Mastitis. The descriptive results presented in the first section show the demographic characteristics, biomedical and psychosocial information and lifestyle of participants. From the second to the fifth section, detailed information on infant feeding practices, including prelacteal feeding, breastfeeding rates, breastfeeding duration and complementary feeding, together with their associated factors were reported. The last section presents the incidence of mastitis within the first 6 months postpartum and factors associated with lactation mastitis.

### **4.1 Descriptive results**

#### **4.1.1 Response Rate for all questionnaires**

A total of 723 mothers were invited to participate while they were in hospital and 695 women agreed to participate. The participation rate of 96% was similar to those of previous infant feeding cohort studies in Zhejiang Province (98%) (Qiu, Yun, et al. 2008) and Xinjiang Uygur Autonomous Region (97%) (Xu, Binns, Yu, et al. 2007b). Those mothers who declined to participate in the study were asked to answer eight short questions about their socio-demographic and biomedical information. This was to enable a comparison to be made between responders and non-responders. All mothers agreed to provide such limited information. There were no significant differences between participants and those who declined to participate regarding age, education level, employment, delivery method, parity, monthly family income, infant's gender and infant's birthweight (Table 4.1).

**Table 4.1 Socio-demographic and biomedical characteristics of participants and non-participants**

Variables	Participants (n = 695) n (%)	Non-participants (n = 28) n (%)	Statistical test results
<b>Maternal age (years)</b>			
< 25	397 (57.1)	20 (71.4)	$\chi^2 = 2.26$ df = 1
≥ 25	298 (42.9)	8 (28.6)	p = 0.133
<b>Maternal education (years)</b>			
≤ 9	380 (54.7)	15 (53.6)	$\chi^2 = 0.161$ df = 2
10 – 12	233 (33.5)	9 (32.1)	p = 0.922
> 12	82 (11.8)	4 (14.3)	
<b>Maternal employment</b>			
Labour job	289 (41.6)	11 (47.8)	$\chi^2 = 0.407$ df = 2
Office job	189 (27.2)	6 (26.1)	p = 0.816
Not working	217 (31.2)	6 (26.1)	
<b>Family monthly income (yuan*)</b>			
≤ 3000	341 (53.3)	15 (71.4)	$\chi^2 = 2.694$ df = 1
> 3000	299 (46.7)	6 (28.6)	p = 0.101
Unknown	55	7	
<b>Delivery method</b>			
Vaginal	199 (28.6)	12 (42.9)	$\chi^2 = 2.635$ df = 1
Caesarean	496 (71.4)	16 (57.1)	p = 0.105
<b>Parity</b>			
Primiparous	555 (79.9)	23 (82.1)	$\chi^2 = 0.088$ df = 1
Multiparous	140 (20.1)	5 (17.9)	p = 0.767
<b>Baby's gender</b>			
Male	341 (49.1)	15 (53.6)	$\chi^2 = 0.219$ df = 1
Female	354 (50.9)	13 (46.4)	p = 0.640
<b>Baby's birthweight (gram)</b>			
< 2500	12 (1.7)	1 (3.6)	$\chi^2 = 0.519$ df = 1
≥ 2500	683 (98.3)	27 (96.4)	p = 0.471

\*1 Chinese yuan = 0.15 AUD

Before the end of 12 months postpartum, 195 out of 695 women (28%) were lost to follow-up or dropped out of the study. Most of them lost to follow-up because we could not contact them via phone during the course of study. The voice prompt

usually suggested that the phone number was out of service. As can be seen in Table 4.2, compared with the women who completed the research, those who were lost to follow-up were more likely to have a lower level of education, be unemployed and have more than one child. There were no differences in maternal age, monthly family income, delivery method, infant's gender or infant's birthweight.

**Table 4.2 Socio-demographic and biomedical characteristics of participants who remained in the study and those who were lost to follow-up**

Variables	Remaining participants (n = 500) n (%)	Lost to follow-up (n = 195) n (%)	Statistical test results
<b>Maternal age (years)</b>			
< 25	275 (55.0)	122 (62.6)	$\chi^2 = 5.542$ df = 3 p = 0.136
25 – 29	139 (27.8)	39 (20.0)	
30 – 34	58 (11.6)	20 (10.3)	
≥ 35	28 (5.6)	14 (7.2)	
<b>Maternal education (years)</b>			
≤ 9	256 (51.2)	124 (63.6)	$\chi^2 = 13.263$ df = 2 p = 0.001
10 – 12	173 (34.6)	60 (30.8)	
> 12	71 (14.2)	11 (5.6)	
<b>Maternal employment</b>			
Labour job	214 (42.8)	75 (38.5)	$\chi^2 = 16.734$ df = 2 p < 0.001
Office job	151 (30.2)	38 (19.5)	
Not working	135 (27.0)	82 (42.1)	
<b>Family monthly income (yuan*)</b>			
≤ 1500	79 (17.1)	35 (19.8)	$\chi^2 = 2.260$ df = 3 p = 0.520
1501 – 3000	162 (35.0)	65 (36.7)	
3001 – 5000	142 (30.7)	44 (24.9)	
> 5000	80 (17.3)	33 (18.6)	
<b>Delivery method</b>			
Vaginal	140 (28.0)	59 (30.3)	$\chi^2 = 0.350$ df = 1 p = 0.554
Caesarean	360 (72.0)	136 (69.7)	
<b>Parity</b>			
Primiparous	412 (82.4)	143 (73.3)	$\chi^2 = 7.169$ df = 1 p = 0.007
Multiparous	88 (17.6)	52 (26.7)	
<b>Baby's gender</b>			
Male	249 (49.8)	92 (47.2)	$\chi^2 = 0.385$ df = 1 p = 0.535
Female	251 (50.2)	103 (52.8)	
<b>Baby's birthweight (gram)</b>			
< 2500	12 (2.4)	0 (0.0)	$\chi^2 = 3.453$ df = 1 p = 0.063
≥ 2500	488 (97.6)	195 (100.0)	

\* 1 Chinese yuan = 0.15 AUD

### 4.1.2 Sample details

Table 4.3 shows the socio-demographic characteristics of the participants. The median age of the 695 participants was 24 years (range 18–44 years). Almost all (99.8%) of the women were married or in a common law marriage. Approximately half had more than 9 years of schooling, and 68.8% were employed. The median monthly family income was 2,850 yuan (approximately 430 AUD), with 17.7% of women having a monthly family income of over 5,000 yuan (approximately 750 AUD). Approximately half of the women's partners had more than 9 years of schooling and only 4.2% were unemployed.

The caesarean section rate was 71.4%, with 77.3% at the hospitals and 59.4 % at the township health centres ( $\chi^2 = 23.98$  df = 1,  $p < 0.001$ ). Although much higher than the rate for China as reported by the WHO (46.2% in 2008), the caesarean section rates reported in this study are similar to those documented recently in some parts of China, such as in Hangzhou, Zhejiang Province (76% in the city, 74% in the suburbs, and 53% in the rural area), and Deyang, Sichuan Province (80%) (Bengin et al. 2010; Qiu, Yun, et al. 2008).

Approximately 80% of mothers were having their first baby, and 98.4% had a gestation age of more than 37 weeks. The infant gender ratio was approximately 1:1, and 94% of infants' birthweights ranged between 2,500 and 3,999 grams.

**Table 4.3 Socio-demographic characteristics of the participants (n = 695)**

Variables	n	%
Maternal age (years)		
< 25	397	57.1
25 – 29	178	25.6
30 – 34	78	11.2
≥ 35	42	6.0
Marital status		
Married/common law marriage	693	99.8
Never married/divorced/separated	2	0.2
Maternal education (years)		
≤ 9	380	54.7
10 – 12	233	33.5
> 12	82	11.8
Maternal employment		
Labour job	289	41.6
Office job	189	27.2
No job	217	31.2
Paternal education (years)		
≤ 9	329	47.4
10 – 12	260	37.4
> 12	106	15.2
Paternal employment		
Labour job	403	58.0
Office job	261	37.6
No job	29	4.2
Monthly family income (yuan <sup>*</sup> )		
≤ 1500	114	17.8
1501 – 3000	227	35.5
3001 – 5000	186	29.0
> 5000	113	17.7
Unknown	55	
Gestation (weeks)		
< 37	11	1.6
≥ 37	681	98.4
Unknown	3	
Method of delivery		
Vaginal delivery	199	28.6
Caesarean section	496	71.4

Parity		
Primiparous	555	79.9
Multiparous	140	20.1
Baby's gender		
Male	341	49.1
Female	354	50.9
Baby's birthweight (gram)		
< 2500	12	1.7
2500 – 3999	653	94.0
≥ 4000	30	4.3

\*1 Chinese yuan = 0.15 AUD

In this study, 466 mothers (67.1%) were recruited from hospitals and 229 (32.9%) from township health centres. Wilcoxon rank-sum test and Chi-square test were performed to compare differences in basic information between participants from these two different types of medical institutions.

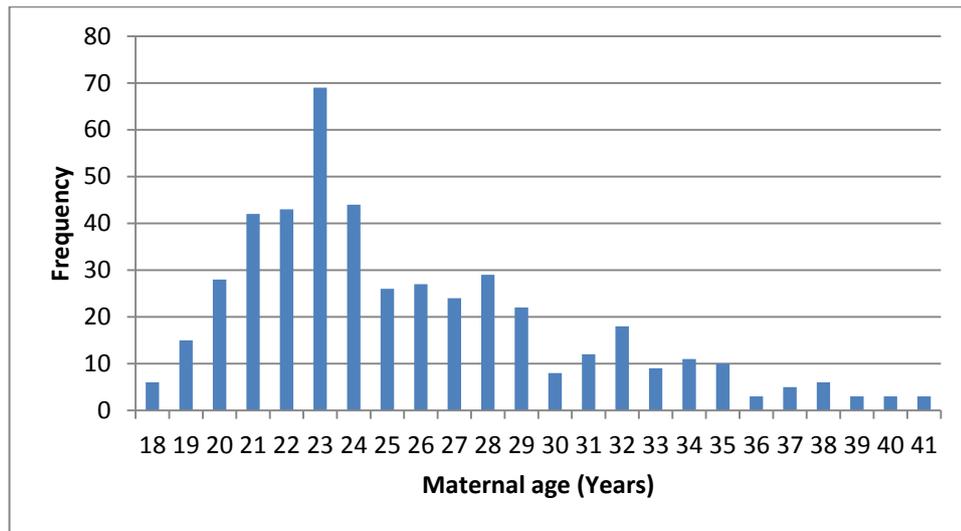
The results of Chi-square test revealed that mothers delivering at township health centres were usually younger at children's birth than those delivering at hospitals. The percentages of mothers gave birth under the age of 25 were 65.5% and 53.0% at township health centres and at hospitals, respectively (Table 4.4).

**Table 4.4 Number of deliveries (%) by maternal age (years) and hospitals and township health centres**

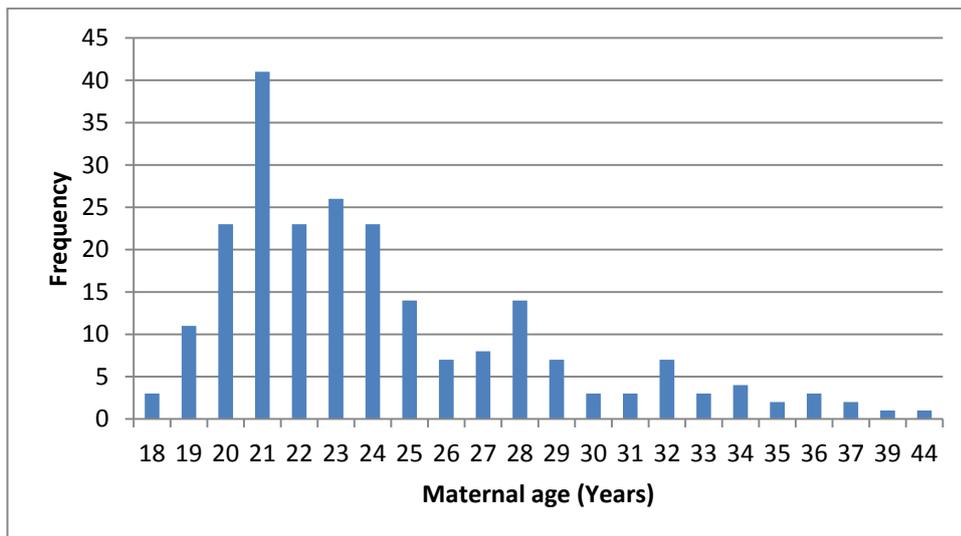
Place of delivery	< 25	25 – 29	30 – 34	≥ 35	Total
Hospital	247(53.0%)	128(27.5%)	58(12.4%)	33(7.1%)	466(100.0%)
Township health centre	150(65.5%)	50(21.8%)	20(8.7%)	9(3.9%)	229(100.0%)
Total	397(57.1%)	178(25.6%)	78(11.2%)	42(6.0%)	695(100.0%)

Pearson Chi-Square = 10.511, df = 3, p = 0.015

The distributions of maternal age in hospitals and township health centres are shown in Figures 4.1 and 4.2, respectively. The Mann-Whitney U test results showed the median age of mothers delivering at hospitals was significantly older than that of those delivering at township health centres (Table 4.5).



**Figure 4.1 Distribution of maternal age in hospitals**



**Figure 4.2 Distribution of maternal age in township health centres**

**Table 4.5 Median and interquartile range of maternal age (years) by place of delivery**

Place of delivery	n	Median	Interquartile Range
Hospital	466	24	6
Township health centre	229	23	6
Total	695	24	6

Mann-Whitney U = 43530.000, p < 0.001

The education levels of mothers and fathers in Jiangyou are shown in Table 4.6 and Table 4.7, respectively. There are few tertiary educational institutions in Jiangyou and most people with university degrees studied in urban areas. After obtaining university degrees, people usually chose to stay in urban areas rather than went back to their rural hometown because of more job opportunities and better facilities in the city. This may explain why the proportions of mothers and fathers achieving high education levels in this study were so low.

Generally women from hospitals had a significantly higher level of education compared with women from township health centres. Approximately 15% of the mothers delivering at hospitals had an education level of university, while their counterparts accounted for 4.8% of mothers giving birth at township health centres (Table 4.6).

**Table 4.6 Number of deliveries (%) by maternal education and place of delivery**

Place of delivery	Primary or lower	Middle school	High school	University	Total
Hospital	26(5.6%)	219(47.0%)	150(32.2%)	71(15.2%)	466(100.0%)
Township health centre	18(7.9%)	117(51.1%)	83(36.2%)	11(4.8%)	229(100.0%)
Total	44(6.3%)	336(48.3%)	233(33.5%)	82(11.8%)	695(100.0%)

Pearson Chi-Square = 16.712, df = 3, p = 0.001

Higher education level was also observed among fathers whose partners gave birth at hospitals than those whose partners delivered at township health centres. The proportion of infant's fathers who had completed university education was 19.5% among those from hospitals, compared with 6.6% from township health centres (Table 4.7).

**Table 4.7 Number of deliveries (%) by paternal education and place of delivery**

Place of delivery	Primary or lower	Middle school	High school	University	Total
Hospital	30(6.4%)	168(36.1%)	177(38.0%)	91(19.5%)	466(100.0%)
Township health centre	19(8.3%)	112(48.9%)	83(36.2%)	15(6.6%)	229(100.0%)
Total	49(7.1%)	280(40.3%)	260(37.4%)	106(15.2%)	695(100.0%)

Pearson Chi-Square = 24.132, df = 3, p < 0.001

A higher proportion of mothers delivering at township health centres (34.5%) were not employed before they became pregnant than that of mothers from hospitals (29.6%). In addition, mothers giving birth at township health centres were more likely to have a blue-collar job, while women from hospitals were more likely to have an office job (Table 4.8).

**Table 4.8 Number of deliveries (%) by maternal employment prior to pregnancy and place of delivery**

Place of delivery	Labour job	Office job	No job	Total
Hospital	186(39.9%)	142(30.5%)	138(29.6%)	466(100.0%)
Township health centre	103(45.0%)	47(20.5%)	79(34.5%)	229(100.0%)
Total	289(41.6%)	189(27.2%)	217(31.2%)	695(100.0%)

Pearson Chi-Square = 7.708, df = 2, p = 0.021

The distributions of father's employment were similar in hospitals and township health centres (Table 4.9). The proportions of fathers with a labour job and an office job were 58.2% and 37.7%, respectively. Approximately 4% of the 695 fathers were jobless.

**Table 4.9 Number of deliveries (%) by paternal employment and place of delivery**

Place of delivery	Labour job	Office job	No job	Total
Hospital	261(56.3%)	183(39.4%)	20(4.3%)	466(100.0%)
Township health centre	142(62.0%)	78(34.1%)	9(3.9%)	229(100.0%)
Total	403(58.2%)	261(37.7%)	29(4.2%)	695(100.0%)

Pearson Chi-Square = 2.105, df = 2, p = 0.349

Sichuan is not a province of strong economy. The per capita GDP of Sichuan was 17,339 yuan (2,667 AUD) in 2009, ranking the 20th in China. In this study, the monthly family income group between 1,501 and 3,000 yuan had the highest proportion. No significant differences in income were found between women delivering at these two types of health care institutions (Table 4.10).

**Table 4.10 Number of deliveries (%) by monthly family income (yuan\*) and place of delivery**

Place of delivery	≤ 1500	1501 – 3000	3001 – 4000	4001 – 5000	> 5000	Total
Hospital	81 (18.8%)	141 (32.6%)	81 (18.8%)	52 (12.0%)	77 (17.8%)	432 (100.0%)
Township health centre	33 (15.9%)	86 (41.4%)	31 (14.9%)	22 (10.6%)	36 (17.3%)	208 (100.0%)
Total	114 (17.8%)	227 (35.5%)	112 (17.5%)	74 (11.6%)	113 (17.7%)	640 (100.0%)

Pearson Chi-Square = 5.124, df = 4, p = 0.275

\* 1 Chinese yuan = 0.15 AUD

This study found that 77.3% and 59.4% women delivered by caesarean section at hospitals and township health centres, respectively. Mothers gave birth at hospitals were significantly more likely to deliver by caesarean section than those from township health centres (Table 4.11).

**Table 4.11 Number of deliveries (%) by delivery method and place of delivery**

Place of delivery	Vaginal	Caesarean	Total
Hospital	106(22.7%)	360(77.3%)	466(100.0%)
Township health centre	93(40.6%)	136(59.4%)	229(100.0%)
Total	199(28.6%)	496(71.4%)	695(100.0%)

Pearson Chi-Square = 23.980, df = 1, p < 0.001

There were no significant differences between the two types of health care institutions regarding gestational age (Table 4.12). The overall proportion of births before 37 weeks was 1.6%. It was close to the rate of 2.4% documented in a previous breastfeeding study in rural Zhejiang Province (Qiu 2008), but was rather lower than

the estimated preterm birth rate for China in 2011 (7.1% of livebirths (Blencowe et al. 2012)). The big gap may be caused by one criterion of selecting participants in this study. Only mothers who delivered healthy babies, defined as those who spent fewer than 4 days in the newborn intensive care unit after birth, were invited to participate. As more likely to stay longer at the newborn intensive care unit, the preterm born babies theoretically have lower chance to be included into this study.

**Table 4.12 Infants born (%) by gestational age and place of delivery**

Place of delivery	< 37	≥ 37	Total
Hospital	6(1.3%)	458(98.7%)	464(100.0%)
Township health centre	5(2.2%)	223(97.8%)	228(100.0%)
Total	11(1.6%)	681(98.4%)	692(100.0%)

Pearson Chi-Square = 0.321, df = 1, p = 0.571

In accordance with the one-child policy in China, the proportion of women who were having their first child was high at around 80% at both hospitals and township health centres. No differences were found between mothers from different places of delivery in parity (Table 4.13).

**Table 4.13 Number of deliveries (%) by parity and place of delivery**

Place of delivery	Primiparous	Multiparous	Total
Hospital	372(79.8%)	94(20.2%)	466(100.0%)
Township health centre	183(79.9%)	46(20.1%)	229(100.0%)
Total	555(79.9%)	140(20.1%)	695(100.0%)

Pearson Chi-Square = 0.001, df = 1, p = 0.979

Unexpected, a few more baby girls than baby boys were observed in this study. However, the difference was not significant. In addition, there were no differences in infant's gender between hospitals and township health centres (Table 4.14).

**Table 4.14 Number of deliveries (%) by infant's gender and place of delivery**

Place of delivery	Boy	Girl	Total
Hospital	222(47.6%)	244(52.4%)	466(100.0%)
Township health centre	119(52.0%)	110(48.0%)	229(100.0%)
Total	341(49.1%)	354(50.9%)	695(100.0%)

Pearson Chi-Square = 1.150, df = 1, p = 0.284

Around 94% of newborns weighed between 2,500 and 3,999 grams at both hospitals and township health centres. The overall rate of low birthweight was 1.7%, with 1.3% at hospitals and 2.6% at township health centres. There were no differences between these two places of delivery in infant birthweight type (Table 4.15). The low birthweight rate documented in this study was similar to that of several other studies in China. For example, a breastfeeding study in Xinjiang Uygur Autonomous Region showed that 2.2% newborns weighed less than 2500 grams among Han people (Xu et al. 2006). Another study of early infant feeding practices documented a low birthweight rate of 1.6% in Shangdong Province (Zhao et al. 2003). According to the UNICEF global database, the low birthweight incidence was 2% in China in 2005, which was lower than those of the majority of other countries around the world (UNICEF 2008).

**Table 4.15 Number of deliveries (%) by infant's birthweight type and place of delivery**

Place of delivery	< 2500g	2500 – 3999g	≥ 4000g	Total
Hospital	6(1.3%)	437(93.8%)	23(4.9%)	466(100.0%)
Township health centre	6(2.6%)	216(94.3%)	7(3.1%)	229(100.0%)
Total	12(1.7%)	653(94.0%)	30(4.3%)	695(100.0%)

Pearson Chi-Square = 2.822, df = 2, p = 0.244

### 4.1.3 Breastfeeding rates

At discharge, a total of 650 out of 695 participants (93.5%) were breastfeeding their infants. Approximately 36% of mothers were fully breastfeeding and 57.2% were using a combination of breastfeeding and bottle feeding. Forty five mothers (6.5%) were bottle feeding their babies at discharge. The differences of feeding methods between hospital and township health centre were not significant (Table 4.16).

**Table 4.16 Prevalence (%) of breastfeeding at discharge by institution type**

Place of delivery	Full breastfeeding	Partial breastfeeding	Bottle feeding	Total
Hospital	175(37.6%)	264(56.6%)	27(5.8%)	466(100.0%)
Township health centre	77(33.6%)	134(58.5%)	18(7.9%)	229(100.0%)
Total	252(36.3%)	398(57.2%)	45(6.5%)	695(100.0%)

Pearson Chi-Square = 1.759, df = 2, p = 0.415

To estimate the rates of ‘any breastfeeding’ and ‘full breastfeeding’ within the first year of life, life-table analysis was applied to deal with censored data. Overall, among women who initiated breastfeeding, 65.1% (95% CI 61.2 to 69.0%) were still breastfeeding at the end of 6 months postpartum. The ‘any breastfeeding’ rate declined to 12.9% (95% CI 9.9 to 15.8%) at infants’ first birthday (Table 4.17).

**Table 4.17 ‘Any breastfeeding’ rates and 95% CIs at hospitals and township health centres by age interval (month)**

Age interval (month)	Hospital		Township health centre		Total	
	%	95% CI	%	95% CI	%	95% CI
0~	95.0	93.0, 97.1	95.2	92.3, 98.1	95.1	93.4, 96.7
1~	92.5	90.0, 95.0	93.1	89.7, 96.6	92.7	90.7, 94.7
2~	89.2	86.3, 92.2	88.9	84.5, 93.3	89.1	86.7, 91.6
3~	83.9	80.4, 87.3	87.8	83.2, 92.4	85.1	82.3, 87.8
4~	79.6	75.8, 83.4	83.4	78.1, 88.7	80.8	77.7, 83.9
5~	72.7	68.5, 76.9	77.9	72.0, 83.8	74.3	70.8, 77.7
6~	63.4	58.8, 68.1	69.0	62.1, 75.8	65.1	61.2, 69.0
7~	50.0	45.1, 55.0	59.4	51.7, 67.2	52.7	48.4, 56.9
8~	34.9	30.1, 39.8	43.6	35.4, 51.8	37.3	33.1, 41.5
9~	28.8	24.2, 33.4	34.1	26.1, 42.1	30.3	26.3, 34.3
10~	17.0	13.2, 20.9	27.7	20.1, 35.4	19.9	16.4, 23.4
11~	13.9	10.4, 17.5	25.8	18.4, 33.2	17.1	13.8, 20.4
12~	10.9	7.7, 14.1	18.2	11.6, 24.9	12.9	9.9, 15.8

The overall percentage of infants fully breastfed was approximately 70% at 3 months postpartum. It subsequently declined sharply to 49.4% by the age of 5 months.

Among women who had commenced ‘full breastfeeding’, less than 30% were still fully breastfeeding their infants at the end of 6 months postpartum (Table 4.18).

**Table 4.18 ‘Full breastfeeding’ rates and 95% CIs at hospitals and township health centres by age interval (month)**

Age interval (month)	Hospital		Township health centre		Total	
	%	95% CI	%	95% CI	%	95% CI
0~	93.3	90.3, 96.3	92.3	87.9, 96.7	92.9	90.4, 95.4
1~	89.4	85.7, 93.1	86.2	80.4, 92.0	88.3	85.2, 91.5
2~	84.3	79.9, 88.7	81.4	74.8, 88.0	83.3	79.6, 87.0
3~	71.1	65.6, 76.7	68.9	60.8, 76.9	70.4	65.8, 74.9
4~	46.9	40.7, 53.1	54.9	46.0, 63.8	49.4	44.3, 54.5
5~	39.5	33.5, 45.6	47.6	38.6, 56.6	42.1	37.0, 47.1
6~	25.1	19.7, 30.4	36.6	27.9, 45.3	28.7	24.1, 33.3

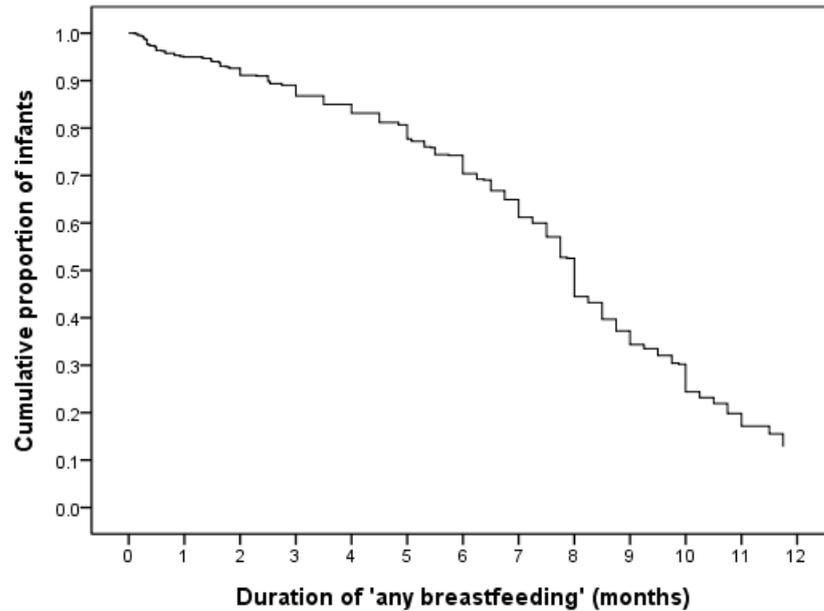
#### 4.1.4 Breastfeeding duration

The median duration of ‘any breastfeeding’ was 8 months and ‘full breastfeeding’ was nearly 5 months (Table 4.19). The survival analyses of the duration of ‘any breastfeeding’ and ‘full breastfeeding’ are presented using Kaplan-Meier survival curves. The survival curve of ‘any breastfeeding’ starts with 100% at the time 0, because mothers who did not initiate breastfeeding were not included in a survival analysis (Figure 4.3). The survival curve of ‘full breastfeeding’ duration within 6 months postpartum is shown in Figure 4.4. Those infants who had never been fully breastfed were excluded from the survival analysis.

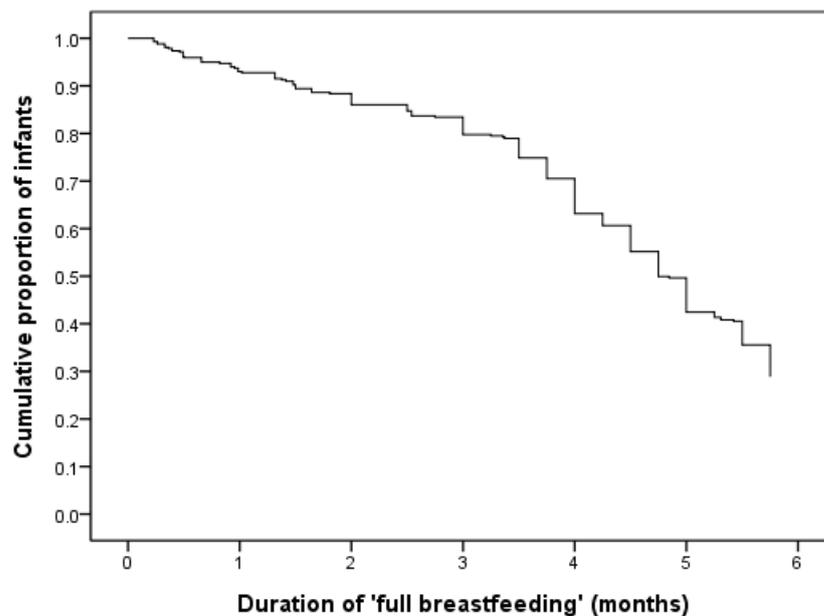
**Table 4.19 Median breastfeeding duration and 95% CI (months) at hospitals and township health centres\***

Place of delivery	Any breastfeeding		Full breastfeeding	
	Median	95% CI	Median	95% CI
Hospital	8.0	7.8, 8.2	4.8	4.5, 5.0
Township health centre	8.5	8.0, 9.0	5.0	4.4, 5.6
Total	8.0	7.8, 8.2	4.8	4.5, 5.0

\*Mothers who never breastfed or never fully breastfed their infants were excluded from a survival analysis when calculating the median duration of ‘any breastfeeding’ or ‘full breastfeeding’.

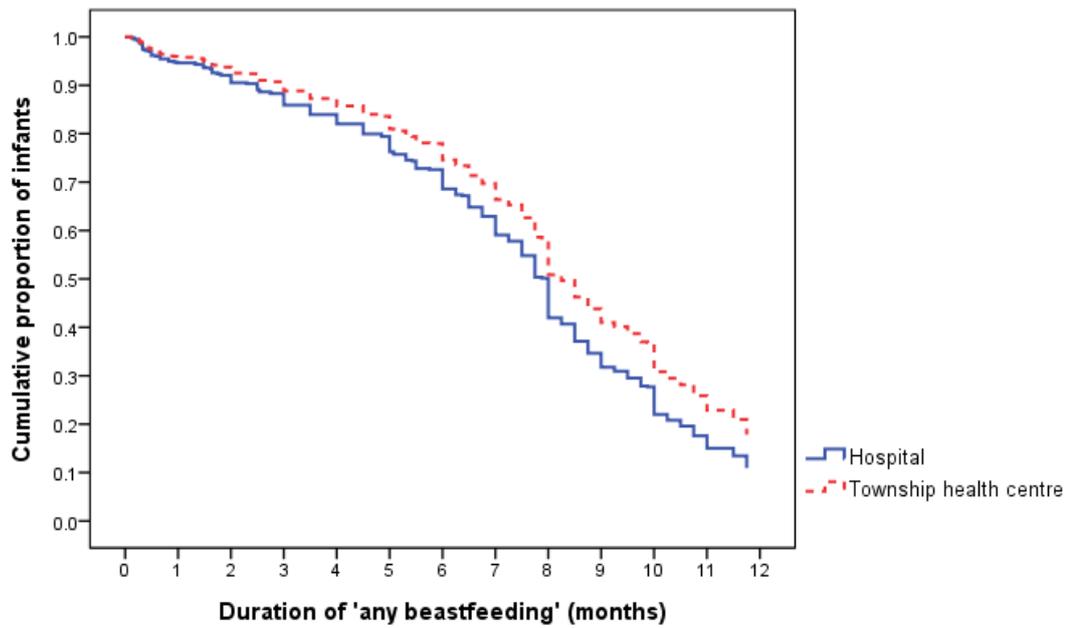


**Figure 4.3 ‘Any breastfeeding’ duration within 12 months postpartum**

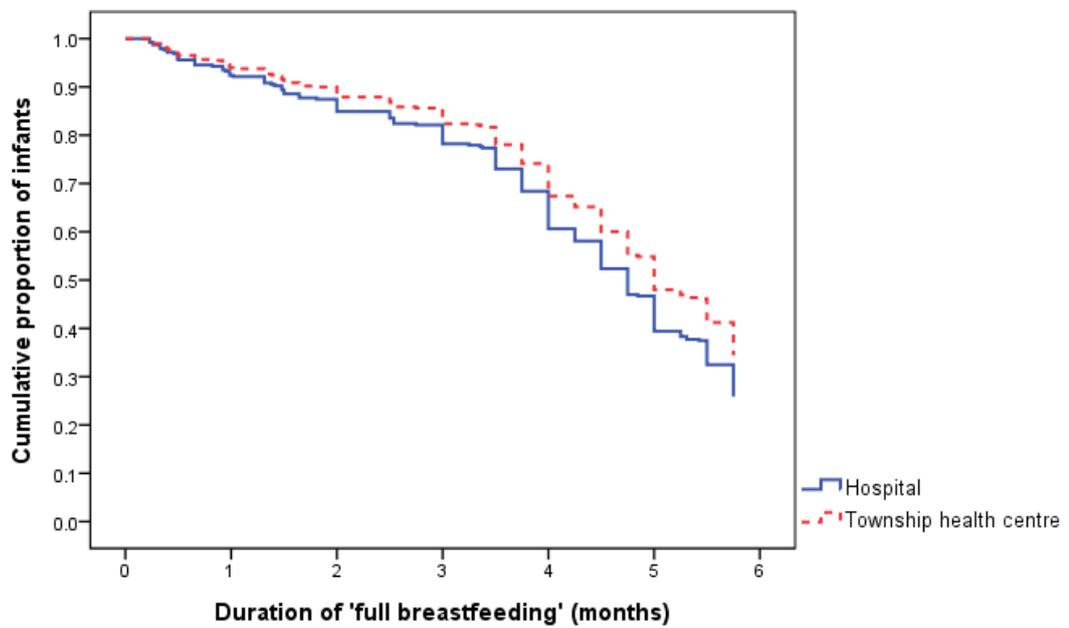


**Figure 4.4 ‘Full breastfeeding’ duration within 6 months postpartum**

Log-rank tests were run to examine if the duration of ‘any breastfeeding’ and ‘full breastfeeding’ differed significantly between the two types of health care institutes. Results showed that infants born at township health centres had a longer duration of ‘any breastfeeding’ than their counterparts born at hospitals ( $p = 0.015$ ) (Figure 4.5). But there were no significant differences in the duration of ‘full breastfeeding’ between these two groups ( $p = 0.067$ ) (Figure 4.6).



**Figure 4.5 Association between place of delivery and ‘any breastfeeding’ duration**



**Figure 4.6 Association between place of delivery and ‘full breastfeeding’ duration**

#### 4.1.5 Reasons for choosing feeding method

A total of 650 mothers (93.5%) were breastfeeding at discharge. When asked why they chose to breastfeed, most women (62.5%) gave more than one reason. The

number of reasons for breastfeeding ranged from 1 to 9. However, the most frequently cited reason was ‘good for baby’ (92.9%). Other main reasons included ‘convenient’ (44.5%), ‘closer to baby’ (29.1%) and ‘good for me’ (28.3%) (Table 4.20).

**Table 4.20 Mother’s reasons for breastfeeding her infant (n = 650)**

	n	%*
<b>Reasons (Prompted)</b>		
Good for baby	604	92.9
Convenient	289	44.5
Closer to baby	189	29.1
Good for me	184	28.3
Cheap	121	18.6
Health worker (e.g. doctor, nurse) advised me to breastfeed	79	12.2
My mother /mother-in-law advised me to breastfeed	67	10.3
helping me lose weight	56	8.6
The baby's father wanted me to breastfeed	55	8.5
<b>Other reasons (Unprompted)</b>		
My relative advised me to breastfeed	6	0.9
Breastfeeding is a tradition	2	0.3
Breastfeeding is natural	1	0.2
Breastfeeding is safe	1	0.2
Breastfeeding is sanitary	1	0.2
<b>Number of reasons given for breastfeeding</b>		
1 reason	244	37.5
2 reasons	136	20.9
3 reasons	117	18.0
4 reasons	58	8.9
5 reasons	49	7.5
6 reasons	29	4.5
7 reasons	6	0.9
8 reasons	4	0.6
9 reasons	7	1.1

\*Percentages added up to more than 100 percent for some respondents gave multiple answers.

Approximately one-half mothers (21 out of 45) who were bottle feeding their babies at discharge had not tried to breastfeed. Eighteen mothers (85.7%) stated that they

did not initiate breastfeeding because of illness, and 13 of them did not commence breastfeeding due to hepatitis B. In addition, 4 women did not choose breastfeeding because they received recommendation of using bottle feeding from health workers. Two mothers chose bottle feeding, believing that breastfeeding would make their breasts sag (Table 4.21). All mothers agreed that breastmilk is better than infant formula, at least when interviewed at discharge. Moreover, ‘dislike breastfeeding’ was not cited as the reason for not breastfeeding by any mothers.

**Table 4.21 Mother’s reasons for bottle feeding the baby from birth (n = 21)**

	n	%
<b>Reasons (prompted)*</b>		
Maternal illness	18	85.7
Hepatitis B (HBsAg, HBeAg and Anti-HBc positive)	9	42.90
Hepatitis B (HBsAg, Anti-HBe and Anti-HBc positive)	4	19.0
Hepatitis B virus carrier	1	4.8
Residual trophoblastic tissue	1	4.8
Having a cold	1	4.8
Postpartum haemorrhage	1	4.8
Herpes	1	4.8
Health worker (e.g. doctor, nurse) suggested bottle feeding	4	19.0
Not enough breastmilk	2	9.5
Breastfeeding will make my breasts sag	2	9.5
I will go back to work soon after the birth	1	4.8
Friend or relative suggested bottle feeding	1	4.8
<b>Number of reasons giving for bottle feeding</b>		
1 reason	14	66.7
2 reasons	7	33.3

\* Percentages added up to more than 100 percent for some respondents gave multiple answers.

Among the 45 mothers who were bottle feeding at discharge, 24 of them had tried to breastfeed their babies during hospital stay. Reasons given for changing to bottle feeding included ‘not enough breastmilk’ (29.2%), ‘baby suffers neonatal jaundice’ (29.2%), ‘baby refuses breast’ (20.8%), ‘trouble attaching the baby to the breast’ (12.5%), ‘inverted nipple’ (12.5%) and ‘breastfeeding is painful’ (8.3%) (Table 4.22).

**Table 4.22 Number of bottle feeding mothers who had tried breastfeeding and reasons for changing to bottle feeding**

	n	%
Had tried to breastfeed (n = 45)		
No	21	46.7
Yes	24	53.3
Reasons for changing to bottle feeding (unprompted)* (n = 24)		
Baby refuses breast	5	20.8
Not enough breastmilk	7	29.2
Baby suffers neonatal jaundice	7	29.2
Trouble attaching the baby to the breast	3	12.5
Inverted nipple	3	12.5
Breastfeeding is painful	2	8.3

\* Percentages added up to more than 100 percent for some respondents gave multiple answers.

About 90% of mothers said that they made the decision of feeding method themselves. In some cases, the baby's father (4.3%), maternal mother or mother-in-law (5.3%) and doctor (4.6%) involved in making the decision (Table 4.23).

**Table 4.23 People who helped participants to decide the feeding method (n = 695)**

	n	%*
Myself	624	89.8
My mother/mother-in-law	37	5.3
Doctor	32	4.6
Baby's father	30	4.3
Nurse	9	1.3
Friends	4	0.6
My relative	2	0.3

\* Percentages added up to more than 100 percent for some respondents gave multiple answers.

More than half of the participants made the decision of feeding method before pregnancy. There were 17.8% mothers who decided how to feed their infants after their babies were born. The majority of the remaining mothers made the decision in early pregnancy (before 20 gestation weeks) (Table 4.24).

**Table 4.24 The time when first deciding how to feed their infants**

	n	%
Before pregnancy	382	55.0
Early in pregnancy (before 20 weeks)	149	21.4
Late in pregnancy (after 20 weeks)	40	5.8
After baby was born	124	17.8
Total	695	100.0

#### 4.1.6 Social support for breastfeeding

A large number of studies have testified that social support for breastfeeding, including support from the partner, a family member, peer, a health professional, is a strong influential factor in infant feeding decisions and practices (Bar-Yam & Darby 1997; Ekstrom, Widstrom & Nissen 2003; Humphreys, Thompson & Miner 1998; Scott & Binns 1999). In this study, a series of questions were asked about participants' social support for breastfeeding.

Table 4.25 shows that most fathers (85.9%) were perceived by their partners to be supportive of breastfeeding, compared with 2.2% of fathers in favour of feeding infants with formula. The rest (11.9%) were those who were perceived to be ambivalent or had not discussed the feeding method with their partners.

**Table 4.25 Mothers' perception of their partners' preferences towards infant feeding methods**

	n	%
Prefers breastfeeding	597	85.9
Prefers formula feeding	15	2.2
Does not mind	48	6.9
Never discussed before birth	35	5.0
Total	695	100.0

Less than 1% of maternal grandmothers were perceived to prefer formula feeding. Most of them (90.2%) were reported by the mothers to be supportive of breastfeeding (Table 4.26). Moreover, 95.7% maternal grandmothers had ever breastfed at least one of her children (Table 4.27).

**Table 4.26 Mothers' perception of maternal grandmothers' preferences towards infant feeding methods**

	n	%
Prefers breastfeeding	627	90.2
Prefers formula feeding	5	0.7
Does not mind	25	3.6
Never discussed before birth	38	5.5
Total	695	100.0

**Table 4.27 Experiences of breastfeeding among maternal grandmothers**

	n	%
No	23	3.3
Yes	665	95.7
Do not know	7	1.0
Total	695	100.0

When asked about their friends' feeding method, 66.3% participants stated that most of their friends breastfed their children and 9.6% thought bottle feeding was more popular among their friends. Approximately 15% of women could not tell which feeding method was more widely adopted by their friends (Table 4.28).

**Table 4.28 Distribution of infant feeding methods of mothers' friends**

	n	%
Most of them bottle fed	67	9.6
Most of them breastfed	461	66.3
Some breastfed and some bottle fed	100	14.4
Friends do not have babies	18	2.6
Do not know	49	7.1
Total	695	100.0

After being pregnant, about one in ten women had ever received formula as a gift from their relatives or friends; however, most women had not (Table 4.29).

**Table 4.29 Receiving formula as a gift from relatives and/or friends**

	n	%
No	629	90.5
Yes	66	9.5
Total	695	100.0

In total, 606 out of 695 mothers (87.2%) received encouragement of breastfeeding from health facility staff during hospital stay. A significantly higher proportion of women delivering at hospitals were encouraged to breastfeed than those giving birth at township health centres (Table 4.30).

**Table 4.30 Number of deliveries (%) by status of breastfeeding encouragement from health facility staff during hospital stay**

	No	Yes	Total
Hospital	45 (9.7%)	421 (90.3%)	466 (100.0%)
Township health centre	44 (19.2%)	185 (80.8%)	229 (100.0%)
Total	89 (12.8%)	606 (87.2%)	695 (100.0%)

Pearson Chi-Square = 12.561, df = 1, p < 0.001

Those participants who had received breastfeeding encouragement from health facility staff were further asked to specify which health facility staff encouraged her to breastfeed. Results show that about 95% women had been encouraged by a doctor and 73.9% had ever been encouraged by a nurse. Nearly 70% women had received encouragement from both a doctor and a nurse. The proportion of women receiving support from a doctor was similar between the two health care institutions, while a higher proportion of women received encouragement from nurses at hospitals (Table 4.31).

**Table 4.31 Number of mothers (%) receiving encouragement of breastfeeding by health facility type and staff type (n = 606)**

	Hospital (n = 421)		Township health centre (n = 185)		Total (n = 606)	
	n	%*	n	%*	n	%*
Doctor	398	94.5	177	95.7	575	94.9
Nurse	344	81.7	104	56.2	448	73.9
Multiple persons	321	76.2	96	51.9	417	68.8

\*Percentages added up to more than 100 percent for some respondents gave multiple answers.

Mothers self-reported to obtain breastfeeding information mainly from the infants' grandmothers (46.8%), books and magazines (30.2%), and health professional (27.5%). In total 6% of women never received any information on breastfeeding (Table 4.32).

**Table 4.32 Main sources of information about breastfeeding (n = 695)**

Source of information	n	%*
My mother or mother-in-law	325	46.8
Books and magazines	210	30.2
Individual consultation with health professional	191	27.5
Friends	169	24.3
Other family members or relatives	161	23.2
Booklets	127	18.3
TV/Radio	113	16.3
Billboard	75	10.8
Internet	52	7.5
Lectures	45	6.5
Never got information	42	6.0
Other sources	5	0.6

\*Percentages added up to more than 100 percent for some respondents gave multiple answers.

#### **4.1.7 Health service providers' practices related to breastfeeding**

All the research sites in this study are Baby Friendly hospitals or Baby Friendly health centres. Maternity staff there should follow the Baby Friendly Initiative to

encourage and support breastfeeding. In the baseline interview, women were asked some questions about the maternity service providers' practices.

In hospitals, only 63.1% of mothers were encouraged by health facility staff to put their babies to the breast and commence breastfeeding right after the birth. The situation was worse in township health centres where the proportion of women being encouraged to put newborns to the breast right after birth was 50.2%. The differences between hospitals and township health centres were significant (Table 4.33).

**Table 4.33 Encouragement of putting infant to the breast right after the birth from hospital facility staff by place of delivery**

Place of delivery	No	Yes	Total
Hospital	172 (36.9%)	294 (63.1%)	466 (100.0%)
Township health centre	114 (49.8%)	115 (50.2%)	229 (100.0%)
Total	286 (41.2%)	409 (58.8%)	695 (100.0%)

Pearson Chi-Square = 10.505, df = 1, p = 0.010

294 women from hospitals and 151 from township health centres who had been encouraged by health facility staff to put their infants to the breast right after the birth were asked an additional question about from whom they obtained the encouragement. Almost all the women who had ever been encouraged at township health centres received the encouragement from the doctor, and a little more than half of them obtained the advocacy from the nurse. At hospitals, doctors and nurses were almost equally involved in encouraging women with early initiation of breastfeeding. Moreover, the proportions of women encouraged by both doctor and nurse were 74.5% and 54.8% at hospitals and township health centres, respectively.

**Table 4.34 Number of hospital facility staff who encouraged mothers to put their infants to the breast right after the birth by place of delivery and staff type**

	Hospital (n = 294)		Township health centre (n = 115)		Total (n = 409)	
	n	%*	n	%*	n	%*
	Doctor	259	88.1	112	97.4	371
Nurse	254	86.4	66	57.4	320	78.2
Multiple persons	219	74.5	63	54.8	282	68.9

\*Percentages added up to more than 100 percent for some respondents gave multiple answers.

Positioning and attaching infant at the breast correctly is not an innate, but a learned skill. Mothers should be shown and taught how to position and attach the baby. Nevertheless, about one fifth of women giving birth at hospitals reported that they had not been taught how to position and attach by health facility staff during hospital stay, and the proportion was around 40% at township health centres. Both at these two medical institutes, a few mothers (3.4% at hospitals and 4.4% at township health centres) thought they did not need to be taught. The association between the place of delivery and being taught how to position and attach baby to the breast was statistically significant (Table 4.35).

**Table 4.35 Number (%) of health facility staff who taught mothers how to position and attach their infants to the breast by place of delivery**

Place of delivery	No	Yes	I did not need to be taught	Total
Hospital	94(20.2%)	356(76.4%)	16(3.4%)	466(100.0%)
Township health centre	86(37.6%)	133(58.1%)	10(4.4%)	229(100.0%)
Total	180(25.9%)	489(70.4%)	26(3.7%)	695(100.0%)

Pearson Chi-Square = 25.593, df = 2, p < 0.001

Correct attachment is important for mothers to build up breastfeeding confidence, especially at the beginning stage of breastfeeding. Except for the 21 women who bottle fed their infants from the birth, on the whole 237 (34.1%) women did not obtain their infants' attachment to the breast checked by health facility staff at the first feed of breastmilk. Maternity staff at hospitals did a relatively better job than those at township health centres. The differences in checking infants' attachment to

the breast at their first breastfeed between hospitals and township health centres were significant (Table 4.36).

**Table 4.36 Number (%) of health facility staff who checked the attachment at the first breastfeed by place of delivery**

Place of delivery	The baby is bottle feeding from the start	No	Yes	Total
Hospital	13(2.8%)	140(30.0%)	313(67.2%)	466(100.0%)
Township health centre	8(3.5%)	97(42.4%)	124(54.1%)	229(100.0%)
Total	21(3.0%)	237(34.1%)	437(62.9%)	695(100.0%)

Pearson Chi-Square = 11.220, df = 2, p = 0.004

Demand feeding means that the mother breastfeed her infant whenever he or she is hungry. It is good for maintaining breastfeeding. However, the majority of women (64.5%) were not encouraged by health facility staff to practice demand feeding. Women giving birth at hospitals were less likely to be encouraged by health facility staff to ‘demand feed’ than women delivering at township health centres (Table 4.37).

**Table 4.37 Number (%) of women encouraged to ‘demand feed’ by health facility staff by facility type**

Place of delivery	No	Yes	Total
Hospital	324(69.5%)	142(30.5%)	466(100.0%)
Township health centre	124(54.1%)	105(45.9%)	229(100.0%)
Total	448(64.5%)	247(35.5%)	695(100.0%)

Pearson Chi-Square = 15.853, df = 1, p < 0.001

Less than 3% of mothers did not make any comments on the infant feeding information provided by the health facility. Overall, 45% and 45% of the participants considered the information ‘very useful’ and ‘a little useful’, respectively. Others (7.7%), however, chose the answer ‘not necessary’, ‘boring’ or ‘does not meet the need’. The differences of mothers’ comments were significant between these two health care institutions (Table 4.38).

**Table 4.38 Mothers' comments on the infant feeding information provided by health facility type**

Place of delivery	Very useful	A little useful	Not necessary	Boring	Does not meet the need	Do not want to make a comment
Hospital	220 (47.2%)	193 (41.4%)	25 (5.4%)	6 (1.3%)	14 (3.0%)	8 (1.7%)
Township health centre	93 (40.6%)	120 (52.4%)	2 (0.9%)	0 (0.0%)	6 (2.6%)	8 (3.5%)
Total	313 (45.0%)	313 (45.0%)	27 (3.9%)	6 (0.9%)	20 (2.9%)	16 (2.3%)

Pearson Chi-Square = 18.705, df = 5, p = 0.002

Several studies have shown that prenatal education exerts positive effects on breastfeeding outcomes (Imdad, Yakoob & Bhutta 2011; Rosen et al. 2008). The proportion of women attending prenatal classes was low at 18.6% in Jiangyou. In comparison the ever-attendance rate was significantly higher among women giving birth at hospitals than that of those giving birth at township health centres (Table 4.39).

**Table 4.39 Number (%) of women attending prenatal class for this or previous pregnancy by health facility type**

Place of delivery	No	Yes	Total
Hospital	367(78.8%)	99(21.2%)	466(100.0%)
Township health centre	199(86.9%)	30(13.1%)	229(100.0%)
Total	566(81.4%)	129(18.6%)	695(100.0%)

Pearson Chi-Square = 6.737, df = 1, p = 0.009

#### 4.1.8 Lifestyle habits before and during pregnancy

The smoking rate during pregnancy of participants in this study was 1.6% (Table 4.40), which is comparable to the rate of 1.5% observed in Zhejiang Province (Qiu 2008). Compared with western countries, the rate of smoking during pregnancy in current study was much lower (Giglia et al. 2007).

**Table 4.40 Number (%) of mother smoking during pregnancy by place of delivery**

Place of delivery	No	Yes	Total
Hospital	461(98.9%)	5(1.1%)	466(100.0%)
Township health centre	223(97.4%)	6(2.6%)	229(100.0%)
Total	684(98.4%)	11(1.6%)	695(100.0%)

Pearson Chi-Square = 1.471, df = 1, p = 0.225

As can be seen in Table 4.41, the percentage of husband who smoked in front of his wife or at home during wife's pregnancy was 61.9%. It is higher than the rates seen in Zhejiang Province as well as western societies (Giglia et al. 2007; Qiu 2008). In this study, the rate of husband smoking was significantly higher among those whose wife delivered at township health centres than those whose wife gave birth at hospitals.

**Table 4.41 Number (%) of husband smoked in front of wife or at home during wife pregnancy by place of delivery**

Place of delivery	No	Yes	Total
Hospital	196(42.1%)	270(57.9%)	466(100.0%)
Township health centre	69(30.1%)	160(69.9%)	229(100.0%)
Total	265(38.1%)	430(61.9%)	695(100.0%)

Pearson Chi-Square = 9.262, df = 1, p = 0.002

The prevalence of drinking alcohol during pregnancy was quite low at 3.0%. The differences between these two types of medical institutions were not significant (Table 4.42). Moreover, among the 21 women who drank alcohol during pregnancy, the majority (76.2%) just drank on special occasions (Table 4.43).

**Table 4.42 Number (%) of women drinking alcohol during pregnancy by place of delivery**

Place of delivery	No	Yes	Total
Hospital	451(96.8%)	15(3.2%)	466(100.0%)
Township health centre	223(97.4%)	6(2.6%)	229(100.0%)
Total	674(97.0%)	21(3.0%)	695(100.0%)

Pearson Chi-Square = 0.188, df = 1, p = 0.665

**Table 4.43 Frequencies of drinking alcohol during pregnancy (n = 21)**

	n	%
At least once a day	1	4.8
A few times a week	1	4.8
A few times a month	3	14.3
Only on special occasions	16	76.2
Total	21	100.0

A little more than half of the women had a habit of tea drinking before pregnancy. No differences were identified between the two types of health institutes by Chi-square test (Table 4.44). Among the 358 mothers who drank tea before pregnancy, less than one tenth had more than 3 cups of tea a day, and the majority of them (64.0%) drank tea only on occasions (Table 4.45).

**Table 4.44 Number (%) of women drinking tea before pregnancy by place of delivery**

Place of delivery	No	Yes	Total
Hospital	236(50.6%)	230(49.4%)	466(100.0%)
Township health centre	101(44.1%)	128(55.9%)	229(100.0%)
Total	337(48.5%)	358(51.5%)	695(100.0%)

Pearson Chi-Square = 2.629, df = 1, p = 0.105

**Table 4.45 Frequencies of drinking tea before pregnancy**

	n	%
More than 3 cups a day	23	6.4
1-3 cups a day	36	10.1
A few cups a week	70	19.6
Only on special occasions	229	64.0
Total	358	100.0

Women who had tea during pregnancy were asked an additional question about what kind of tea they drank. Green tea, Jasmine tea and chrysanthemum tea were the three most popular kinds of tea. They were consumed by 63.7%, 29.6% and 15.9% women, respectively.

The prevalence of women drinking tea during pregnancy decreased to about 30.0%. There were no differences between hospitals and township health centres in the proportion of drinking tea during pregnancy (Table 4.46). Among the 206 mothers who had tea during pregnancy, about three fourths of them had tea only on special occasions (Table 4.47).

**Table 4.46 Number (%) of women drinking tea during pregnancy by place of delivery**

Place of delivery	No	Yes	Total
Hospital	331(71.0%)	135(29.0%)	466(100.0%)
Township health centre	158(69.0%)	71(31.0%)	229(100.0%)
Total	489(70.4%)	206(29.6%)	695(100.0%)

Pearson Chi-Square = 0.305, df = 1, p = 0.581

**Table 4.47 Frequencies of drinking tea during pregnancy**

	n	%
More than 3 cups a day	12	5.8
1-3 cups a day	11	5.3
A few cups a week	25	12.1
Only on special occasions	158	76.7
Total	206	100.0

According to mothers' tea consumption habits before and during pregnancy, approximately 30% women changed their tea consumption habits after being pregnant (Table 4.48). The most frequently cited reason for changing the habit during pregnancy was 'not good for the baby' (74.6%) (Table 4.49). No women chose 'good for the mother' as the reason for changing tea consumption habits.

**Table 4.48 Number (%) of mothers changed tea drinking habit during pregnancy**

Place of delivery	No	Yes	Total
Hospital	330(70.8%)	136(29.2%)	466(100.0%)
Township health centre	156(68.1%)	73(31.9%)	229(100.0%)
Total	486(69.9%)	209(30.1%)	695(100.0%)

Pearson Chi-Square = 0.530, df = 1, p = 0.467

**Table 4.49 Reasons for changing tea drinking habit during pregnancy (n = 209)**

	n	%
Not good for baby	156	74.6
Did not like drinking tea during pregnancy	34	16.3
Not good for mother	14	6.7
Liked drinking tea during pregnancy	7	3.3
Good for baby	1	0.5
Other reasons		
Suffered from kidney stone	1	0.5
Heard that drinking tea during pregnancy is not good	1	0.5
More easily to get hungry if I drink tea	1	0.5
No reason	8	3.8

Sichuan Province is famous for its spicy cuisine. In this study, 88.3% women had spicy food during pregnancy, and there were no significant differences between hospitals and township health centres (Table 4.50). Nevertheless, only 5.9% women ate spicy food almost every meal during pregnancy. The remaining 94.1% participants distributed nearly evenly in ‘at least one meal a day (not every meal)’ (30.3%), ‘a few meals a week’ (35.0%), and ‘a few meals a month’ (28.8%) (Table 4.51).

**Table 4.50 Number (%) of women eating spicy food during pregnancy by place of delivery**

Place of delivery	No	Yes	Total
Hospital	58(12.4%)	408(87.6%)	466(100.0%)
Township health centre	23(10.0%)	206(90.0%)	229(100.0%)
Total	81(11.7%)	614(88.3%)	695(100.0%)

Pearson Chi-Square = 0.861, df = 1, p = 0.353

**Table 4.51 Frequencies of eating spicy food during pregnancy (n = 614)**

	n	%
Nearly every meal	36	5.9
At least one meal a day (not every meal)	186	30.3
A few meals a week	215	35.0
A few meals a month	177	28.8

#### 4.1.9 Lifestyle habits during breastfeeding period

At each follow-up interview within 6 months postpartum, mothers were asked about their tea drinking habits. Only a small proportion of women drank tea during breastfeeding period. For instance, less than 9% of 615 women drank tea while breastfeeding at 1 month postpartum. Moreover, 8% women drank tea only on special occasions. Similar situations were also found at the 3 and 6 months postpartum follow-up interviews (Table 4.52).

**Table 4.52 Frequencies of drinking tea during breastfeeding period**

	1 month (n = 615)		3 months (n = 562)		6 months (n = 499)	
	n	%	n	%	n	%
More than 3 cups a day	3	0.5	1	0.2	3	0.6
1-3 cups a day	2	0.3	5	0.9	1	0.2
A few cups a week	1	0.2	12	2.1	10	2.0
Only on special occasions	50	8.1	70	12.5	60	12.0
I do not drink tea	559	90.9	474	84.3	425	85.2

Mothers who drank tea during breastfeeding were asked about what kind of tea they drank at each follow-up interview within 6 months postpartum. Green tea and jasmine tea were the most popular two types of tea among breastfeeding mothers. More than half of them answered they drank green tea, and jasmine tea was consumed by approximately 30% of the mothers who drank tea during breastfeeding.

**Table 4.53 Reasons mothers cited for tea's influences on breastfeeding (n = 239)**

	n	%
Not good for the baby	125	52.3
Affect the baby's sleep	32	13.4
Not good for the baby's skin	13	5.4
Reduce the amount of breastmilk	4	1.7
Not good for the baby's growth and development	3	1.3
Negatively influence the baby's absorption of minerals	2	0.8
Not good for the mother	1	0.4
Tea is bitter	1	0.4
Tea will go to breastmilk	1	0.4
Do not know the reason	57	23.8

At 1 month follow-up interview, 239 mothers considered drinking tea would influence breastfeeding; 333 mothers did not know if it would influence breastfeeding or not; the rest 44 mothers believed that drinking tea would not affect breastfeeding. The reasons given by mothers for why they thought tea influenced breastfeeding are presented in Table 4.53.

With regard to having spicy food during breastfeeding period, most women did not eat spicy food within the first month postpartum while only a few (2.8%) had spicy food at least one meal per day. The proportion of mothers who had spicy food rose to 85.9% and 91.4% at 3 months and 6 months, respectively (Table 4.54).

**Table 4.54 Frequencies of eating spicy food during breastfeeding period**

	1 month (n = 615)		3 months (n = 562)		6 months (n = 499)	
	n	%	n	%	n	%
Nearly every meal	–	–	6	1.1	3	0.6
At least one meal a day(not every meal)	17	2.8	97	17.3	112	22.4
A few meals a week	30	4.9	173	30.8	166	33.3
A few meals a month	162	26.3	207	36.8	175	35.1
I do not eat spicy food	406	66.0	79	14.1	43	8.6

As shown in Table 4.55, the proportion of mothers who drank alcohol during breastfeeding period remained very low within 6 months postpartum. Moreover, most of the mothers who drank alcohol during breastfeeding only drank on special occasions.

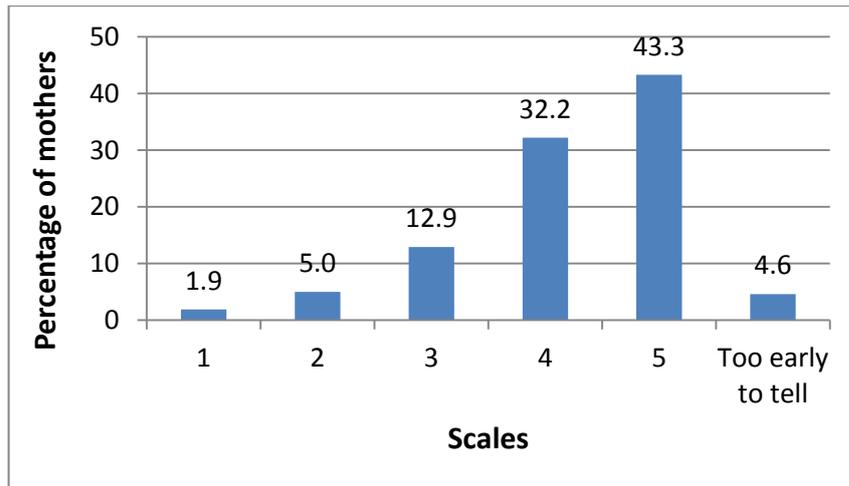
**Table 4.55 Frequencies of drinking alcohol during breastfeeding period**

	1 month (n = 615)		3 months (n = 562)		6 months (n = 499)	
	n	%	n	%	n	%
	At least once a day	3	0.5	1	0.2	–
A few times a week	7	1.1	4	0.7	–	–
A few times a month	5	0.8	3	0.5	1	0.2
Only on special occasions	12	2.0	24	4.3	13	2.6
I do not drink alcohol	588	95.6	530	94.3	486	97.4

#### **4.1.10 Breastfeeding confidence, enjoyment and satisfaction**

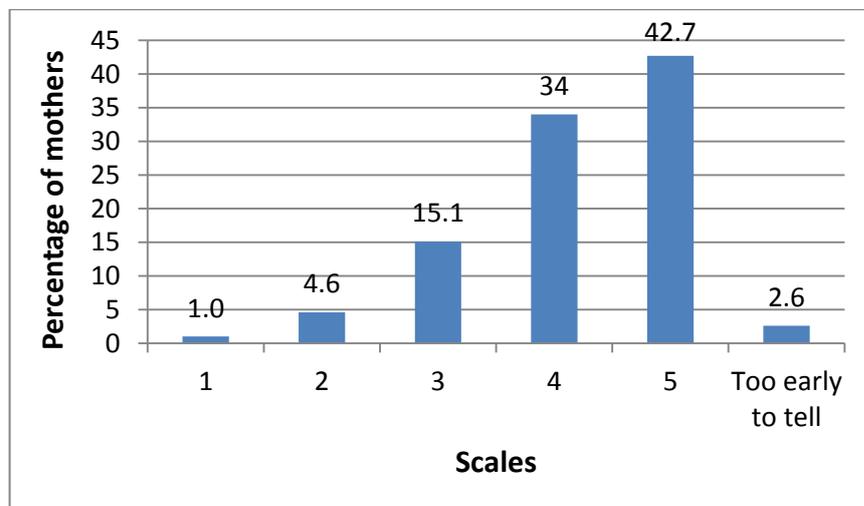
At the baseline interview, mothers were asked three questions to evaluate their confidence in, enjoyment of and satisfaction with breastfeeding, respectively. A 5-point Likert scale was employed to rate five different levels. Score 1 stands for ‘not confident/ enjoyable/ satisfied’, and score 5 represents ‘very confident/ enjoyable/ satisfied’. Scores 2 to 4 stand for somewhere in-between these two extreme responses.

In respect of breastfeeding confidence, mothers’ proportion increased with the confidence score (Figure 4.7). The smallest proportion (1.9%) was found in the group of ‘not confident’, and the largest proportion (43.3%) was observed among the group of women who felt very confident in breastfeeding. There were 4.6% of mothers who thought it was too early to tell their confidence in breastfeeding at discharge.



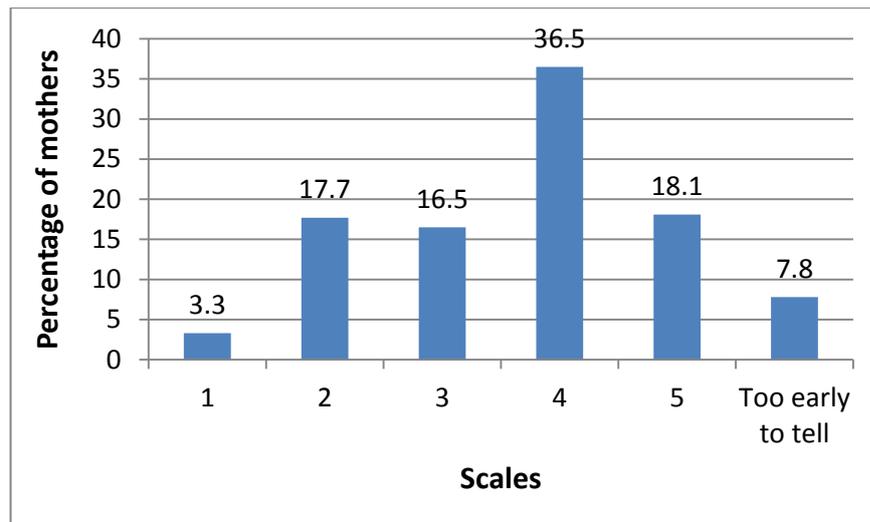
**Figure 4.7 Mothers' self-rated confidence level in breastfeeding**

The situation of breastfeeding enjoyment was similar with that of breastfeeding confidence. The greatest percentage (42.7%) was seen in score 5 which means 'very enjoyable', and only 1.0% of women thought breastfeeding was not enjoyable (Figure 4.8).



**Figure 4.8 Mothers' self-rated enjoyment level in breastfeeding**

When asked about their satisfaction about breastfeeding, 36.5% of mothers' satisfaction level fell to score 4, which is between the 'neutral' and 'very satisfied' range. 3.3% of women felt not satisfied with breastfeeding. The remaining mothers distributed almost equally in the groups of scores 2, 3 and 5 (Figure 4.9).

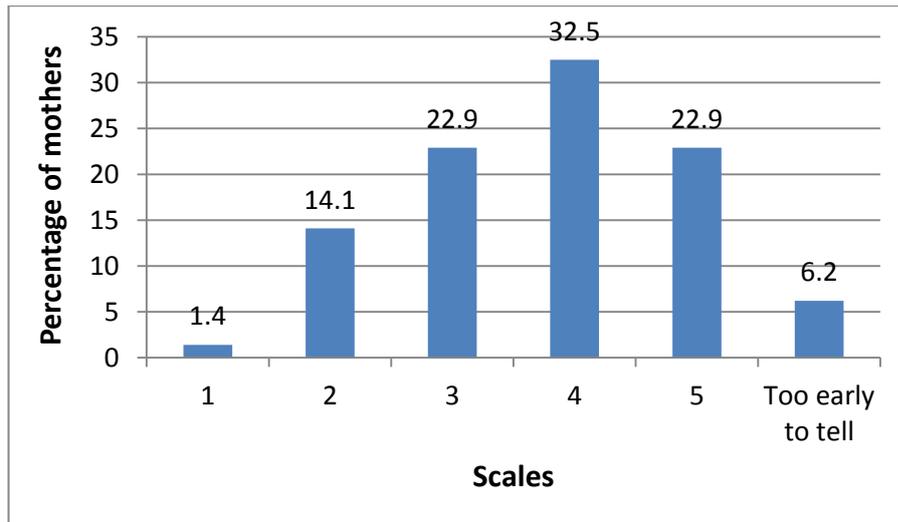


**Figure 4.9 Mothers' self-rated satisfaction level of breastfeeding experience**

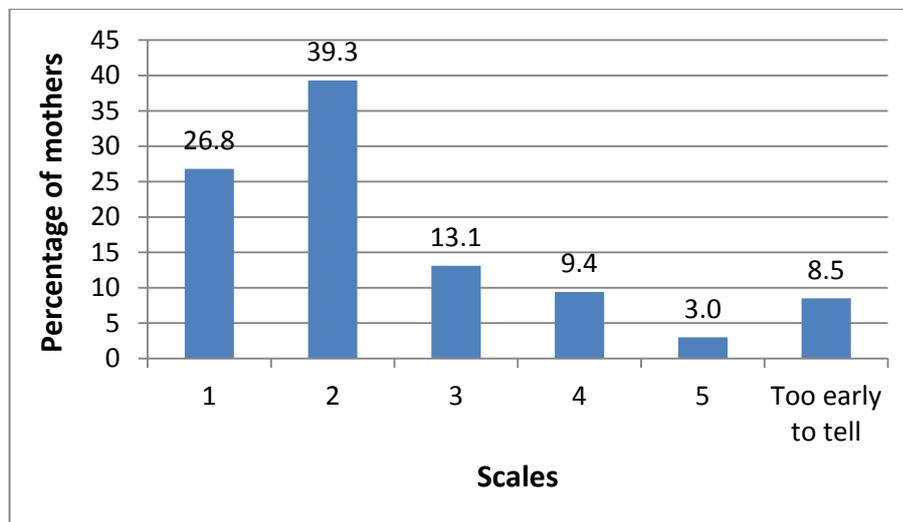
#### **4.1.11 Comfort with breastfeeding in public**

At the baseline interview, mothers were asked two questions about how comfortable they felt breastfeeding in front of others. A 5-point Likert scale was used to rate five different levels ranging from 1 (not comfortable) to 5 (very comfortable).

With regards to mother's comfort with breastfeeding in front of female people, the percentages of women who chose the scores between 3 and 5 were 22.9%, 32.5% and 22.9%, respectively. Only 10 women (1.4%) felt uncomfortable to breastfeed in front of other females (Figure 4.10). However, when asked about how comfortable they felt breastfeeding in front of other males, the participants' responses were quite different. The majority of women gave a score of 1 (26.8%) or 2 (39.3%). The proportions of women whose responses fell between 'neutral' and 'very satisfied' were 13.1%, 9.4% and 3.0% (Figure 4.11).



**Figure 4.10 Mother's comfort with breastfeeding in front of a female**



**Figure 4.11 Mother's comfort with breastfeeding in front of a male**

#### **4.1.12 Breastfeeding problems experienced within 6 months postpartum**

The most commonly cited breastfeeding problems mothers experienced during hospital stay were 'engorged breast' (54.4%), 'breastfeeding is painful' (48.1%) and 'feeling of not doing very well' (40.6%). Only 4.5% of breastfeeding mothers reported that no breastfeeding problems had been experienced during hospital stay (Table 4.56).

**Table 4.56 Breastfeeding problems experienced during hospital stay (n = 663)**

	n	%*
Breast engorged	361	54.4
Breastfeeding is painful	319	48.1
Feeling of not doing very well	269	40.6
Take a long time before milk starts flowing at start of feed	260	39.2
Not enough breastmilk	245	37.0
Baby too tired to feed	207	31.2
Cracked or sore nipples	179	27.0
Trouble positioning and/or attaching the baby to the breast	152	22.9
Baby does not wake up for feeds	122	18.4
Inverted nipples	120	18.1
Baby has problems sucking	96	14.5
Baby gets too much milk	25	3.8
Baby gets milk too fast	23	3.5
Baby not gaining enough weight	21	3.2
Mastitis	7	1.1
Other problem (armpit lump)	1	0.2
No breastfeeding problems	30	4.5

\*Percentages added up to more than 100 percent for some respondents gave multiple answers.

Table 4.57 presents breastfeeding problems cited by mothers at each follow-up interview within 6 months postpartum. Insufficient breastmilk remained to be one of the most commonly reported problems at each follow-up interview. 35.4%, 31.9% and 44.7% of breastfeeding mothers at 1, 3 and 6 months postpartum, respectively, said that they had not enough breastmilk since the previous interview.

**Table 4.57 Breastfeeding problems experienced by mothers from discharge to 6 months postpartum**

	1 month		3 months		6 months	
	(n = 615)		(n = 562)		(n = 499)	
	n	%*	n	%*	n	%*
Not enough breastmilk	218	35.4	179	31.9	223	44.7
Breast engorged	251	40.8	124	22.1	52	10.4
Breastfeeding is painful	131	21.3	116	20.6	238	47.7
Baby gets milk too fast	87	14.1	11	2.0	–	–
Cracked or sore nipples	61	9.9	38	6.8	29	5.8
Inverted nipples	56	9.1	16	2.8	6	1.2
Baby gets too much milk	20	3.3	7	1.2	4	0.8
Baby not gaining enough weight	11	1.8	6	1.1	54	10.8
The baby refuses breast	9	1.5	8	1.4	3	0.6
The breasts are painful after breastfeeding	5	0.8	3	0.5	–	–
The baby has problem sucking	3	0.5	–	–	–	–

\*Percentages added up to more than 100 percent for some respondents gave multiple answers.

At each follow-up interview within 6 months postpartum, mothers who had stopped breastfeeding were asked for reasons of weaning. Insufficient milk was the most prevalently reported reason, followed by maternal return to employment. 7 out of 84 mothers ceased breastfeeding between 3 and 6 months postpartum because they thought their watery breastmilk was not nutritious enough for their babies. In addition, two mothers stopped breastfeeding because their doctors suggested that their breastmilk was not nutritious for their infants (Table 4.58). These misunderstandings of breastmilk are against the recommendations of the WHO (WHO 2001). It revealed that there was a lack of knowledge regarding the benefits of prolonged breastfeeding among some women and even some health professionals in Jiangyou.

**Table 4.58 Reasons for stopping breastfeeding before 6 months postpartum**

	1 month (n = 33)	3 months (n = 47)	6 months (n = 84)
Not enough breastmilk	21	39	55
Nipple problems	3	2	2
Baby is sick	2	3	3
Mother is sick	6	4	8
Breastfeeding is painful	2	–	3
I do not know how much breastmilk the baby had	1	–	–
Worried about the body shape	1	–	–
The baby has problem sucking	2	–	–
Return to work	–	5	15
Mother's tired	–	1	5
Baby refused breast	–	5	3
My breastmilk is watery and does not have much nutrition	–	1	7
My family wanted me to feed the baby with formula	–	1	–
The baby's stool is too thin	–	1	–
Right time to wean	–	–	2
I did not want to breastfeed any longer	–	–	1
I want to lose weight	–	–	1
Formula is better than breastmilk after 6 months postpartum	–	–	1
The baby bites nipple or likes keeping nipple in mouth	–	–	2
The baby has bowel movements too often	–	–	1
The doctor advised that my breastmilk was not nutritious for baby	–	–	2

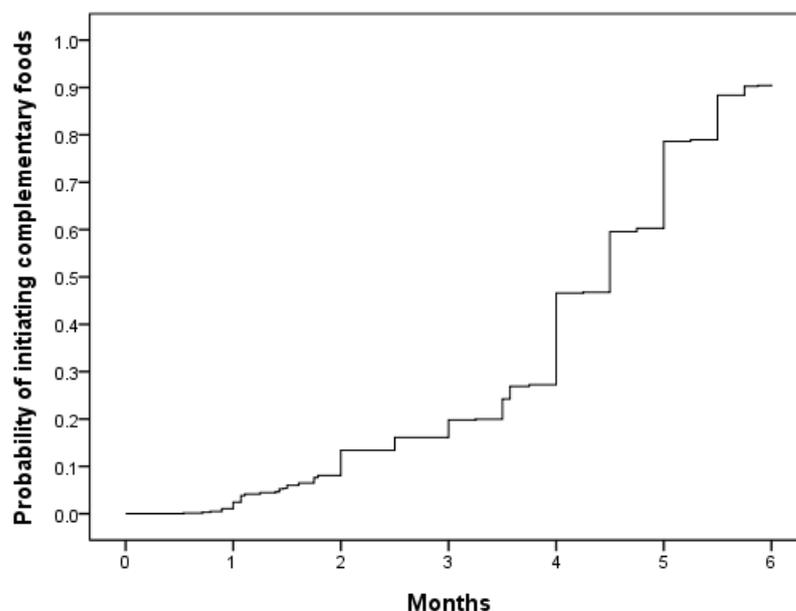
#### **4.1.13 Water and complementary foods**

Giving infants water within the first six months of life was a universal practice in Jiangyou. At discharge, 66.8% of 695 babies had received water and approximately 80% of 599 mothers were giving their babies water at 6 months postpartum. Mothers were asked for the reasons for giving infants water. It was shown that the main reasons cited were 'baby is thirsty' (49.2%) and 'it's good for the baby' (31.8%).

Complementary food refers to any food, manufactured or locally prepared, that is suitable as a complement to breastmilk or infant formula when either becomes insufficient to satisfy an infant's nutritional requirements (Binns 2003). In Jiangyou, fruit juice, vegetable juice, bone broth and fish soup were the most common fluids given to infants before 6 month of age and the most popular solids were yolk, fruit paste, porridge and infant cereal.

Figure 4.12 illustrates Kaplan-Meier survival curves for the timing of introducing complementary foods (liquids and solids) within 6 months postpartum. The median age to start complementary foods was 4.5 (95% CI 4.4 to 4.6) months. Fruit juice and vegetable juice were the earliest food introduced to infants in Jiangyou, followed by yolk. Approximately 27% infants had received complementary foods by age of 4 months and the proportion increased to 90.7% at the end of 6 months.

As mothers in the developing countries are at high risk of following inaccurate guidelines (Batal, Boulghourjian & Akik 2010), providing mothers with sufficient updated information on infant feeding is rather important. In this study, mothers were asked about their main sources of information on complementary foods at six-month interview. Results showed that less than one-half of women chose health professionals as one of their main sources of information, and that approximately 60% women mainly turned to their mothers, mothers-in-law, or other family members or relatives for information and guidance on complementary feeding.



**Figure 4.12 Probability of initiating complementary foods within 6 months postpartum**

**Table 4.59 Main sources of information about introducing complementary foods to the infant (n = 599)**

Source of information	n	%*
Individual consultation with health professional	247	41.24
My mother or mother-in-law	209	34.89
Other family members or relatives	137	22.87
Never got information	63	10.52
Friends	79	13.19
Books and magazines	48	8.01
Booklets	3	0.50
Lectures	3	0.50
TV/Radio	2	0.33
I have experience in feeding baby	1	0.17

\*Percentages added up to more than 100 percent for some respondents gave multiple answers.

## **4.2 Early initiation of breastfeeding and prelacteal feeds**

Breastfeeding newborn infants within the first hour of life is recommended by the WHO and is in accordance with the Step Four of the BFHI (WHO 2012a; WHO & UNICEF 2007). By definition, putting newborns to the breast within one hour of birth is understood to be early initiation of breastfeeding (WHO 2008).

In the study, the time to first breastfeed was classified into five groups: within 1 hour, between 1 and 24 hours, between 24 and 48 hours, between 48 and 72 hours, and after 72 hours. Chi-square tests showed that the timing of breastfeeding initiation was different between hospitals and township health centres (Pearson Chi-Square = 36.76,  $df = 4$ ,  $p < 0.001$ ). As shown in Table 4.60, breastfeeding was initiated within one hour after birth by only 1.7% women from township health centres and by 12.7% from hospitals. The majority of mothers initiated breastfeeding within 72 hours of birth both in hospitals (93.3%) and township health centres (96.1%).

**Table 4.60 Distribution of time to first breastfeed (n = 695)**

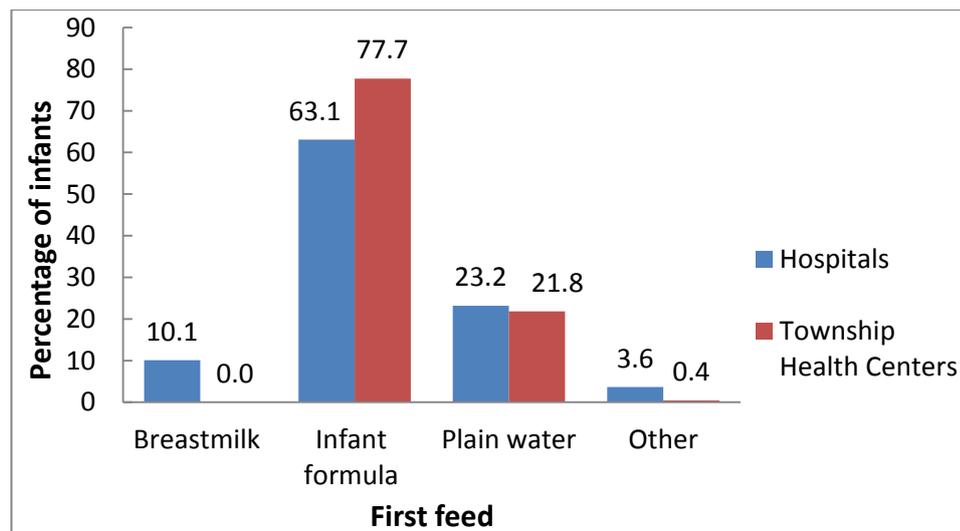
	Hospital (n = 465) n (%)	Township health centre (n = 228) n (%)	Total* (n = 693) n (%)
Within 1 hour	59 (12.7)	4 (1.8)	63 (9.1)
Between 1 and 24 hours	79 (17.0)	25 (11.0)	104 (15.0)
Between 24 and 48 hours	171 (36.8)	123 (53.9)	294 (42.4)
Between 48 and 72 hours	125 (26.9)	67 (29.4)	192 (27.7)
After 72 hours	31 (6.7)	9 (3.9)	40 (5.8)

\*Data missing for 2 mothers

#### 4.2.1 Prelacteal feeds

Prelacteal feeds are defined as any feeds given before the beginning of lactogenesis II, which is the onset of copious breastmilk secretion that occurs within four days of birth (Neville & Morton 2001). Prelacteal feeds are given in many cultures and might include plain water, glucose, sugar water, infant formula, or other traditional feeds such as diluted infant cereal with honey, tea, ghee, and herbal preparations (Tang, Hewitt & Yu 2012).

In Jiangyou, prelacteal feeding was the norm (93.2%). Breastmilk or colostrum was the first feed for only one in ten infants born at hospitals, plain water for 23.2%, infant formula for 63.1%, and other drinks for 3.6%. All of the babies born at the township health centres had non-breastmilk drinks as their first feeds (Figure 4.13). Infant formula (67.9%) and plain water (22.7%) were the most common prelacteal feeds (Table 4.61).



**Figure 4.13 Distribution of infants' first feed by place of delivery (n = 695)**

**Table 4.61 Distribution of infants' first feed (n = 695)**

First feed	n	%
Breastmilk	47	6.8
Infant formula	472	67.9
Plain water	158	22.7
Other*	18	2.6
Total	695	100.0

\*Including glucose water, powdered cow's milk, fresh cow's milk, boiling rhizoma coptidis, goat colostrum, honey water and walnut juice.

#### **4.2.2 Breastfeeding initiation within the first hour of life**

The association between early initiation of breastfeeding and potential factors was analysed by cross-tables and univariate binary logistic regression. The results of univariate analysis showed that the prevalence of breastfeeding in the first hour postpartum was significant lower among mothers with family monthly income over 5,000 yuan (OR 0.31, 95% CI 0.11 to 0.86), and among mothers who delivered at township health centres (OR 0.12, 95% CI 0.04 to 0.34). Women who had attended antenatal class for this or a previous pregnancy were more likely to have an early breastfeeding initiation than those who had not (OR 2.65, 95% CI 1.52 to 4.64). The univariate analysis results also revealed a significantly higher rate of early breastfeeding initiation among mothers who were encouraged by health facility staff

to put baby to breast right after the birth (OR 7.50, 95% CI 3.19 to 17.66) (Table 4.62).

**Table 4.62 Number (%) of mothers initiating breastfeeding within one hour and crude odds ratios of potential determinants (n = 693)**

Variables	Time to first breastfeed		Crude OR (95% CI)	p
	≤ 1 hour n (%)	> 1 hour n (%)		
<b>Maternal age (years)</b>				
< 25	33 (8.3)	364 (91.7)	1.00	
≥ 25	30 (10.1)	266 (89.9)	1.24 (0.74, 2.09)	0.410
<b>Maternal education</b>				
High school or below	55 (9.0)	558 (91.0)	1.00	
University	8 (10.0)	72 (90.0)	1.13 (0.52, 2.46)	0.764
<b>Maternal occupation</b>				
No job	23 (10.6)	194 (89.4)	1.00	
Labour job	29 (10.0)	260 (90.0)	0.94 (0.53, 1.68)	0.836
Office job	11 (5.9)	176 (94.1)	0.53 (0.25, 1.11)	0.093
<b>Family monthly income (yuan<sup>¥</sup>)</b>				
≤ 5000	57 (10.8)	469 (89.2)	1.00	
> 5000	4 (3.6)	108 (96.4)	0.31 (0.11, 0.86)	0.024
<b>Baby's gender</b>				
Male	30 (8.8)	310 (91.2)	1.00	
Female	33 (9.3)	320 (90.7)	1.07 (0.63, 1.79)	0.810
<b>Baby's birthweight (gram)</b>				
< 2500	3 (25.0)	9 (75.0)	1.00	
≥ 2500	60 (8.8)	621 (91.2)	0.29 (0.08, 1.10)	0.069
<b>Gestational age (weeks)</b>				
< 37	1 (9.1)	10 (90.9)	1.00	
≥ 37	62 (9.1)	617 (90.9)	1.01 (0.13, 7.98)	0.996
<b>Method of delivery</b>				
Vaginal delivery	21 (10.6)	178 (89.4)	1.00	
Caesarean section	42 (8.5)	452 (91.5)	0.79 (0.45, 1.37)	0.396
<b>Parity</b>				
Primiparous	46 (8.3)	507 (91.7)	1.00	
Multiparous	17 (12.1)	123 (87.9)	1.52 (0.84, 2.75)	0.162
<b>Place of delivery</b>				
Hospital	59 (12.7)	406 (87.3)	1.00	
Township health centre	4 (1.8)	224 (98.2)	0.12 (0.04, 0.34)	< 0.001
<b>Attendance at antenatal class</b>				
No	41 (7.3)	524 (92.7)	1.00	

Yes	22 (17.2)	106 (82.8)	2.65 (1.52, 4.64)	0.001
Encouragement of early initiation from health facility staff				
No	6 (2.1)	278 (97.9)	1.00	
Yes	57 (13.9)	352 (86.1)	7.50 (3.19, 17.66)	< 0.001
Mothers' perception about colostrum				
Important	52 (9.6)	489 (90.4)	1.00	
Harmful/should be discarded/do not know	11 (7.2)	141 (92.8)	0.73 (0.37, 1.44)	0.370

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\*1 Chinese yuan = 0.15 AUD

Adjusted odds ratios were calculated using multivariate backward stepwise logistic regression models. Results showed that three factors were associated with breastfeeding initiation within the first hour of life after adjusting for potential confounding variables (Table 4.63). Babies born at township health centres were less likely to have breastmilk or colostrum within one hour of their life than babies born at hospitals (aOR 0.11, 95% CI 0.04 to 0.32). Mothers who had attended antenatal class for this or a previous pregnancy were more likely to feed their newborns with breastmilk within one hour after delivery after controlling confounders (aOR 2.57, 95% CI 1.36 to 4.87). Similarly, mothers who were encouraged by health facility staff to put baby to breast right after delivery were more likely to practice early breastfeeding initiation compared with those who did not (aOR 5.60, 95% CI 2.31 to 13.55).

**Table 4.63 Factors associated with initiation of breastfeeding within one hour after adjustment for potential confounders**

Variables	n	Adjusted OR (95% CI)	p
Place of delivery			
Hospital	430	1.00	
Township health centre	206	0.11 (0.04, 0.32)	< 0.001
Attendance at antenatal class			
No	518	1.00	
Yes	118	2.57 (1.36, 4.87)	0.004
Encouragement of early initiation from health facility staff			
No	252	1.00	
Yes	384	5.60 (2.31, 13.55)	< 0.001

### **4.3 Breastfeeding at discharge**

#### **4.3.1 'Any breastfeeding' at discharge**

A breastfeeding rate of 93.5% (95% CI 91.7 to 95.3) at discharge was documented in this study. Factors associated with breastfeeding at discharge were evaluated using binary logistic regression.

Table 4.64 shows the factors that might be associated with the rate of breastfeeding at discharge. According to the univariate analysis, whether receiving encouragement of breastfeeding from the health facility staff during hospital stay, reported feeding preferences of father and maternal grandmother, and time of deciding feeding method were associated with breastfeeding at discharge. The rate of 'any breastfeeding' tended to be higher among mothers who had received encouragement with breastfeeding from the health facility staff during hospital stay (OR 4.36, 95% CI 2.26 to 8.41). Both infants whose father reported to prefer breastfeeding (OR 4.75, 95% CI 2.50 to 9.01) and infants whose maternal grandmother reported to be supportive of breastfeeding (OR 3.86, 95% CI 1.89 to 7.89) were more likely to be breastfed at discharge. However, the rate of 'any breastfeeding' tended to be lower among mothers who made the decision of feeding method during or after pregnancy than that among mothers who made the decision before pregnancy (OR 0.39, 95% CI 0.20 to 0.73). No association was found between 'any breastfeeding' and any of those listed socio-demographic and biomedical factors.

**Table 4.64 Breastfeeding rates at discharge (%) and crude odds ratios of potential determinants (n = 695)**

Variables	Any breastfeeding n (%)	Non-breastfeeding n (%)	Crude OR (95% CI)	p
Maternal age (years)				
< 25	371 (93.5)	26 (6.5)	1.00	
≥ 25	279 (93.6)	19 (6.4)	1.03 (0.56, 1.90)	0.927
Maternal education				
High school or lower	570 (93.0)	43 (7.0)	1.00	
University	80 (97.6)	2 (2.4)	3.02 (0.72, 12.70)	0.132
Maternal occupation				
No job	202 (93.1)	15 (6.9)	1.00	
Labor job	270 (93.4)	19 (6.6)	1.06 (0.52, 2.13)	0.881
Office job	178 (94.2)	11 (5.8)	1.20 (0.54, 2.68)	0.654
Monthly family income (yuan*)				
≤ 3000	322 (94.4)	19 (5.6)	1.00	
> 3000	279 (93.3)	20 (6.7)	0.82 (0.43, 1.57)	0.556
Parity				
Primiparous	518 (93.3)	37 (6.7)	1.00	
Multiparous	132 (94.3)	8 (5.7)	1.18 (0.54, 2.59)	0.683
Baby's gender				
Male	322 (94.4)	19 (5.6)	1.00	
Female	328 (92.7)	26 (7.3)	0.74 (0.40, 1.37)	0.344
Baby's birthweight (gram)				
< 2500	10 (83.3)	2 (16.7)	1.00	
≥ 2500	640 (93.7)	43 (6.3)	2.98 (0.63, 14.01)	0.168
Method of delivery				
Vaginal delivery	182 (91.5)	17 (8.5)	1.00	
Caesarean section	468 (94.4)	28 (5.6)	1.56 (0.83, 2.92)	0.163
Attendance at antenatal class				
No	533 (94.2)	33 (5.8)	1.00	
Yes	117 (90.7)	12 (9.3)	0.60 (0.30, 1.20)	0.152
Encouragement of breastfeeding from health facility staff				

during hospital stay				
No	73 (82.0)	16 (18.0)	1.00	
Yes	577 (95.2)	29 (4.8)	4.36 (2.26, 8.41)	<0.001
Father's feeding preference				
Other <sup>†</sup>	80 (81.6)	18 (18.4)	1.00	
Breastfeeding	570 (95.5)	27 (4.5)	4.75 (2.50, 9.01)	<0.001
Maternal grandmother's feeding preference				
Other <sup>†</sup>	56 (82.4)	12 (17.6)	1.00	
Breastfeeding	594 (94.7)	33 (5.3)	3.86 (1.89, 7.89)	<0.001
Maternal grandmother breastfed her children				
No	20 (87.0)	3 (13.0)	1.00	
Yes	623 (93.7)	42 (6.3)	2.23 (0.64, 7.79)	0.211
Time of deciding feeding method				
Before pregnancy	367 (96.1)	15 (3.9)	1.00	
During or after pregnancy	283 (90.4)	30 (9.6)	0.39 (0.20, 0.73)	0.003

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\* 1 Chinese yuan = 0.15AUD

<sup>†</sup> formula feeding, did not mind how infants are fed or did not discuss it with the mother

All the potential factors listed in Table 4.64 were entered into a backward stepwise logistic regression model. The multivariate results indicated that whether being encouraged with breastfeeding by health facility staff during hospital stay, reported feeding preference of baby's father and time of deciding feeding method were associated with breastfeeding initiation after controlling potential confounders. The results showed that father's reported support for breastfeeding was the strongest factor associated with 'any breastfeeding' at discharge. If a father was reported to be supportive of breastfeeding, the baby was significantly more likely to be breastfed at discharge (aOR 4.46, 95% CI 2.15 to 9.28). Health facility staff's support for breastfeeding was also positively associated with breastfeeding at discharge. Mothers who received encouragement of breastfeeding from hospital staff were more likely to breastfeed their babies at discharge than those who did not receive any breastfeeding encouragement from doctors or nurses (aOR 3.41, 95% CI 1.58 to 7.34). However,

mothers making the decision of infant feeding during or after pregnancy were less likely to be breastfeeding at discharge than those who made decision before pregnancy (aOR 0.46, 95% CI 0.22 to 0.93) (Table 4.65).

**Table 4.65 Factors associated with ‘any breastfeeding’ at discharge after adjustment for potential confounders**

Variables	n	Adjusted OR (95% CI)	p
Encouragement of breastfeeding from health facility staff during hospital stay			
No	79	1.00	
Yes	554	3.41 (1.58, 7.34)	0.002
Father’s feeding preference			
Other <sup>†</sup>	86	1.00	
Breastfeeding	547	4.46 (2.15, 9.28)	< 0.001
Time of deciding feeding method			
Before pregnancy	346	1.00	
During or after pregnancy	287	0.46 (0.22, 0.93)	0.030

<sup>†</sup>formula feeding, did not mind how infants are fed or did not discuss it with the mother

### 4.3.2 ‘Full breastfeeding’ at discharge

The WHO recommends that infants be exclusively breastfed for the first six months of life to achieve optimal growth, development and health (WHO & UNICEF 2003). In this study, only 7 out of 695 mothers were ‘exclusive breastfeeding’ at discharge. Therefore, factors associated with ‘exclusive breastfeeding’ cannot be determined due to small numbers of exclusive breastfeeding cases. Instead, factors correlated within ‘full breastfeeding’ at discharge were assessed.

The percentage of mothers who fully breastfed their infants at discharge was 36.3%. The results of univariate analysis assessing factors associated with full breastfeeding are presented in Table 4.66. Commencing breastfeeding within the first hour of life, father’s support for breastfeeding and maternal grandmother’s support for breastfeeding were found to be positively associated with full breastfeeding at discharge. Mothers who started breastfeeding within one hour postpartum were more

likely to be fully breastfeeding at discharge than those who initiated breastfeeding after one hour (OR 2.23, 95% CI 1.32 to 3.76). Moreover, if an infant's father and/or maternal grandmother were supportive of breastfeeding, the infant was more likely to be fully breastfed at discharge than those whose father or maternal grandmother preferred formula feeding or ambivalent (OR 1.79, 95% CI 1.11 to 2.91) and (OR 2.89, 95% CI 1.52 to 5.51).

**Table 4.66 Factors influencing full breastfeeding (FBF) at discharge (n = 693)**

Variables	FBF n (%)	Non-FBF n (%)	Crude OR (95% CI)	p
<b>Maternal age (years)</b>				
< 25	134 (33.8)	263 (66.2)	1.00	
≥ 25	118 (39.6)	180 (60.4)	1.29 (0.94, 1.76)	0.113
<b>Maternal education</b>				
High school or below	219 (35.7)	394 (64.3)	1.00	
University	33 (40.2)	49 (59.8)	1.21 (0.76, 1.94)	0.425
<b>Maternal occupation</b>				
No job	66 (30.4)	151 (69.6)	1.00	
Labour job	114 (39.4)	175 (60.6)	1.49 (1.03, 2.17)	0.036
Office job	72 (38.1)	117 (61.9)	1.41 (0.93, 2.13)	0.104
<b>Monthly family income (yuan<sup>*</sup>)</b>				
≤ 5000	194 (36.8)	333 (63.2)	1.00	
> 5000	39 (34.5)	74 (65.5)	0.91 (0.59, 1.39)	0.645
<b>Baby's gender</b>				
Male	122 (35.8)	219 (64.2)	1.00	
Female	130 (36.7)	224 (63.3)	1.04 (0.77, 1.42)	0.795
<b>Baby's birthweight (gram)</b>				
< 2500	3 (25.0)	9 (75.0)	1.00	
≥ 2500	249 (36.5)	434 (63.5)	1.72 (0.46, 6.42)	0.419
<b>Method of delivery</b>				
Vaginal delivery	67 (33.7)	132 (66.3)	1.00	
Caesarean section	185 (37.3)	311 (62.7)	1.17 (0.83, 1.66)	0.368
<b>Parity</b>				
Primiparous	196 (35.3)	359 (64.7)	1.00	
Multiparous	56 (40.0)	84 (60.0)	1.22 (0.84, 1.79)	0.303
<b>Attendance at antenatal class</b>				
No	203 (35.9)	363 (64.1)	1.00	
Yes	49 (38.0)	80 (62.0)	1.10 (0.74, 1.63)	0.652
<b>Breastfeeding encouragement from hospital staff</b>				
No	27 (30.3)	62 (69.7)	1.00	
Yes	225 (37.1)	381 (62.9)	1.36 (0.84, 2.19)	0.215
<b>Initiating breastfeeding within one hour</b>				
No	217 (34.4)	413 (65.6)	1.00	

Yes	34 (54.0)	29 (46.0)	2.23 (1.32, 3.76)	0.003
Father's feeding preference				
Other <sup>†</sup>	25 (25.5)	73 (74.5)	1.00	
Breastfeeding	227 (38.0)	370 (62.0)	1.79 (1.11, 2.91)	0.018
Maternal grandmother's feeding preference				
Other <sup>†</sup>	12 (17.6)	56 (82.4)	1.00	
Breastfeeding	240 (38.3)	387 (61.7)	2.89 (1.52, 5.51)	0.001
Time of deciding feeding method				
Before pregnancy	146 (38.2)	236 (61.8)	1.00	
During or after pregnancy	106 (33.9)	207 (66.1)	0.83 (0.61, 1.13)	0.235

\* 1 Chinese yuan = 0.15 AUD

<sup>†</sup> formula feeding, did not mind how infants are fed or did not discuss it with the mother

Multivariate backward stepwise logistic regression analyses were employed to estimate the independent association between studied factors and 'full breastfeeding' at discharge (Table 4.67). After adjusting for potential confounding factors, initiating breastfeeding within the first hour of life and maternal grandmother's support for breastfeeding remained significant in the multivariate model. Mothers who initiated breastfeeding within the first hour of life were more likely to be full breastfeeding at discharge than those who started breastfeeding after one hour postpartum (aOR 2.10, 95% CI 1.23 to 3.60). In addition, the rate of full breastfeeding was also higher among infants whose maternal grandmother was supportive of breastfeeding (aOR 3.15, 95% CI 1.55 to 6.42).

**Table 4.67 Factors associated with full breastfeeding at discharge after adjustment for potential confounders**

Variables	n	Adjusted OR (95% CI)	p
Initiating breastfeeding within one hour			
No	577	1.00	
Yes	61	2.10 (1.23, 3.60)	0.007
Maternal grandmother's feeding preference			
Other <sup>†</sup>	57	1.00	
Breastfeeding	581	3.15 (1.55, 6.42)	0.002

<sup>†</sup> formula feeding, did not mind how infants are fed or did not discuss it with the mother

The association between early breastfeeding initiation and breastfeeding duration has been widely studied by many researchers (Hossain et al. 1995; Moore, Anderson & Bergman 2007; Murray, Ricketts & Dellaport 2007). But few studies are available on evaluating the relationship between early breastfeeding initiation and breastfeeding outcomes at discharge. Buxton et al. reported a positive association between delayed establishment of breastfeeding and breastfeeding cessation within seven days postpartum (Buxton et al. 1991). In this study, the results showed that earlier initiation of breastfeeding was associated with a higher rate of ‘full breastfeeding’ at discharge.

We did not detect any association between maternal grandmother’s feeding preference and ‘any breastfeeding’ at discharge. However, grandmother’s feeding preference was a strong factor correlated with ‘full breastfeeding’ at discharge. Mothers were more likely to be fully breastfeeding at discharge if they perceived that their own mothers were supportive of breastfeeding. Although the family size is becoming smaller than the past in recent decades, extended family remains the norm in China, especially in rural areas. In Jiangyou, only one in four mothers lived in a small family, however, the majority lived with their husband’s or their own parents. Based on the results of this study, women living in rural China may still be influenced by their mothers’ opinions when making decisions on feeding methods.

## **4.4 Breastfeeding duration**

There has been a large amount of evidence about the benefits of prolonged breastfeeding for both child and mother (WHO 2009). The American Academy of Pediatrics (AAP) recommends breastfeeding for at least 12 months and beyond as long as it is mutually desired by mother and child (Gartner et al. 2005), and WHO recommends breastfeeding up to two years of age or beyond (WHO 2003b).

In the present study, the median duration of ‘any breastfeeding’ was 8 months and the median length of ‘full breastfeeding’ was nearly 5 months. Kaplan-Meier tests were employed to estimate the differences in median duration of breastfeeding in univariate analysis. Cox proportional hazard analysis was used to assess the relation between studied factors and duration of ‘any breastfeeding’ or ‘full breastfeeding’ with and without adjustment for potential confounders. A hazard ratio (HR) greater than 1 denotes an elevated risk of discontinuation of ‘any breastfeeding’ before 12 months postpartum or of ‘full breastfeeding’ before 6 months postpartum.

### **4.4.1 ‘Any breastfeeding’ duration**

Univariate analysis showed that older maternal age ( $\geq 25$  years), multiparous parity, intended breastfeeding duration of more than 6 months, introduction of solid foods at least 6 months postpartum and returning to work at least 6 month postpartum or with no job were factors positively related to longer ‘any breastfeeding’ duration (Table 4.68).

At 12 months postpartum, fewer women aged below 25 years were still breastfeeding compared with women aged  $\geq 25$  years (HR 0.67, 95% CI 0.56 to 0.81). With regard to parity, multiparous mothers were less likely to stop breastfeeding before the baby was 12 months old than primiparous mothers (HR 0.65, 95% CI 0.51 to 0.83). If a mother planned to breastfeed her baby for more than 6 months, she would be more likely to be breastfeeding at 12 months postpartum than a mother whose intended breastfeeding duration was 6 months or shorter (HR 0.65, 95% CI 0.54 to 0.78). In addition, infants who were introduced to solid foods when they were at least six

months old were more likely to be breastfed at 12 months postpartum than infants who were introduced to solid foods before six months old (HR 0.75, 95% CI 0.61 to 0.94). Moreover, a higher proportion of mothers who returned to work when the baby was at least six months old were breastfeeding at 12 months postpartum than that of mothers who went back to work before six months after birth (HR 0.57, 95% CI 0.45 to 0.72).

Mothers with a monthly family income of more than 3,000 yuan were less likely to be still breastfeeding at 12 months compared with their counterparts with a monthly family income of 3,000 and below (HR 1.25, 95% CI 1.04 to 1.50).

According to the results of univariate analyses, the place of delivery was also associated with 'any breastfeeding' duration. Infants born at township health centres were more likely to be breastfeeding at 12 months than infants born at hospitals (HR 0.78, 95% CI 0.63 to 0.96). The time of deciding feeding method was another factor related to 'any breastfeeding' duration. Mothers who had chosen their method of infant feeding after delivery were significantly less likely to be breastfeeding at 12 months compared with mothers who made their decision before or during pregnancy (HR 1.42, 95% CI 1.12 to 1.81). Surprisingly, more infants whose maternal grandmother preferred breastfeeding stopped breastfeeding before one year old (HR 1.54, 95% CI 1.10 to 2.17).

**Table 4.68 ‘Any breastfeeding’ duration (months) and crude hazards ratio (95% CI) of discontinuing breastfeeding at 12 months by potential factors**

Variables	n	Median duration (month) (95% CI)	Crude HR (95% CI)
<b>Maternal age (years)</b>			
< 25	382	7.75 (7.45, 8.05)	1.00
≥ 25	286	8.50 (8.04, 8.96)	0.67 (0.56, 0.81)
<b>Maternal education</b>			
High school or lower	588	8.00 (7.83, 8.17)	1.00
University	80	7.50 (6.47, 8.53)	1.04 (0.80, 1.35)
<b>Monthly family income (yuan<sup>*</sup>)</b>			
≤ 3000	331	8.00 (7.72, 8.28)	1.00
> 3000	286	7.75 (7.44, 8.06)	1.25 (1.04, 1.50)
<b>Parity</b>			
Primiparous	536	7.75 (7.53, 7.97)	1.00
Multiparous	132	8.75 (7.44, 10.06)	0.65 (0.51, 0.83)
<b>Baby’s gender</b>			
Male	329	8.00 (7.77, 8.24)	1.00
Female	339	8.00 (7.76, 8.24)	1.05 (0.88, 1.25)
<b>Method of delivery</b>			
Vaginal delivery	190	8.25 (7.78, 8.72)	1.00
Caesarean section	478	8.00 (7.77, 8.23)	1.08 (0.89, 1.32)
<b>Attendance at antenatal class</b>			
No	547	8.00 (7.81, 8.19)	1.00
Yes	121	8.00 (7.54, 8.46)	0.82 (0.65, 1.04)
<b>Place of delivery</b>			
Hospital	449	8.00 (7.78, 8.22)	1.00
Township health centre	216	8.50 (8.04, 8.96)	0.78 (0.63, 0.96)
<b>Father’s feeding preference</b>			
Other <sup>†</sup>	85	7.25 (6.57, 7.94)	1.00
Breastfeeding	583	8.00 (7.83, 8.17)	0.91 (0.69, 1.20)
<b>Maternal grandmother’s feeding preference</b>			
Other <sup>†</sup>	60	9.00 (6.96, 11.04)	1.00
Breastfeeding	608	8.00 (7.83, 8.17)	1.54 (1.10, 2.17)
<b>Maternal grandmother breastfed her children</b>			
No	21	8.00 (6.18, 9.82)	1.00

Yes	640	8.00 (7.83, 8.17)	0.98 (0.59, 1.64)
Intended breastfeeding duration			
≤ 6 months/undecided	303	7.50 (6.98, 8.02)	1.00
> 6 months	353	8.50 (8.11, 8.89)	0.65 (0.54, 0.78)
Time of deciding feeding method			
Before pregnancy	375	8.00 (7.79, 8.21)	1.00
During pregnancy	179	8.00 (7.32, 8.68)	0.91 (0.74, 1.14)
After delivery	114	7.00 (6.16, 7.84)	1.42 (1.12, 1.81)
Time of introducing solid foods			
< 6 months	461	7.88 (7.61, 8.14)	1.00
≥ 6 months	144	8.00 (7.39, 8.61)	0.75 (0.61, 0.94)
Age of infant when mother returned to work			
< 6 months	97	6.00 (4.47, 7.53)	1.00
≥ 6 months/no job	532	8.00 (7.78, 8.22)	0.57 (0.45, 0.72)

\*1 Chinese yuan = 0.15 AUD

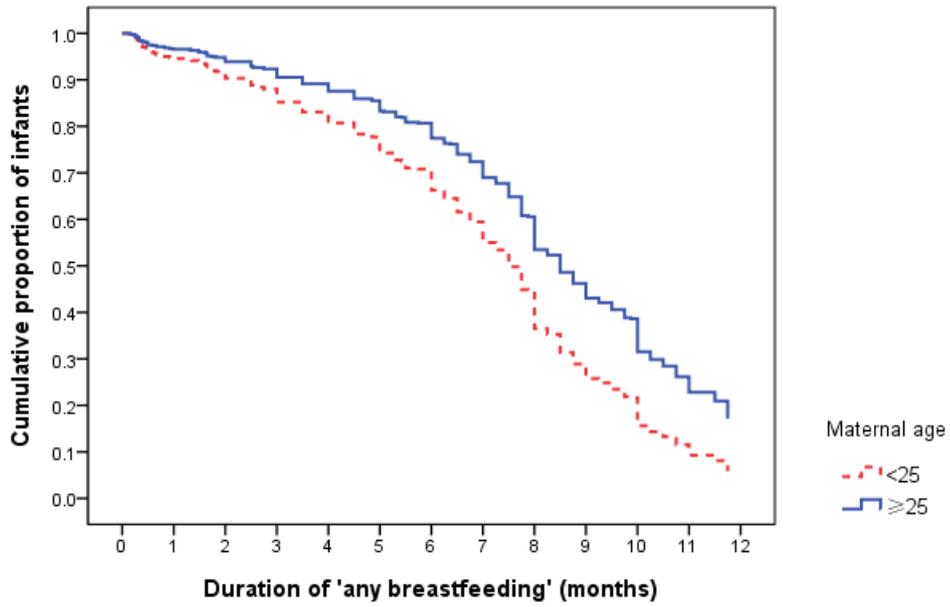
†formula feeding, did not mind how infants are fed or did not discuss it with the mother

Backward stepwise multivariate Cox regression analyses were applied to identify factors associated with overall breastfeeding duration. All 15 variables were entered into the full model at the initial step and then backward stepwise procedure was applied to obtain the final model. Complete data were available for 540 of the 650 breastfeeding mothers (83.1%). After controlling for the effects of potential confounders, five factors were still significantly related to breastfeeding duration. Older mothers ( $\geq 25$  years) (aHR 0.60, 95% CI 0.49 to 0.74), women who gave birth at township health centres (aHR 0.75, 95% CI 0.60 to 0.95), women who planned to breastfeed for more than 6 months (aHR 0.69, 95% CI 0.56 to 0.84), women who introduced solid foods to the baby at least six months postpartum (aHR 0.77, 95% CI 0.60 to 0.97), and women who returned to work at least 6 postpartum or with no job (aHR 0.59, 95% CI 0.45 to 0.76) were positively and independently associated with longer ‘any breastfeeding’ duration (Table 4.69).

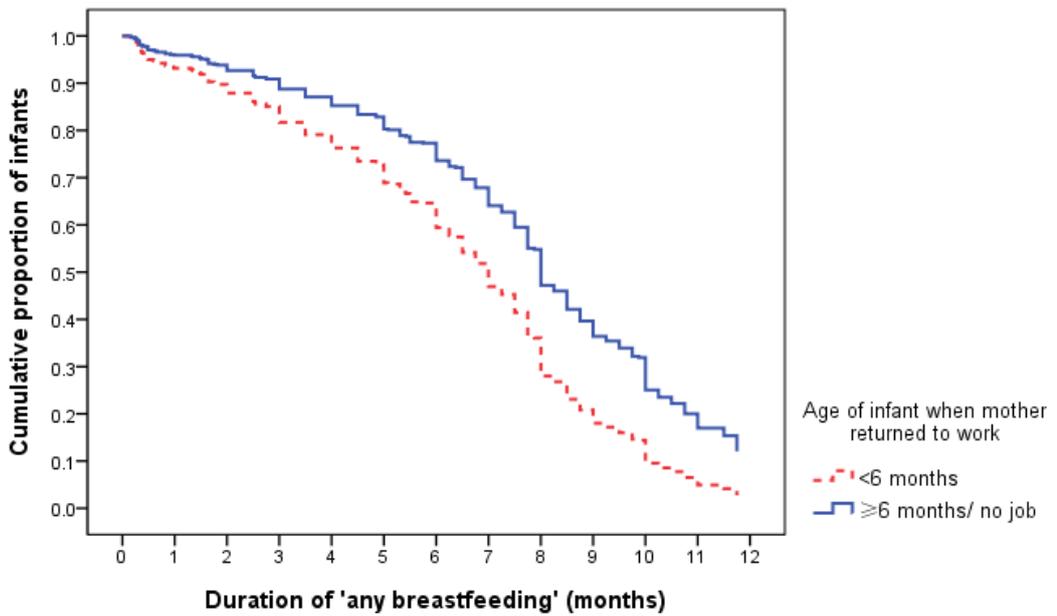
**Table 4.69 Factors independently associated with the risk of discontinuing ‘any breastfeeding’ before 12 months**

Variables	n	Adjusted HR (95% CI)	p
Maternal age			
< 25years	303	1.00	
≥ 25 years	237	0.62 (0.51, 0.76)	< 0.001
Place of delivery			
Hospital	380	1.00	
Township health centre	160	0.75 (0.60, 0.95)	0.016
Intended breastfeeding duration			
≤ 6 months/undecided	247	1.00	
> 6 months	293	0.71 (0.58, 0.86)	0.001
Time of introducing solid foods			
< 6 months	414	1.00	
≥ 6 months	126	0.77 (0.61, 0.98)	0.031
Age of infant when mother returned to work			
< 6 months	87	1.00	
≥ 6 months/no job	453	0.59 (0.46, 0.76)	< 0.001

Maternal age and the time when mothers returned to work were the most significant determinants of ‘any breastfeeding’ duration. Figures 4.14 4.15 present the cumulative proportions of infants by durations of any breastfeeding, showing the associations of ‘any breastfeeding’ duration and maternal age and the time mothers returned to work, respectively.



**Figure 4.14 The association of breastfeeding duration and maternal age**



**Figure 4.15 The association of breastfeeding duration and age of infant when mother returned to work**

#### 4.4.2 'Full breastfeeding' duration

'Full breastfeeding' refers to infants whose main source of nourishment having been breastmilk. 'Full breastfeeding' includes 'exclusive breastfeeding' and 'predominant breastfeeding'. The infant may receive only breastmilk with no other liquids or solids (except vitamins, mineral supplements, or medications), or receives breastmilk and water, water-based drinks, fruit juice, oral rehydration salts (ORS), but no breastmilk substitutes or solids (Australian Food and Nutrition Monitoring Unit 2001).

Younger maternal age (Qiu, Binns, Zhao, Lee, et al. 2010), lower maternal education level (Chuang et al. 2010; Tarrant et al. 2010) and early return to employment (Chuang et al. 2010; Qiu, Binns, Zhao, Lee, et al. 2010) have been identified as risk factors for early breastfeeding cessation among Chinese population. However, relatively little is known about determinants of exclusive or full breastfeeding in a Chinese culture. Two previous cohort studies in Xinjiang Region and Zhejiang Province both found rather short duration of 'exclusive breastfeeding' (Qiu, Yun, et al. 2008; Xu, Binns, Zheng, et al. 2007). The situation was even worse in Jiangyou, with only one mother still exclusively breastfed at six months postpartum. To improve breastfeeding practices in rural areas of Sichuan Province, it is important to understand the risk factors related with 'exclusive breastfeeding' or 'full breastfeeding'. As only one woman was still 'exclusive breastfeeding' at six months after delivery in the present study, factors associated with the duration of 'full breastfeeding', instead of 'exclusive breastfeeding', were determined. Cox proportional hazard models were used to determine independent factors associated with the duration of 'full breastfeeding'.

Table 4.70 shows the results of univariate analyses about factors associated with 'full breastfeeding' duration. Contrary to what might be anticipated, mothers with higher education level (university) were more likely to stop full breastfeeding before six months than mothers with an education level of high school or lower (HR 1.92, 95% CI 1.37 to 2.68). Mothers who went back to work when the baby was at least 6 months old or with no job were more likely to be still full breastfeeding at 6 months postpartum (HR 0.57, 95% CI 0.42 to 0.78). Other listed factors were found to be not significantly associated with 'full breastfeeding' duration in the study.

**Table 4.70 ‘Full breastfeeding’ duration (months) and crude hazards ratio (95% CI) of discontinuing full breastfeeding at 6 months by potential factors**

Variables	n	Median duration (months) (95% CI)	Crude HR (95% CI)
<b>Maternal age (years)</b>			
< 25	234	5.00 (4.74, 5.26)	1.00
≥ 25	183	4.75 (4.36, 5.14)	1.13 (0.89, 1.44)
<b>Maternal education</b>			
High school or lower	367	5.00 (4.68, 5.33)	1.00
University	50	4.00 (3.80, 4.20)	1.92 (1.37, 2.68)
<b>Monthly family income (yuan<sup>*</sup>)</b>			
≤ 3000	215	5.00 (4.74, 5.26)	1.00
> 3000	168	4.75 (4.33, 5.18)	1.18 (0.91, 1.51)
<b>Parity</b>			
Primiparous	329	4.75 (4.52, 4.98)	1.00
Multiparous	88	5.00 (4.43, 5.57)	0.87 (0.65, 1.18)
<b>Baby’s gender</b>			
Male	199	4.85 (4.58, 5.11)	1.00
Female	218	4.75 (4.48, 5.03)	0.98 (0.77, 1.25)
<b>Baby’s birthweight (gram)</b>			
< 2500	4	4.00 (0.00, 8.94)	1.00
≥ 2500	413	4.75 (4.54, 4.96)	0.89 (0.29, 2.78)
<b>Delivery method</b>			
Vaginal delivery	81	5.00 (4.61, 5.40)	1.00
Caesarean section	184	4.75 (4.49, 5.02)	1.15 (0.89, 1.50)
<b>Time to first feed</b>			
Within one hour postpartum	42	5.00 (4.39, 5.61)	1.00
After one hour postpartum	374	4.75 (4.54, 4.96)	1.15 (0.75, 1.76)
<b>Attendance at antenatal class</b>			
No	344	5.00 (4.77, 5.23)	1.00
Yes	73	4.50 (4.06, 4.94)	1.27 (0.95, 1.71)
<b>Father’s feeding preference</b>			
Other <sup>†</sup>	47	5.25 (4.04, 6.46)	1.00
Breastfeeding	370	4.75 (4.54, 4.96)	1.35 (0.90, 2.02)
<b>Maternal grandmother’s feeding preference</b>			

Other <sup>†</sup>	30	5.75 (4.48, 7.03)	1.00
Breastfeeding	387	4.75 (4.54, 4.96)	1.50 (0.91, 2.49)
Maternal grandmother breastfed her children			
No	15	5.00 (4.42, 5.58)	1.00
Yes	397	4.75 (4.53, 4.98)	0.99 (0.52, 1.86)
Time of deciding feeding method			
Before pregnancy	231	4.75 (4.53, 4.97)	1.00
During pregnancy	123	4.75 (4.36, 5.14)	0.98 (0.74, 1.28)
After delivery	63	5.00 (4.08, 5.92)	0.85 (0.60, 1.22)
Age of infant when mother returned to work			
< 6 months	63	3.75 (3.37, 4.13)	1.00
≥ 6 months/no job	339	5.00 (4.71, 5.30)	0.57 (0.42, 0.78)

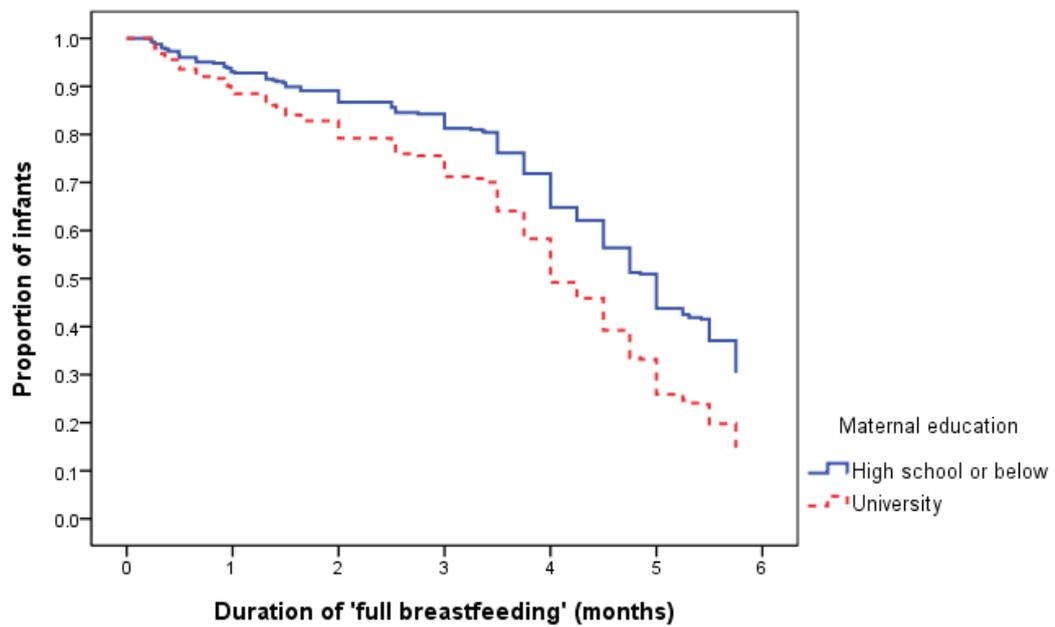
\* 1 Chinese yuan = 0.15 AUD

<sup>†</sup> formula feeding, did not mind how infants are fed or did not discuss it with the mother

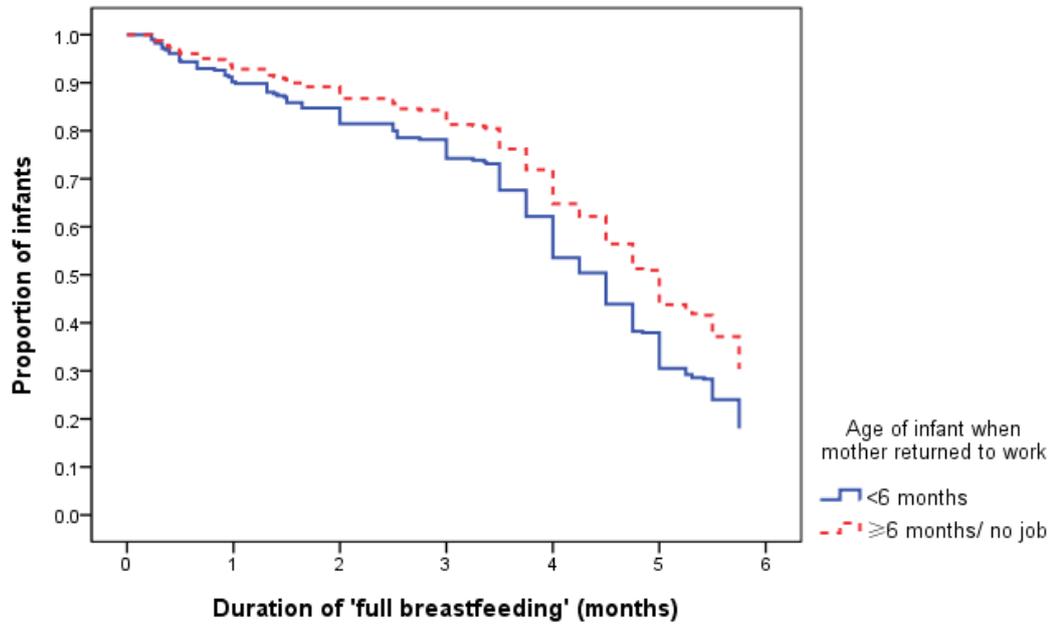
Multivariate backward stepwise Cox regression analyses were conducted to investigate factors independently associated with the risk of discontinuing ‘full breastfeeding’ before 6 months. The results are summarised in Table 4.71. The multivariate analyses demonstrated positive, independently significant association between shorter ‘full breastfeeding’ duration and maternal education level (aHR 1.65, 95% CI 1.13 to 2.42). In addition, ‘full breastfeeding’ duration was found to be independently associated with the age of infant when mother returned to work. Mothers who returned to work after six months postpartum or those with no job were less likely to stop full breastfeeding before 6 months (aHR 0.70, 95% CI 0.49 to 0.99). Figures 4.16 and 4.17 display the cumulative proportion of infants by duration of ‘full breastfeeding’, showing the differences between different maternal education levels in the length of ‘full breastfeeding’ and the associations between time to return to work and ‘full breastfeeding’ duration.

**Table 4.71 Factors independently associated with the risk of discontinuing ‘full breastfeeding’ before 6 months**

Variables	n	Adjusted HR (95% CI)	p
<b>Maternal education</b>			
High school or lower	321	1.00	
University	43	1.65 (1.13, 2.42)	0.009
<b>Age of infant when mother returned to work</b>			
< 6 months	59	1.00	
≥ 6 months/no job	305	0.70 (0.49, 0.99)	0.043



**Figure 4.16 Association between maternal education and ‘full breastfeeding’ duration**



**Figure 4.17 Association between time to return to work and 'full breastfeeding' duration**

## 4.5 Early introduction of complementary foods

The early introduction of complementary foods prior to 6 months of age may shorten breastfeeding duration (Martines, Ashworth & Kirkwood 1989; Qiu, Binns, Zhao, Lee, et al. 2010), expose the infant to increased rates of morbidity and mortality (Arifeen et al. 2001; Kalanda, Verhoeff & Brabin 2006), and initially cause poorer infant growth (Romulus-Nieuwelink et al. 2011). In the longer term, excessive use of complementary foods may lay the foundations for childhood obesity (Seach et al. 2010). According to the results of previous research in China, it is almost universal practice across the country to give infants complementary foods before the age of 6 months (Jiang et al. 2007; Luo, Tu & Feng 2004; Qiu, Yun, et al. 2008; Xu, Binns, Lee, et al. 2007a). Nevertheless, only a few studies have identified the factors associated with early introduction of complementary foods in China.

In the present study, Cox proportional hazard models were employed to determine risk factors of early introduction of complementary foods. Mothers who completed the six-month follow-up interview and did not introduce complementary foods contributed six months of follow-up to the model. Mothers who had unknown complementary feeding practices due to loss to follow-up only contributed follow-up time for which they were known to have not introduced complementary foods. They were censored at the time of their last interview.

In the univariate analysis, higher maternal education (HR 1.33, 95% CI 1.03 to 1.70), and introduction of infant formula within 6 months (HR 1.84, 95% CI 1.46 to 2.32) were associated with introducing complementary foods before 6 months. Multiparous mothers (HR 0.80, 95% CI 0.64 to 0.99), mothers who perceived most of their friends breastfed (HR 0.66, 95% CI 0.54 to 0.80) and those who returned to work after 6 months or had no job (HR 0.67, 95% CI 0.54 to 0.83) were at lower risk of early introduction of complementary foods (Table 4.72).

**Table 4.72 Median age of introducing complementary foods (CF) (months) and crude hazards ratio (95% CI) of introduction CF before 6 months by potential factors**

Variables	n	Median age of introducing CF (months) (95% CI)	Crude HR (95% CI)
<b>Maternal age (years)</b>			
< 25	396	4.50 (4.31, 4.69)	1.00
≥ 25	298	4.50 (4.36, 4.64)	1.05 (0.89, 1.25)
<b>Maternal education</b>			
High school or below	612	4.50 (4.40, 4.60)	1.00
University	82	4.00 (3.67, 4.33)	1.33 (1.03, 1.70)
<b>Family monthly income (yuan<sup>*</sup>)</b>			
≤ 3000	341	4.50 (4.41, 4.60)	1.00
> 3000	299	4.50 (4.35, 4.66)	1.12 (0.94, 1.33)
<b>Living independently</b>			
No	519	4.50 (4.40, 4.60)	1.00
Yes	175	4.50 (4.29, 4.71)	1.02 (0.84, 1.24)
<b>Parity</b>			
Primiparous	554	4.50 (4.40, 4.60)	1.00
Multiparous	140	4.50 (4.26, 4.75)	0.80 (0.64, 0.99)
<b>Baby's gender</b>			
Male	340	4.50 (4.36, 4.64)	1.00
Female	354	4.50 (4.35, 4.65)	1.08 (0.91, 1.27)
<b>Method of delivery</b>			
Vaginal delivery	198	4.50 (4.30, 4.70)	1.00
Caesarean section	496	4.25 (4.14, 4.36)	1.19 (0.99, 1.44)
<b>Attendance at antenatal class</b>			
No	565	4.50 (4.40, 4.60)	1.00
Yes	129	4.50 (4.16, 4.84)	0.97 (0.79, 1.20)
<b>Most friends breastfed their babies</b>			
No/do not know	233	4.00 (3.88, 4.12)	1.00
Yes	461	4.50 (4.36, 4.64)	0.66 (0.54, 0.80)
<b>Intended time of introducing CF</b>			
Within 6 months	505	4.50 (4.40, 4.60)	1.00
After 6 months	71	4.50 (3.78, 5.22)	0.84 (0.63, 1.12)

Do not know	118	4.50 (4.14, 4.86)	0.84 (0.66, 1.06)
Introduction of infant formula within 6 months			
No	126	5.00 (4.82, 5.18)	1.00
Yes	524	4.00 (3.90, 4.11)	1.84 (1.46, 2.32)
Satisfaction with baby's weight change			
Not satisfied/do not know	431	4.50 (4.39, 4.61)	1.00
Satisfied	219	4.50 (4.28, 4.72)	1.00 (0.84, 1.20)
Age of infant when mother returned to work			
< 6 months	113	4.00 (3.78, 4.23)	1.00
≥ 6 months/no job	540	4.50 (4.42, 4.58)	0.67 (0.54, 0.83)

\* 1 Chinese yuan = 0.15AUD

To explore risk factors independently associated with early complementary feeding, multivariate backward stepwise Cox proportional hazards regression was used. The results showed that after controlling for potential confounders, whether most friends breastfed their babies, the time of introducing infant formula and the age of infant when mother went back to work were independent significant determinants of early complementary feeding (Table 4.73).

If mothers perceived that most of her friends breastfed their infants, they were less likely to initiate complementary feeding prior to six months postpartum (aHR 0.70, 95% CI 0.58 to 0.84). Infants who were introduced to infant formula before 6 month of age were at a higher risk of receiving complementary foods prematurely compared to infants who did not have infant formula within 6 months after birth (aHR 1.81, 95% CI 1.42 to 2.31). In addition, mothers who returned to work when the infants were at least 6 months old or did not have jobs had lower hazards of introducing complementary foods early (aHR 0.73, 95% CI 0.58 to 0.91).

**Table 4.73 Factors independently and significantly associated with the risk of early introduction of complementary foods before 6 months**

Variables	n	Adjusted HR (95% CI)	p
Most friends breastfed their babies			
No/do not know	194	1.00	
Yes	407	0.70 (0.58, 0.84)	< 0.001
Introduction of infant formula within 6 months			
No	116	1.00	
Yes	485	1.81 (1.42, 2.31)	< 0.001
Age of infant when mother returned to work			
< 6 months	107	1.00	
≥ 6 months/no job	494	0.73 (0.58, 0.91)	0.005

## **4.6 Mastitis**

Mastitis is an inflammation of breast tissue. It is one of the most common problems experienced by breastfeeding mothers. The definition of mastitis case used in this study was self-reported symptoms of a pink, tender, hot, swollen area of the breast, accompanied by one or more of the following: i) an elevated temperature (either estimated or measured as being 38°C), ii) one of the constitutional symptoms of fever (body aches, headaches and chills) and iii) diagnosis of mastitis from a medical practitioner. Symptoms have to have been present for a minimum time of 24 hours (Kinlay, O'Connell & Kinlay 2001; Scott et al. 2008).

The proportional hazards Cox regression model was used to estimate the influences of potential risk factors on developing mastitis within 6 months postpartum. Some women might have repeated mastitis, but the risk factors for the first episode of mastitis were explored in this study. Women who stopped breastfeeding before 6 months and were known to be free of mastitis were censored at the time breastfeeding ceased.

### **Incidence of mastitis**

Forty two lactating mothers suffered at least one episode of mastitis during the first six months postpartum. The incidence of the first episode of mastitis was 7.4% (95% CI 5.2 to 9.5). Among these 42 mothers with mastitis, 25 suffered only one episode of mastitis, 12 suffered two episodes and 5 suffered three or more episodes, leading to a total of 69 mastitis episodes. Consistent with the findings of several previous studies, one-half of the first mastitis episodes occurred during the first 4 weeks in Jiangyou (Amir et al. 2007; Scott et al. 2008).

### **Factors associated with mastitis**

The crude hazard ratios of developing mastitis within 6 months postpartum are shown in Table 4.74. Mastitis was more likely to occur in women who sometimes, often or always felt stressed than those who had not or seldom felt stressed (HR 2.42, 95% CI 1.07 to 5.44). A cracked and sore nipple was significantly associated with an increased risk of mastitis (HR 2.01, 95% CI 1.10 to 3.68).

**Table 4.74 Crude hazard ratio (95% CI) of developing mastitis during the first six months postpartum by potential factors**

Variables	n	% with mastitis	Crude HR (95% CI)	p
<b>Maternal age (years)</b>				
< 25	379	6.9	1.00	
≥ 25	285	5.6	0.79 (0.42, 1.47)	0.458
<b>Maternal education</b>				
High school or below	584	6.5	1.00	
University	80	5.0	0.77 (0.27, 2.15)	0.616
<b>Maternal occupation</b>				
No job	206	8.3	1.00	
Employed	458	5.5	0.63 (0.34, 1.17)	0.143
<b>Parity</b>				
Primiparous	532	6.0	1.00	
Multiparous	132	7.6	1.28 (0.63, 2.60)	0.496
<b>Tea drinking before or during pregnancy</b>				
No/on special occasions	540	6.9	1.00	
At least a few cups a week	124	4.0	0.58 (0.23, 1.49)	0.259
<b>Mother felt stressed</b>				
No/seldom	227	3.1	1.00	
Sometimes/often/always	437	8.0	2.42 (1.07, 5.44)	0.033
<b>Cracked and sore nipples</b>				
No	423	4.4	1.00	
Yes	241	9.5	2.01 (1.10, 3.68)	0.024
<b>Engorged breasts</b>				
No	169	4.7	1.00	
Yes	495	6.9	1.34 (0.62, 2.90)	0.456
<b>Empty breasts when felt breasts were full</b>				
No/seldom/sometimes	475	6.9	1.00	
Often/always	18	4.8	0.66 (0.34, 1.48)	0.355
<b>Breastfed baby for longer than 30 minutes</b>				
No	569	5.9	1.00	
Yes	95	8.4	1.37 (0.63, 2.96)	0.425

To control for potential confounders, all the variables presents in Table 4.74 were entered into a backward stepwise Cox regression model. The results showed that whether mothers felt stressed or with cracked and sore nipples were independently significant factors for mastitis (Table 4.75). Stressed mothers were more likely to develop mastitis after adjusting for possible confounding factors (aHR 2.34, 95% CI 1.04 to 5.27). In addition, mothers with a cracked and sore nipple were also at a higher risk of having mastitis compared to mothers who did not (aHR 1.95, 95% CI 1.06 to 3.57).

**Table 4.75 Factors independently associated with the risk of developing mastitis within 6 months postpartum**

Variables	n	Adjusted HR (95% CI)	p
Mother felt stressed			
No/seldom	227	1.00	
Sometimes/often/always	437	2.34 (1.04, 5.27)	0.040
Cracked and sore nipples			
No	423	1.00	
Yes	241	1.95 (1.06, 3.57)	0.031

To our knowledge, this study is the first to explore the factors of lactation mastitis among Chinese population. The findings support previous studies that cracked and sore nipples and maternal stress were associated with increased risk of developing mastitis. A cohort study conducted in Australia found similar results that women with cracked nipples had a greater risk of mastitis after controlling confounders (aHR 1.44, 95% CI 1.00 to 2.07) (Kinlay, O'Connell & Kinlay 2001). Also, Foxman et al. identified nipple cracks and sores as mastitis risk factors (Foxman et al. 2002). It is because that nipple trauma enhances the entry of bacteria into breast tissue. Nearly 30% of women reported cracked or sore nipples at discharge in Jiangyou, which is similar with the proportion documented by Foxman et al. (Foxman et al. 2002). In a review on lactation, Neifert states that sever nipple pain and trauma that continues after the first few days after delivery should not be considered a normal part of beastfeeding (Neifert 1999). Persistent sore nipples are commonly caused by poor positioning of the infant and/or poor latch-on (Tait 2000). The Academy of Breastfeeding Medicine suggests mothers be able to correctly position the baby at the

breast with no pain during the feeding prior to discharge from hospital (Philipp & Academy of Breastfeeding Medicine Protocol Committee 2010).

Maternal self-reported stress was found to be another predictor of lactation mastitis. Mothers who felt stressed were more likely to develop mastitis later during the course of breastfeeding. Teaching mothers with newborns how to deal with stress by providing coping strategies may be helpful to reduce the incidence of mastitis. Moreover, the family members, especially husbands, should be encouraged to provide practical assistance and emotional support for mothers when needed.

Although a past history of mastitis was identified as a risk factor of mastitis in previous studies (Foxman et al. 2002; Jonsson & Pulkkinen 1994; Kinlay, O'Connell & Kinlay 2001), only 6 mothers had experienced lactation mastitis in this study. Thus mothers' past history of mastitis was not included in the proportional hazards Cox regression model due to such a small number of cases

### **Mastitis and breastfeeding duration**

The Kaplan-Meier test was performed to determine if the duration of breastfeeding differed between women who developed mastitis and women who did not. The results showed that of the 42 mothers who developed mastitis, the median duration of breastfeeding was 8 months (95% CI 7.8 to 8.2). The median breastfeeding duration of the remaining women was also 8 months (95% CI 7.7 to 8.3). There were no significant differences in breastfeeding duration between those two groups of mothers (Log-rank test  $\chi^2 = 0.30$ ,  $df = 1$ ,  $p = 0.586$ ).

## **Chapter 5 Discussion**

In this chapter, the results presented in the previous chapter are discussed in relation to the aims of the study, which were to investigate the infant feeding practices and their determinants and to examine the breastfeeding problems experienced by mothers in rural Sichuan, China. In the discussion related with each specific objective, comparisons between the main findings in the present study and those in the literature are also reported.

The participation rate of this study was high at 96% on discharge. At the end of 12 months postpartum, contact was made with 72% of the sample, a high rate given the current internal migration rates of rural China. The final sample was still within the calculated minimum sample size requirements. The sample size was large enough to reflect the major variations of infant feeding practices in the population of Jiangyou.

### **5.1 Early breastfeeding initiation within one hour and prelacteal feeds**

Only 9.1% mothers initiated breastfeeding within one hour postpartum and more than 93% infants received prelacteal feeds in Jiangyou. In published studies, extremely low rates of early initiation of breastfeeding have been reported from several parts of China: for example 0% and 2.8% mothers initiated breastfeeding within 12 hours of birth in Shaanxi and Henan Provinces, respectively (Fu 2006; Shen, Fang & Luo 2002). Shen et al. believed that the majority of mothers in Henan Province, delayed initiating breastfeeding until the second or third day postpartum because of a traditional belief that breastfeeding should not be initiated until the breasts become engorged (Shen, Fang & Luo 2002). The prevalence of initiating breastfeeding within the first hour of life in the current study was comparable with that found in Hebei Province (18%) (Shi et al. 2008), although it was much lower than those documented in studies from Hong Kong (25%) (Tarrant et al. 2011), Heilongjiang, Jilin, and Liaoning Province, where around half of the newborn infants began consuming breastmilk within half an hour after birth (Jiang & Li 2008; Song

2008; Xia & Gao 2007; Zhang & Yang 2009). The prevalence of early breastfeeding initiation in Jiangyou was also found to be greatly lower than those reported in national surveys conducted in several Asian countries, such as 45.6% in Vietnam (Dibley, Senarath & Agho 2010), 43.6% in Philippines (Dibley, Senarath & Agho 2010), 35.4% in Nepal (Pandey et al. 2010), and 23.5% in India (Patel et al. 2010; Tang, Binns, et al. 2013).

Less than 7% of newborn infants received the colostrum or breastmilk as their first feed in Jiangyou. The prelacteal feed rate was higher than reported in previous studies in China where rates were 26% and 53.3% in urban Zhejiang Province and Xinjiang Uygur Autonomous Region, respectively (Qiu et al. 2007; Xu, Binns, Yu, et al. 2007a). The most common prelacteal foods used in Jiangyou were infant formula and plain water, which is consistent with previous studies in China (Qiu et al. 2007; Tang, Binns, et al. 2013; Zhao et al. 2003).

The rather disappointing breastfeeding practices in the immediate postpartum period in Jiangyou are in line with the findings of a small survey conducted immediately after the Sichuan earthquake in 2008 (Bengin et al. 2010). In that survey only 4 out of 31 mothers initiated breastfeeding within one hour after birth, and 26 of the 27 breastfed babies received infant formula prelacteally, while the other breastfed babies were given water as first feed (Bengin et al. 2010; Tang, Binns, et al. 2013).

There is no published data available on the rates of early breastfeeding initiation or prelacteal feeding in Jiangyou or other rural areas of Sichuan Province prior to the major earthquake in 2008. It is not possible to confirm whether the near-universal practice of delaying breastfeeding initiation or feeding prelacteal foods in that area has been influenced by the earthquake and whether the widespread distribution of infant formula occurred at that time. However, it is important that all the maternity service providers in Jiangyou should implement Step Four of the Baby Friendly Hospital Initiative (WHO & UNICEF 2009) – and that was not happening (Tang, Binns, et al. 2013).

To some extent, all three of the determinants of early breastfeeding initiation in the study are correlated with the maternity services providers' practices. This differs

from the findings of several previous studies (Rowe-Murray & Fisher 2002; Vieira et al. 2010).

Mothers who gave birth at township health centres had a much lower rate of breastfeeding initiation within one hour of birth than those who delivered at hospitals. Despite this being the first study to evaluate the impact of giving birth at township health centres on early breastfeeding initiation, the result was not surprising. Generally, township health centres in China are not comparable with hospitals in terms of professional training of staff provision for continuing education, working environment and medical equipment. The results of the study suggest that in order to improve breastfeeding practices in rural areas, further investment in professional training with regard to breastfeeding is required for township health centres. In addition, an implementation plan needs to be in place and to be followed. While the prevalence of early breastfeeding initiation was higher in hospitals, it still fell significantly below optimum levels (Tang, Binns, et al. 2013).

In the study a higher proportion of women who attended antenatal classes for this or a previous pregnancy more often initiated breastfeeding early than did those who had not attended these classes. This is consistent with the results of a study in Brazil where a positive association between prenatal education with guidance on the benefits of breastfeeding and higher rates of breastfeeding initiation within the first hour of life was identified (Vieira et al. 2010). Less than 20% of women in the present study had attended antenatal classes during their pregnancy. In Jiangyou, the first and primary source of information on breastfeeding was the woman's mother or mother-in-law (47%) rather than health professionals (28%). Previous studies have shown that prenatal breastfeeding education programs can exert a positive influence on the initiation of breastfeeding (Fairbank et al. 2000). To encourage successful breastfeeding, the WHO states that all pregnant women should be informed about the benefits of breastfeeding as well as early initiation during antenatal education (WHO & UNICEF 2009). Reasons why the antenatal class attendance was low need to be explored and effective measures can then be taken to make antenatal classes accessible to pregnant women in rural Sichuan (Tang, Binns, et al. 2013).

There was a significant association between receiving encouragement for early initiation from hospital staff and putting baby to breast right after delivery. Again, this emphasised the importance of the role of maternity services providers played in the early initiation of breastfeeding. Only about 60% of mothers in the research were told by the hospital staff to start breastfeeding soon after delivery. If doctors and nurses always encourage and help mothers to put their newborn infants to the breast right after delivery, the rate of early breastfeeding initiation would be improved (Tang, Binns, et al. 2013).

In the study we have found that caesarean section delivery is not associated with lower rates of early breastfeeding initiation, which is different from the findings of several previous studies (Chien & Tai 2007; Vieira et al. 2010). However, it should be noted that the rates of caesarean section were high in the present study, with 77.3% at hospitals and 59.4% at township health centres. The sample size may not be large enough to detect a difference.

As a matter of fact, obviously rising rates of caesarean section have been seen around China since 1990s (Sufang et al. 2007). A survey examining delivery methods and pregnancy outcomes in Asia carried out by the WHO in 2007–2008 reported a caesarean section rate of 46.2% in China (Lumbiganon et al. 2010). Some studies carried out in different parts of China even found higher caesarean section rates. For instance, a longitudinal cohort study about breastfeeding in Zhejiang Province documented that the caesarean section rate was 76% in the city, 74% in the suburbs and 53% in the rural area (Qiu, Binns, et al. 2008).

The WHO suggests that the caesarean section rate should be within the range of 12% to 15%, although very few countries have rates as low as such a range (Chalmers 1992). Caesarean section is associated with a higher risk of postpartum depression and neonatal respiratory problems and other cause of maternal and infant morbidity, compared with natural vaginal delivery (Pasupathy & Smith 2008; Steer & Modi 2009). In addition, delivery by caesarean section requires additional health care resources and imposes a considerable cost burden on the health system and families. According to Qin et al., fear of pain during vaginal delivery, believing that caesarean section is safer and better for the baby and preferring the baby to be born at a

particular time were the main reasons Chinese mothers asked for caesarean. Maternity health staff were also responsible for the high rate of elective caesarean section as they often did not strictly assess the indications for caesarean section (Qin et al. 2011; Tang, Pan, et al. 2013).

There are three points that need to be considered when interpreting the results of early breastfeeding initiation rate and its associated factors. Firstly, the timing of breastfeeding initiation was dependent on maternal recall at discharge. However since the questions were asked within a few days of the event it is unlikely that significant recall errors occurred. Secondly, previous studies have found that time the infant spent with the mother and supplementary feeding are important factors in breastfeeding. They were not included in the models in this study as almost all (99.3%) infants spent 24 hours a day with the mother in the same room after birth. Therefore, “rooming-in” was not considered as a factor associated with breastfeeding behaviour at discharge. Thirdly, the rates of prelacteal feeds (and hence supplementary feeding) are so great (93.8%) that this factor was not incorporated into the model (Tang, Binns, et al. 2013).

## **5.2 Breastfeeding at discharge**

The ‘any breastfeeding’ rate of 93.5% (95% CI 91.7 to 95.3%) at discharge found in this study was similar to that seen in the Xinjiang Uygur Autonomous Region (92.2%, 95% CI 90.7 to 93.7 %) (Xu, Binns, Yu, et al. 2007a). The rate was higher than those found in Taiwanese (84.1%, 95% CI 82.3 to 85.9%) (Chuang et al. 2007) and in Hong Kong women (33.5%, 95% CI 32.5 to 34.5%) (Leung, Ho & Lam 2002). However, it was lower than the rate documented in a study from rural Zhejiang Province which was 97.4% (95% CI 96.0 to 98.8%) (Qiu et al. 2009). Compared to recent breastfeeding rates at discharge in other Asian countries, the breastfeeding rate in our study was lower than that in rural Vietnam (98.3%, 95% CI 97.1 to 99.5%) (Duong, Binns & Lee 2004), however, it was higher than the rates from a national survey of South Korea (81.3%, 95% CI 78.7 to 83.9%) (Chung, Kim & Nam 2008) and in a study of Singaporean Chinese (77.0%, 95% CI 75.5 to 78.5%) (Hornbeak et al. 2010). In comparison to western countries, the breastfeeding rate at

discharge was close to that reported in Australia 93.8% (95% CI 91.9 to 95.7%) (Scott, Binns, Graham, et al. 2006), and higher than that found in the United States (73.4%, 95% CI 72.4 to 74.4%) (Centers for Disease Control and Prevention 2010).

Among the 45 mothers who were not breastfeeding at discharge, 13 did not commence breastfeeding because of hepatitis B infection. Hepatitis B is one of the most widespread global infections with an estimated 2 billion people showing evidence of past infection and more than 240 million have long-term liver infections (WHO 2012b). In China, the rate of chronic hepatitis B virus (HBV) infection varied between 5% and 18% (Chen, Wang & Yu 2000). Worldwide, about 5% of mothers are chronic HBV carriers (Qiu, Binns, Zhao, Zhang, et al. 2010; WHO 1996). A population-based study in Hong Kong found a lower breastfeeding initiation rate that is associated with maternal HBV infection. Mother-to-child transmission was believed to be mothers' main concern for not breastfeeding (Tong Leung et al. 2012). It is possible that such an explanation also applies to mothers with HBV in Jiangyou for not initiating breastfeeding. However, the WHO reported there is no evidence that breastfeeding from HBV infected mothers would elevate the risk of HBV infection to her infant, even without immunization. Thus, breastmilk remains the ideal food for infants even in a population where HBV infection is highly endemic and immunization against HBV is not available (WHO 1996).

'Mothers' perceptions of paternal attitudes towards breastfeeding' was an important determinant of breastfeeding at discharge in this study. The proportion of mothers who were breastfeeding at discharge was significantly higher in those who perceived partners preferred breastfeeding. This finding was in line with a number of studies in western countries (Arora et al. 2000; Bar-Yam & Darby 1997; Cohen, Lange & Slusser 2002; Littman, Medendorp & Goldfarb 1994; Scott & Binns 1999; Scott, Binns, Graham, et al. 2006). As the results of the limited studies of Chinese women about the influence of paternal attitudes on breastfeeding outcomes have been inconsistent (Chang & Chan 2003; Li et al. 2004; Qiu et al. 2007), the results of this study provide new evidence of fathers' importance in the rate of breastfeeding at discharge in rural China.

Although father's true attitudes may be biased by the mothers' opinions, it is reasonable to speculate that the rates of breastfeeding at discharge in rural China could be improved if fathers advocated breastfeeding. Approximately 14% of fathers reported to prefer bottle feeding or be unsure about which feeding method should be used for their infant. To persuade fathers to support breastfeeding, it would be helpful to find out the reasons why fathers prefer their babies not to be breastfed. Unfortunately, there are no previous studies reported from China which have explored the reasons for father's feeding preference.

In the study by Giuglianni et al., fathers of bottle fed babies had a poorer understanding of the advantages of breastfeeding compared to fathers of breastfed babies. In addition, it was shown that most fathers believed that breastfeeding is painful and that it was impossible to prevent sore or cracked nipples (Giugliani, Bronner, et al. 1994). Similarly, in a study which assessed expectant fathers' attitudes towards breastfeeding, fathers whose partners planned to breastfeed exclusively were better well-informed about breastfeeding, while fathers whose partners planned to give their babies formula were more likely to believe that breastfeeding is not nature, is bad for breasts, makes breasts ugly and interferes with sex (Freed, Fraley & Schanler 1992). It is reasonable to speculate that poor knowledge of breastfeeding is also correlated with fathers' preference of bottle feeding or ambivalent attitude of feeding method in rural China.

Traditionally, prenatal education programs have been targeted at women by providing information on the benefits of breastfeeding and nursing techniques to promote breastfeeding (Kaplowitz & Olson 1983). More recently breastfeeding intervention programs targeting expectant fathers have been instituted with a positive impact on breastfeeding outcomes. For example, a randomised controlled trial of 59 expectant parents was conducted at Johns Hopkins Hospital to examine the effectiveness of a two-hour education class for expectant fathers on breastfeeding outcomes. It was shown that breastfeeding was initiated by a significantly larger proportion of women among the group whose partner attended the breastfeeding class than women whose partners attended only baby care classes (Wolfberg et al. 2004). A controlled clinical trial with the intervention of training fathers how to prevent and manage lactation problems found a higher rate of full breastfeeding at 6

months in the intervention group (Pisacane et al. 2005). Moreover, another controlled clinical trial in Brazil which included 586 expectant parents showed that the inclusion of fathers in a breastfeeding promotion program could increase the rates of exclusive breastfeeding within the first six months of life (Odeh Susin & Justo Giugliani 2008).

No studies were found to have evaluated the effect of inclusion fathers in intervention programs on breastfeeding among Chinese population. Future research investigating paternal participation in intervention programs and breastfeeding practices may help to better understanding of fathers' role in breastfeeding in China.

Maternity services providers' attitude also played a major role in helping mothers to start breastfeeding. We found that mothers who were encouraged by health facility staff with breastfeeding during hospital stay were more likely to be breastfeeding at discharge. This was consistent with a study of Chinese mothers in Australia, which demonstrated that 'any breastfeeding' rate at discharge was higher among women who perceived doctor's support of breastfeeding than those who did not think their doctor were supportive of breastfeeding (Li et al. 2004). Thus, the education on maternity services providers regarding the importance of their role in supporting mothers with breastfeeding is essential in Jiangyou.

Research in different cultures has shown that the timing of making feeding decision was related to breastfeeding outcomes (Qiu, Binns, Zhao, Lee, et al. 2010; Scott, Binns, Graham, et al. 2006; Xu, Binns, Zheng, et al. 2007). In this study, the timing of deciding feeding method was associated with breastfeeding initiation. Mothers who made up the infant feeding decision before pregnancy were more likely to be breastfeeding at discharge than those who made the decision during pregnancy or after birth. In Jiangyou, only half of the mothers made the decision of feeding method before pregnancy, and about 18% chose the feeding method after delivery. Public education in rural Sichuan Province, addressing the issue of attracting women to make their decision of breastfeeding before pregnancy, may lead to a higher rate of breastfeeding at discharge.

Because of diverse local conditions and different methodology used in studies, there has been a lack of consistency in the effects of socio-demographic factors on breastfeeding at discharge in Chinese mothers (Chang & Chan 2003; Hornbeak et al. 2010; Leung, Ho & Lam 2002; Qiu, Binns, Zhao, Lee, et al. 2010; Tarrant et al. 2010; Xu, Binns, Yu, et al. 2007a). In this study, we did not detect any association between socio-demographic or biomedical factors and breastfeeding at discharge.

A large number of studies in developed societies have found that women with higher level of education are more likely to have better breastfeeding practices (Hauck et al. 2011; Li et al. 2004; Rasenack et al. 2012; Scott et al. 2001; Tarrant et al. 2010). However, the relationship sometimes reverses in less developed societies (Chang & Chan 2003; Haku 2007). In this study, we failed to find any association between maternal education and breastfeeding at discharge. As a matter of fact, there are few tertiary study opportunities in Jiangyou, and most mothers with university degrees studied in urban areas. It is possible that these highly educated mothers who were supposed to be more aware of breastfeeding benefits were also more influenced by the formula feeding subculture of urban areas. Therefore, no association between education and breastfeeding at discharge was observed in this study.

### **5.3 Breastfeeding duration**

Only a few studies have investigated the duration of breastfeeding to 12 months in China. A cross-sectional study of infants and children under 3 years old in 10 provinces of rural western China in 2005 reported that the median breastfeeding duration was 14 months in the northwest of China and 12 months in the southwest of China (Liang, Yan & Zeng 2007). The median breastfeeding duration (8 months) found in the present study was shorter than this 2005 study, but it was similar to another cross-sectional survey of 783 infants and children under 2 years in rural Sichuan. The survey conducted in Sichuan Province in 2007 showed that 58.3% infants were receiving breastmilk at the age of 6 months and the average weaning time was 7.6 months (Yan et al. 2009).

The proportion of infants who were breastfed within 6 months after delivery in our study was higher than those found in some other regions and countries such as Hong Kong, Australia and USA. However, the sharp decline of ‘any breastfeeding’ rate from 6 to 12 months of infant’s birth in Jiangyou resulted in an equal or lower proportion of infants receiving breastmilk at the age of 12 months compared to others studies (Centers for Disease Control and Prevention 2010; Scott, Binns, Oddy, et al. 2006; Tarrant et al. 2010). For example, the percentages of infants who were still receiving any breastmilk at 1, 3, 6, 12 months in this study versus those reported by a recent prospective study in Hong Kong were 92.7% vs. 63.0%, 85.1% vs. 37.3%, 65.1% vs. 26.9%, and 12.9% vs. 12.5%, respectively (Tarrant et al. 2010). The relatively high breastfeeding rates within 6 months and low prevalence of breastfeeding at 12 months may reflect that mothers in this study had been aware of the necessity of breastfeeding, but were not well informed about the benefits of prolonged breastfeeding duration. Therefore, programs emphasising the preferred breastfeeding duration to 24 months or longer could be useful in this rural area.

Research in different cultures has found that older women are generally more likely to choose breastfeeding and breastfeed for a longer period than their younger counterparts (Chaves, Lamounier & Cesar 2007; Chuang et al. 2007; Forster, McLachlan & Lumley 2006; Scott et al. 2001). Similarly, this study showed that mothers aged 25 years old or over were more likely to have longer breastfeeding duration than women aged below 25 years (Figure 4.14). While maternal age is an unchangeable factor, proper breastfeeding education among younger mothers may improve breastfeeding practices in the rural area of Sichuan Province.

No previous studies have evaluated the association between health facility where a baby was delivered and the duration of breastfeeding in China. It was surprising to find in this study that mothers who gave birth at township health centres breastfed for a relatively longer period than mothers who delivered at hospitals. In Jiangyou, a baby is usually taken to the health facility where he/she was born at to receive regular health care services after birth. It is possible that information about infant feeding mothers obtained from the health facilities had affected their breastfeeding behaviours. However, to find a definite relationship between health facility and breastfeeding duration, further research is needed.

Mother's intended breastfeeding duration has been consistently reported as a strong predictor of actual breastfeeding duration (Donath & Amir 2003; Forster, McLachlan & Lumley 2006). We found that women who intended to breastfeed for longer than 6 months were more likely to continue breastfeeding at 12 months postpartum. Apart from advising women to breastfeed longer in future breastfeeding education programs, knowing about expectant mothers' intended breastfeeding duration may help health workers to identify women with a higher risk of a short period of breastfeeding. Therefore, attention should be paid to these women during post-delivery visit to increase breastfeeding duration.

Feeding infants breastmilk without any other foods or liquids for the first 6 months of life is recommended by the WHO to protect babies against morbidity, especially diarrhoea and respiratory illness (WHO 2009). In this study, we found that introducing solid foods before 6 months was associated with shorter duration of breastfeeding at the first year of infant's life. This is consistent with the results of several previous studies (Scott et al. 2009; Vingraite, Bartkeviciute & Michaelsen 2004). It was shown that around 76% infants were introduced to solid foods before they were aged 6 months in Jiangyou. The early introduction rate was similar to the 77.6% documented in Xingjiang, China (Xu, Binns, Lee, et al. 2007a). Many other studies also indicated the universal practices of premature introduction of solid foods in different parts of China (Jiang et al. 2007; Sun et al. 2011; Wang, Kang & Wang 2000; Yang et al. 2011; Zhao et al. 2001). There is an urgent need for exerting greater efforts to educate mothers in China that solid foods are unnecessary for infants within 6 months.

We did not find an association between maternal employment and the initiation of breastfeeding. However, mothers breastfed shorter if they those who returned to work within 6 months after giving birth compared with women who returned to work after 6 months or were not employed (Figure 4.15). Early returning to work has been shown to be one of the barriers to extended breastfeeding in several studies (Chuang et al. 2010; Ladomenou, Kafatos & Galanakis 2007; Scott, Binns, Oddy, et al. 2006). In China, the mandated maternity leave period is 90 days (The State Council of the People's Republic of China 2005). Prolonging the maternity leave period will be an

effective measure to extend the breastfeeding duration. Nevertheless, a realistic mean to weaken the negative impact of early maternal return to work on breastfeeding would be making working environment friendly to breastfeeding mothers. Meanwhile, providing mothers with information on how to continue breastfeeding after returning to work and emphasising the disadvantages of infant formula feeding for baby's health would contribute to prolonged breastfeeding duration in Jiangyou.

In addition, the practice of 'exclusive breastfeeding' for the first 6 months of life was less than recommended in Jiangyou. Prelacteal feeding contributed largely to the extremely low 'exclusive breastfeeding' rate at discharge (only 7 out of 695 were exclusively breastfeeding at discharge). Later, giving infants water while breastfeeding and prematurely introducing complementary foods worsened the infant feeding practice in this area. At six months postpartum, only one mother was still exclusively breastfeeding.

Like some other parts of China (Xu, Binns, Lee, et al. 2007a), giving infants water prior to six months of age was a universal practice in Jiangyou. According to the WHO, even non-caloric fluids affect breastmilk intake. Infants who were given water had lower breastmilk intake compared to those who received no extra fluids (WHO 1998a). In addition, it has been determined that there is no need to provide extra liquids to breastfed babies to satisfy their fluid requirement even in hot climates (WHO 1998a).

On the other hand, it was also found in Jiangyou that mothers who went back to work before the baby was six months old were less likely to be fully breastfeeding at six months postpartum than those who returned to work after six months or those who were not employed. Similarly, returning to employment before infants were 6 months old has been found to be a risk factor of stopping fully breastfeeding before 6 months in an Australian population (Scott, Binns, Oddy, et al. 2006). One previous study in Hong Kong reported that mothers returning to employment believe that to make the transition back to work easier and to get the baby be used to infant formula, it is best to use some infant formula from the beginning (Tarrant et al. 2010). A similar explanation may be applicable to this study that shorter 'full breastfeeding' duration observed among mothers who returned to work earlier. The benefits of 'exclusive

breastfeeding’, as well as the risk of infant formula supplementary feeding should be stressed in any future breastfeeding promotion programs in rural China.

Unexpectedly, it was found in the present study that higher maternal education level was associated with a shorter duration of ‘full breastfeeding’. Higher maternal education level has been shown to be a protective factor of ceasing breastfeeding among diverse cultural communities (Amin, Hablas & Al Qader 2011; Grjibovski et al. 2005; Hornbeak et al. 2010; Kohlhuber et al. 2008; Riva et al. 1999; Scott et al. 2001). A cohort study determining maternal and infant characteristics associated with ‘full breastfeeding’ in Australia found that mothers with lower education were more likely to transit from full to no breastfeeding in the first month postpartum than women having bachelor degree or higher (Baxter, Cooklin & Smith 2009). The reasons why rural Chinese mothers with higher education level were more likely to stop ‘full breastfeeding’ before six months postpartum warrant further research.

#### **5.4 Early introduction of complementary foods**

Complementary feeding documented in this study indicates poor adherence to the WHO recommendations in this rural area of Sichuan Province. Infants were introduced to complementary foods too early (27% infants had received complementary foods by 4 months of age). This is in lines with the findings of previous cohort studies in Xinjiang and Zhejiang Province (Qiu, Yun, et al. 2008; Xu, Binns, Lee, et al. 2007a). Public health interventions to improve appropriate complementary feeding practices are needed in rural Sichuan with special focus on high risk groups.

The introduction of infant formula within 6 months was shown to be a risk determinant associated with the premature introduction of complementary foods. In Jiangyou, about 4 in 5 infants had received some infant formula within 6 months of birth. Many mothers stated that they gave their infants formula because they wanted their babies to start getting used to bottle feeding as well as the flavour of formula, so that they could wean in the following several months. As reported in the previous section (*See Section 4.1.4 Breastfeeding duration p79*), prolonged breastfeeding was not popular in Jiangyou. It is reasonable to expect that the interventions which could

help extend breastfeeding duration may also help delay or eliminate the introduction of infant formula. As a result, the unhealthy early introduction of complementary foods might be reduced in Jiangyou.

According to Qiu et al., a common reason for giving formula or complementary food in Zhejiang Province is the traditional belief that ‘the more or the quicker the baby gained weight, the healthier the baby is’ (Qiu, Yun, et al. 2008). It is commonly assumed in China that a chubby baby equals a healthy baby. However, we did not find an association between mothers’ satisfaction with infant’s weight change and complementary feeding in this study. In rural Vietnam, women who live in an extended family were less likely to feed their infants with solid foods early, as family members were available to share housework (Duong, Binns & Lee 2005). However, in Jiangyou, no association between living independently and early introduction of complementary foods was identified.

Mothers’ perception about their friends’ feeding methods was shown to be a strong determinant of early complementary feeding. It is possible that a mother who thought most of her friends breastfed would more likely to breastfeed for a longer duration and thus less likely to introduce complementary foods early. However, no previous studies have explored the relation between premature introduction of complementary food and friends’ feeding methods. To have a clear explanation of the effect of friends’ feeding methods on early complementary feeding, further studies in this area are needed.

As expected, mothers who did not return to employment before 6 months postpartum and mothers who were not employed were less likely to prematurely introduce complementary foods. It is consistent with our findings about factors related with breastfeeding duration, where mothers who had to return to work before 6 month after delivery were at a higher risk of weaning early. Thus, providing mothers with information and knowledge on how to continue breastfeeding after return to work and emphasising the importance of ‘exclusive breastfeeding’ within 6 months will probably decrease the prevalence of early complementary feeding in Jiangyou.

In the present study, return to work early was found to be an important factor associated with poor infant feeding behaviours. Return to employment before infants were 6 months was a risk factor of early introduction of complementary foods. Time of return to work was also associated with the duration of both ‘any breastfeeding’ and ‘full breastfeeding’. A recent US cohort study with a large nationally representative sample size aiming at investigating the effect of return to work on breastfeeding also found that delayed return to work could lengthen the duration of any and predominant breastfeeding (Ogbuanu et al. 2011).

In most rural areas of Sichuan Province, there are a considerable number of people including women working in big cities within the province or other parts of China. For many of them, their socioeconomic status does not allow them any other choice. It is a traditional custom for Chinese women to be confined for a period of 30 or 40 days after giving birth, and follow a specific set of behaviours in both dietary and exercises, known as ‘doing the month’ or ‘zuoyuezi’ (Tien 2004). As a result, in most cases, rural women who work far away from home will go back to their hometown several months before delivery so that they and their infants can be taken care of by their mothers, mothers-in-law or other family members after birth. Usually a period of six months to one year later, women will then return to big cities to continue their employment.

The median age of infants when mothers returned to work was 16 weeks in Jiangyou. Among the 114 mothers who went back to work within 6 months postpartum, 76 mothers (66.67%) reported that they could continue breastfeeding after returning to employment. The main reasons that the rest 38 mothers gave for weaning after back to work included ‘my work place is in another city’ (39.5%), ‘I can’t bring the baby to my workplace’ (18.4%), ‘I don’t have time to take care of the baby’ (18.4%) and ‘I don’t have time to breastfeed the baby’ (15.8%). In addition, among mothers who breastfed their babies during work, less than 30% breastfed in an isolated room, 64.3% breastfed at home, and 7.1% in public place.

To increase breastfeeding duration and appropriate complementary feeding practices in Jiangyou, it will be necessary to overcome the negative impact of mothers returning to work on infant feeding practices. Employers should be encouraged to

make workplaces more breastfeeding friendly. Providing lactating mothers with options to work part-time, flexible work schedules, breastfeeding breaks and designated places for expressing milk or breastfeeding, would help them maintain breastfeeding after return to work. Based on the findings of the study, many mothers had to wean or introduce complementary foods early because they worked far away from home. An employer-sponsored on-site or near-site day care would be beneficial in encouraging a longer breastfeeding duration and timely complementary feeding. Moreover, it is important to offer mothers information on how to continue breastfeeding after returning to work. Knowledge of techniques of storing expressed breastmilk and safely thawing need to be made widely available in rural areas of Sichuan Province.

It must be admitted that it will not be easy to persuade employers to be cooperative in improving breastfeeding. Nevertheless, for the health of both mothers and infants, and for the benefits of the whole society in the long term, it is rewarding for the government to take effective measures to make these suggestions become reality.

Based on mothers' self-reporting, some inappropriate infant feeding advice was given by health professionals in Jiangyou. For instance, two mothers reported that they stopped breastfeeding before six months postpartum because their doctors suggested that their breastmilk was not nutritious enough for their infants. Also, at each follow-up interview, 12, 2, 6 mothers, respectively, gave the reason 'the doctor advised me to give baby water' for giving infants water before the age of six months. Although receiving inappropriate advice from professionals is not a common phenomenon, it may, to some extent, reflect the necessity of updating health practitioners the knowledge and information on infant feeding in Jiangyou.

## **5.5 Breastfeeding problems**

Insufficient breastmilk was the most common breastfeeding problems experienced by women. It was also the most prevalently reported reason for discontinuing lactation. It has been suggested by physiological studies that only 1% to 5% of women have genuine problems with milk supply (Dennis 2002). The high proportions of women

reporting insufficient breastmilk may reflect the inappropriate breastfeeding practices, such as delayed breastfeeding initiation and not demanding feeding, after delivery in the rural area of Sichuan Province.

In this cohort study, 7.4% (95% CI 5.2 to 9.5%) of mothers had mastitis at least once during the first six months postpartum. No previous studies have reported the incidence of lactation mastitis in China. The incidence found in this study was lower than those in recent cohort studies in Western countries, such as Australia (27.1%, first 3 months (Fetherston 1998); 17.3%, first 6 months (Amir et al. 2007); 20%, first 6 months (Kinlay, O'Connell & Kinlay 2001)), the United States (9.5%, first 12 weeks (Foxman et al. 2002)), New Zealand (23.7%, first one year (Vogel, Hutchison & Mitchell 1999b)) and Scotland (18%, first 26 weeks (Scott et al. 2008)). The disparities in mastitis incidence may be explained by differences in case definition and the populations studied.

Consistent with previous studies, cracked and sore nipples were risk factors associated with increased incidence of mastitis among women in Jiangyou (Amir et al. 2007; Foxman et al. 2002; Kinlay, O'Connell & Kinlay 2001). As enduring nipple cracks and sores are usually linked to incorrect positioning and attachment, it is important to ensure women are able to position and attach their infants to the breast without pain before discharge (Philipp & Academy of Breastfeeding Medicine Protocol Committee 2010; Tait 2000). However, only 70% of mothers in this study were taught how to position and attach babies during hospital stay and less than 63% were checked by the health facility staff about babies' attachment to the breast. In order to lower the incidence of mastitis, it is important for maternal health practitioners in Jiangyou to make sure mothers have mastered proper breastfeeding techniques before discharge.

Among mothers who had experienced mastitis, nearly 90% had asked for help or advice from others, and 70% asked professionals. Rather alarmingly, one cohort study in Scotland found approximately 10% women were inappropriately advised to either stop breastfeeding from the affected breast or to cease breastfeeding altogether (Scott et al. 2008).

According to the Academy of Breastfeeding Medicine (ABM), the best form of mastitis management is frequent and effective milk removal as it reduces milk stasis. Mothers should be suggested to breastfeed more frequently, starting on the affected breast. Breastfeeding may begin on the unaffected breast, if letdown is too painful, and then switch to the affected breast once letdown is achieved. Correctly positioning the infant at the breast and massaging the breast during feeding are both important. Massage should be directed from the blocked area moving toward the nipple. Expressing milk after each feeding may also help drain milk and thereby relieve the symptoms of mastitis. Abrupt cessation of breastfeeding increases the risk of abscess development, thus women unable to continue breastfeeding should remove the milk from breast. The ABM also recommends adequate rest, fluids, and nutrition as supportive measures in reducing mastitis (Academy of Breastfeeding Medicine Protocol Committee 2008).

## **Chapter 6 Conclusions and recommendations**

This chapter provides a summary of key findings from the research. The limitations of the study, directions for future research and recommendations for better clinic practice and health policies are also presented.

### **6.1 Main findings**

#### **6.1.1 Early breastfeeding initiation within one hour and the prelacteal feeds**

Early breastfeeding initiation rate was rather low in Jiangyou with less than one in ten babies commencing breastfeeding within the first hour of life. The majority of newborns received breastmilk after 24 hours of birth. The prelacteal feeding was a near-universal practice. Only 7% of newborn infants received colostrum or breastmilk as their first feed. The most common prelacteal feeds were infant formula and plain water. The widespread distribution of infant formula following the major earthquake in 2008 might negatively influence the breastfeeding practices in the immediate postpartum period in Jiangyou. Delivery at hospital, attendance at antenatal class, and hospital staff's encouragement of early breastfeeding initiation were protective factors of breastfeeding initiation within the first hour of life. To some extent, all these three factors are correlated with the maternity service providers' practices.

#### **6.1.2 Breastfeeding outcomes and factors associated with breastfeeding at discharge and breastfeeding duration**

The breastfeeding rate at discharge was relatively high at 93.5% in the study. Father's attitude towards breastfeeding was identified to be an important determinant of breastfeeding at discharge. The infants were more likely to be breastfeeding at discharge if their fathers were reported to prefer breastfeeding. Because of the common pre- and post-lacteal feeding during hospital stay, only 7 out of 695 mothers were 'exclusive breastfeeding' at discharge. The proportion of infants who were fully

breastfed at discharge was 36.3%. Early breastfeeding initiation was significantly associated with a higher rate of ‘full breastfeeding’ at discharge.

The median duration of ‘any breastfeeding’ was approximately 8 months in Jiangyou, which is far low from what is recommended. The rates of ‘any breastfeeding’ declined rapidly after 6 months postpartum. Older maternal age, giving birth at township health centres, planning to breastfeed for more than 6 months, introducing solid foods after 6 months postpartum and returning to work when the infants were at least 6 months of age were associated with longer duration of ‘any breastfeeding’. The median duration of ‘full breastfeeding’ was about 5 months. Higher maternal education level and return to work early were risk factors of discontinuing fully breastfeeding within six months postpartum.

### **6.1.3 Early introduction of complementary foods and its associated factors**

Giving infants water and introducing complementary foods to infants before 6 months postpartum were widely practiced in Jiangyou. Approximately nine in ten babies had received complementary foods before they were six months of age. Fruit juice and vegetable juice were the earliest food introduced to infants, followed by yolk. Less than 50% of women’s primary information source about introducing complementary foods was from health professionals. As mentioned above, 7 out of 695 infants were exclusively breastfed at discharge. Along with early water and complementary feeding, only one baby was exclusively breastfed for the first 6 months in Jiangyou. Besides shorter duration of ‘any breastfeeding’ and ‘full breastfeeding’, maternal returning to work before six months postpartum was also associated with premature introduction of complementary foods.

### **6.1.4 Breastfeeding problems and determinants of lactation mastitis**

Perceived insufficient breastmilk was the most common breastfeeding problem experienced by mothers during the first 6 months. It was also the common reason cited by mothers for stopping breastfeeding before 6 months. The incidence of the first episode of mastitis was 7.4%, which was much lower than that reported by

recent cohort studies in Western countries. Cracked and sore nipples and maternal stress were factors associated with increased incidence of mastitis.

## **6.2 Limitations of the study**

This study is the first prospective cohort study of infant feeding in a rural area of Sichuan Province. However, there are several limitations that need to be considered when interpreting the results and findings of the thesis.

Firstly, the study sample of 695 women was recruited from a rural area located in the northwest of Sichuan Province. There are approximately 66 million people living in the broad countryside of the province with different backgrounds. While the study location is a typical rural area of Sichuan, it should be cautious to extrapolate the results of the present study to all rural areas of the province.

Secondly, all the quantitative data were collected by self-reporting of participants. Although this is the standard method used by almost all similar studies, there may be recall bias when collecting some information, such as newborn's first feed, time to first breastfeed, maternal tea and alcohol drinking habits. With regard to socioeconomic information, especially family income, education level and employment, respondents may either refuse to answer questions or not answer them truthfully. It is possible that a woman with very low education level may feel too embarrassed to reveal her real schooling background. Similarly, people with extremely low or high family income may not wish to expose their economic status to others. In the study, 55 out of 695 women (7.9%) chose not to answer the question about family monthly income.

In addition, the fathers' preference of infant feeding method was identified by asking mothers instead of fathers themselves. As a result, fathers' true attitudes may be biased by the mothers' opinions (Freed, Fraley & Schanler 1993).

Finally, as only cases with complete observations can be used in a multivariate model, selection bias may have been introduced to the study. It is expected that the

missing data occurred at random and were neither associated with any other variables nor the subjects of this study.

### **6.3 Recommendations for future research**

China is a vast country with diverse regional characteristics, thus, the infant feeding practices may differ from one part to another. In order to well document and improve infant feeding practices around the country, future cohort studies in different areas are required.

If the breastfeeding practices found from this study reflect the general situation of the whole rural areas of Sichuan Province, it would mean that the breastfeeding rates in rural Sichuan fall far below international and national targets. Future breastfeeding promotion programs with focus on the benefits of exclusive breastfeeding and prolonged duration of breastfeeding are needed. Evaluating these education programs at regular intervals and making modifications correspondingly may help achieve their greatest impacts.

As little was known about fathers' knowledge on breastfeeding, there are needs for future research to measure paternal preference of feeding methods as well as the reasons for their choices by directly questioning fathers.

The incidence of mastitis found in the study was unexpectedly low. As limited information about mastitis incidence and risk factors is available in China, further studies with larger sample size are required among Chinese women in the future.

## **6.4 Recommendations for better clinical practice and health policies**

To achieve better infant feeding practices and reduce maternal breastfeeding problems in rural China, several recommendations based on the findings of the study are listed as follows:

1. Encourage all expectant mothers to participate in antenatal classes which should include introducing the benefits of breastfeeding as well as early breastfeeding initiation to increase the early breastfeeding initiation rate in this rural area.
2. Include expectant fathers in breastfeeding education programs to improve their breastfeeding knowledge as paternal support for breastfeeding is an important predictor of breastfeeding initiation.
3. Although delivery methods were not shown to be related with breastfeeding practices in the study, considering the adverse effects of caesarean section on both mothers and infants, the indications for caesarean section should be strictly assessed by maternity practitioners to decrease the elective caesarean section rate.
4. The ten steps of Baby Friendly Hospital Initiative as recommended by the WHO need to be strictly followed by all maternity health providers in Jiangyou. Mothers should be assisted with early breastfeeding initiation and be discouraged with the use of prelacteal feeds. Also, persistent inspection of the implementation and reaccreditation of the certification of the BFHI by the government are necessary.
5. The benefits of exclusive breastfeeding for the first six months and prolonged breastfeeding duration to at least two years need to be emphasised in the future breastfeeding education strategies programs.
6. To overcome the negative impact of early return to work, employers should be encouraged to provide breastfeeding friendly workplaces. Multiple options to work part-time, flexible work schedule, breastfeeding breaks and facilities, and on-site or nearby-site day care will be helpful for lactating mothers to continue breastfeeding after going back to work. On the other hand, working

mothers should be provided with additional education programs in the early postpartum period with information and techniques on how to express, store and thaw breastmilk in order to encourage them to maintain breastfeeding as long as possible.

7. In order to prevent lactation mastitis, the problem of nipple pain should be resolved during hospital stay by correcting women's positioning and attachment of their infants at the breast.
8. Medical and nursing schools should include the knowledge and skills about how to educate and assist mothers in establishing successful breastfeeding into their curriculum. All maternity health staff should receive further training and regular updates on breastfeeding management.

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## **Appendices**

### **Appendix 1 Ethics approval letters**

memorandum

To	Professor Colin Binns, Public Health
From	A/Professor Stephan Millett, Chairperson, Human Research Ethics Committee
Subject	Protocol Approval HR 169/2009
Date	05 March 2010
Copy	Li Tang c/- Public Health Professor Andy Lee, Public Health Graduate Studies Officer Health Sciences

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "A Cohort Study Of Infant Feeding Practices And Maternal Breastfeeding Problems In A Rural Area Of Sichuan Province, PR China.". Your application has been reviewed by the HREC and is **approved** subject to the conditions detailed below:

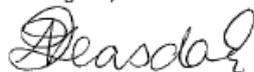
1. Please advise what protocols are in place for the follow up questionnaire if the participant's infant has passed away after the initial recruitment to study.
2. Please advise why women under the age of eighteen will be excluded from the study.
3. Please provide definition of a 'healthy baby'.
4. Please clarify if information sheets and consent forms will be translated for participants, or will information be verbally advised to some or all potential participants.

**Please do not commence your research until your response to the above conditions has been approved by the Executive Officer.**

**Please note the following:**

- Reference Number:169/2009. Please quote this number in any future correspondence.
- The following standard statement **must be** included in the information sheet to participants:  
*This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 169/2009). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au).*
- 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.

Regards,



RP A/Professor Stephan Millett  
Chair Human Research Ethics Committee

**Memorandum**

<b>To</b>	Professor Colin Binns, Public Health
<b>From</b>	Miss Linda Teasdale, Manager, Research Ethics
<b>Subject</b>	<b>PROTOCOL APPROVAL – EXTENSION HR169/2009</b>
<b>Date</b>	23 March 2011
<b>Copy</b>	Li Tang c/- Public Health Professor Andy Lee, Public Health Graduate Studies Officer, Faculty of Health Sciences

Office of Research and Development

**Human Research Ethics Committee****TELEPHONE** 9266 2784**FACSIMILE** 9266 3793**EMAIL** hrec@curtin.edu.au

Thank you for keeping us informed of the progress of your research. The Human Research Ethics Committee acknowledges receipt of your Form B progress report for the project *"A cohort study of infant feeding practices and maternal breastfeeding problems in a rural area of Sichuan Province, PR China.."*

Approval for this project is extended for the year to **03/02/2012**.

Your approval number remains **HR169/2009**. Please quote this number in any further correspondence regarding this project.

Please note: An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Thank you.



Linda Teasdale  
Manager, Research Ethics  
Office of Research and Development

## **Appendix 2      Information letter**

A cohort study of infant feeding practices and maternal breastfeeding problems in a rural area of Sichuan Province, PR China

Dear Mothers,

The school of Public health at Curtin University is studying the ways that mothers feed their babies and breastfeeding problems mothers experience here in Jiangyou. The information that we received will be used to help us understand the needs of young babies and their mothers and will be used to develop health promotion programs. All the information that we collect will be kept completely confidential. None of the answers to any of the questions that you give will be shown to anyone else.

I would like you are interested in our study. There will be 5 interviews at 0, 1, 3 6 and 12 months after your delivery. It will take you 10-20 minutes for each interview to answer some questions related to your new baby feeding and breastfeeding problems that you may experience during the first half year of your baby. You are totally free to reject or withdraw at any time without negative outcomes for your health care and medical treatment. Your assistance will support our study, and finally help other mothers and their babies.

Thanks a lot for your kindly support. We appreciate your assistance.

Yours sincerely

**Colin Binns**

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### **Appendix 3      Consent form**

*Title of Project:* A cohort study of infant feeding practices and maternal breastfeeding problems in a rural area of Sichuan Province, PR China

I have been informed of and understand the purpose of the study, and have been given an opportunity to ask questions. I agree to participate in the study as outlined to me. I declare that I preserve my right not to answer any question. I understand that I am free to withdraw from further participation at any time without any negative consequences. I also understand that information gained in this study may be published as grouped statistics.

Full name of participant: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix 4 Baseline questionnaire (English version)

### Infant feeding study in Jiangyou rural areas (baseline at discharge from the hospital or township health centre)

Hospital / Township health centre code

Mother identification number

Date of interview: \_\_\_/\_\_\_/\_\_\_\_ (DD /MM/ YYYY)

Name of interviewer: \_\_\_\_\_

1. Did you have a baby boy or girl?

A boy-----1      A girl-----2

2. When was your baby born?

Date: \_\_\_/\_\_\_/\_\_\_\_ (DD /MM/YYYY)

3. How many weeks pregnant were you when your baby was born?

\_\_\_\_\_ weeks \_\_\_\_\_ days

4. How much did your baby weigh at birth?

\_\_\_\_\_ grams

5. What is **your** date of birth?

Date: \_\_\_/\_\_\_/\_\_\_\_ (DD/MM/YYYY)

6. What is your name?

\_\_\_\_\_

7. How are you feeding your baby now?

Mainly breastfeeding, and with some water-----1

Mainly breastfeeding, and with some juice-----2

Breastfeeding only -----3

Mainly breastfeeding but “topping up” with infant formula-----4

Mainly bottle feeding but also breastfeeding -----5

Mix feeding (breastmilk and formula) -----6

Bottle feeding only-----7

Other (please specify) \_\_\_\_\_

8. Have you changed the way of feeding your baby since delivery?

No-----1 GO TO Q10

Yes-----2

9. If Yes, what was the change?

\_\_\_\_\_

10. If you are giving your baby any bottle feeds, how many bottles did your baby have yesterday (24 hours)?

Infant formula	_____ ml (use 00 if none)
Plain water	_____ ml (use 00 if none)
Glucose water	_____ ml (use 00 if none)
Powdered cow's milk	_____ ml (use 00 if none)
Fresh cow's milk	_____ ml (use 00 if none)
Soy milk	_____ ml (use 00 if none)
Rice soap	_____ ml (use 00 if none)
Fruit juice	_____ ml (use 00 if none)
Other _____	_____ ml (use 00 if none)

11. **If you are only bottle feeding**, did you try to breastfeed your baby?

No -----0 GO TO Q11

Yes-----1

12. Why did you change to bottle feeding? (unprompted)

Baby refuses breast-----1

Trouble attaching the baby to the breast-----2

Breastfeeding is painful-----3

Baby suffers neonatal jaundice-----4

Inverted nipple-----5

Not enough breastmilk-----6

No breastmilk-----7

13. If you decided to bottle feed your baby from the start, what were the reasons for this choice? (**You can have more than one answer**)

I don't have enough milk-----1

Formula is better for the baby-----2

Bottle feeding is easier-----3

I don't like breastfeeding-----4

I will go back to work soon after the birth-----5

Breastfeeding will make my breasts sag-----6

The baby's father prefers bottle feeding-----7

Formula is just as good as breastmilk-----8

Breastfeeding is too embarrassing-----9

My mother or mother-in-law suggested bottle feeding-----10

Friend or relative suggested bottle feeding-----11

Health worker (e.g. doctor, nurse) suggested bottle feeding-----12

I have health problem-----13 (Name of the illness : \_\_\_\_\_)

Other (please specify) \_\_\_\_\_

14. **If you are breastfeeding**, why did you decide to breastfeed? (**You can have more than one answer**)

- Breastmilk is better for the baby -----1
- Breastfeeding is more convenient -----2
- Breastfeeding is cheaper -----3
- Mother and baby become closer-----4
- Emptying breast is good for mother-----5
- Breastfeeding helps me lose weight -----6
- The baby's father wanted me to breastfeed -----7
- My mother /mother-in-law advised me to breastfeed-----8
- Health worker (e.g. doctor, nurse) advised me to breastfeed -----9
- My relative advised me to breastfeed -----10 (unprompted)
- Breastfeeding is natural-----11 (unprompted)
- Breastfeeding is a tradition-----12 (unprompted)
- Breastfeeding is safe-----13 (unprompted)
- Breastfeeding is sanitary-----14 (unprompted)

15. When did you **first** decide how you were going to feed your new baby?

- Before I became pregnant -----1
- Early in my pregnancy (before 20weeks) -----2
- Late in my pregnancy (after 20weeks) -----3
- After my baby was born-----4
- Other (please specify) \_\_\_\_\_

16. Who helped you decide whether you would bottle feed or breastfeed? (**You can have more than one answer**)

- No one, I decided myself-----1
- The baby's father-----2
- My mother or mother-in-law-----3
- Friends-----5
- Doctor-----6
- Nurse -----7
- My relative-----8
- Other (please specify) \_\_\_\_\_

17. What was your baby's **first** feed?

- Plain water -----1
- Glucose water -----2
- Breastmilk (or colostrum) -----3
- Formula -----4
- Powdered cow's milk -----5

- Fresh cow's milk-----6  
 Other (please specify) \_\_\_\_\_
18. Does the baby's father have any preference for how you feed your baby?  
 He prefers bottle feeding -----1  
 He prefers breastfeeding -----2  
 He doesn't mind how I feed my baby -----3  
 Never really discussed the matter with him-----4
19. Did your mother breastfeed any of her children?  
 No -----0  
 Yes -----1  
 Don't know-----2
20. Does your mother have any preference for how you feed your baby?  
 She prefers bottle feeding -----1  
 She prefers breastfeeding -----2  
 She doesn't mind how I feed my baby -----3  
 Never really discussed the matter with her-----4
21. How have your friends fed their babies?  
 Most of them bottle fed -----1  
 Most of them breastfed -----2  
 Some breastfed and some bottle fed -----3  
 Friends don't have babies -----4  
 Don't know-----5
22. After knowing that you are pregnant, did any relatives and/or friends visit you and give you some formula as a gift?  
 No-----0  
 Yes-----1
23. When in hospital have any hospital medical staff supported or encouraged you with breastfeeding?  
 No-----0 GO TO Q25  
 Yes-----1
24. If yes, who supported or encouraged you with breastfeeding? (**You can have more than one answer**)  
 Doctor-----1  
 Nurse-----2
25. Did any hospital staff encourage you to put your baby to the breast right after the birth?  
 No -----0 GO TO Q27  
 Yes-----1

26. If yes, who encouraged you to put your baby to the breast right after the birth?

(You can have more than one answer)

Doctor-----1

Nurse -----2

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

Immediately after birth, cord still attached -----1

Within 15 minutes-----2

Between 15 and 30 minutes-----3

Between 30 minutes and 1 hour-----4

Within a few hours-----5

The next day-----6

The third day-----7

The fourth day-----8

The fifth day-----9

Don't know-----10

Not yet-----11

Other (please specify) \_\_\_\_\_

28. How often are you feeding your baby?

On demand (feeding whenever baby wants to be fed) -----1

By the clock – about every 2 hours-----2

By the clock – about every 3 hours-----3

By the clock – about every 4 hours-----4

29. About how long does your baby spend at the breast for a feed?

Baby is bottle feeding-----1

Less than 15 minutes-----2

15 minutes to half an hour-----3

Half an hour to an hour-----4

Over an hour-----5

Other (please specify) \_\_\_\_\_

30. About how many times a day do you feed your baby? (24 hours)

\_\_\_\_\_times

31. About how many of these feeds are breastmilk feeds? (use 00 if none) \_\_\_\_ feeds

32. About how many of these feeds are formula feeds? (use 00 if none) \_\_\_\_ feeds

33. Have you been encouraged by hospital staff to 'demand feed'? ('Demand feeding' is feeding whenever the baby wants to feed.)

No-----0

Yes-----1

34. Did any staff member teach you how to position and attach your baby to the breast?  
 No-----0  
 Yes-----1  
 I didn't need to be taught-----2
35. Did any staff member check how your baby's mouth was attached to your breast when you first started feeding?  
 The baby is bottle feeding from the start-----1  
 No-----2  
 Yes-----3
36. After birth, how long the baby stays in your room every day?  
 Never-----1  
 24 hours-----2  
 Day time-----3  
 Night time-----4  
 Other (please specify) \_\_\_\_\_
37. How long was it before your milk came in?  
 Within one day of the birth -----1  
 The second day of the birth -----2  
 The third day of the birth -----3  
 Still waiting for the milk to come in -----4  
 The fourth day of the birth -----5  
 The fifth day of the birth -----6  
 The sixth day of the birth -----7
38. What did the baby have before your milk came in?  
 Nothing -----1  
 Glucose water -----2  
 Infant formula -----3  
 Plain water-----4  
 Other (please specify) \_\_\_\_\_
39. In the first few days a mother makes colostrum; this early secretion (watery) which comes in breastmilk, is  
 Harmful to the baby-----1  
 Important for the baby-----2  
 Should be discarded-----3  
 Don't know -----4
40. Since you have been in hospital have you received any of the following from hospital staff? **(You can have more than one answer)**

- Pamphlets on breastfeeding baby-----1
- Lectures or classes on breastfeeding baby -----2
- Demonstrations on how to breastfeed baby -----3
- Video (TV) or slide show on how to breastfeed baby -----4
- Samples of infant formula-----5
- Booklets or other information about infant formula-----6
- Individual consultation or discussion with any of the staff about breastfeeding baby-----7
- None of the above -----8

41. Your main sources of breastfeeding information? (**You can have more than one answer**)

- Booklets-----1
- TV/ Radio-----2
- Lectures-----3
- Individual consultation with health professional-----4
- Books and magazines-----5
- My mother or mother-in-law-----6
- Other family members or relatives-----7
- Friends-----8
- Never got information-----9
- Others sources (Please specify) \_\_\_\_\_

42. How do you think about the information about feeding your baby given by the hospital?

- Very useful -----1
- A little useful-----2
- Not necessary-----3
- Boring-----4
- Does not meet the need-----5
- Don't want to make a comment-----6

43. For the next few weeks, how do you think you will feed your baby?

- Continue bottle feeding-----1
- Continue breastfeeding-----2
- Continue to combine breast- and bottle feeding-----3
- Stop breastfeeding and start bottle feeding-----4
- Stop bottle feeding and start breastfeeding-----5
- Haven't decided yet-----6
- Other (please specify) \_\_\_\_\_

44. When do you plan to start giving your baby complementary food? (e.g. infant cereal, yolk, porridge)

Before 2 months-----1

Between 2 and 3 months-----2

Between 4 and 6 months-----3

Between 7 and 9 months-----4

Between 10 and 12 months-----5

Over 12 months-----6

Don't know -----7

Other (please specify) \_\_\_\_\_

45. Which complementary food will you intend to give then? (**You can have more than one answer**)

Yolk -----1

Rice soup-----2

Infant cereal-----3

Porridge-----4

Fresh or powdered cow's milk -----5

Milk-based desserts/ yoghurt-----6

Fruit paste-----7

Fruit juice-----8

Vegetable paste-----9

Vegetable juice-----10

Protein foods -----11

Biscuit/cakes -----12

Fish soup-----13

Bone broth-----14

Soy milk-----15

Walnut and/or peanut paste-----16

Noodles-----17

Corn paste-----18

Liver soup-----19

Don't know-----20

Others (please specify) \_\_\_\_\_

46. Do you think mothers have changed their infant feeding practices since the earthquake?

No, no changes to infant feeding practices-----1

Yes, more mothers now want to breastfeed their infants-----2

Yes, more mothers now want to breastfeed their infants to at least six months----3

Yes, fewer mothers now want to breastfeed their infants-----4

Yes, fewer mothers now want to breastfeed their infants to at least six months---5

Don't know-----6

47. Do you think mothers have changed their attitudes to infant formula since the earthquake?

No, no changes to infant formula-----1

Yes, more mothers now want to feed their infants with infant formula-----2

Yes, fewer mothers now want to feed their infants with infant formula-----3

Don't know-----4

**The following questions are for mothers who are breastfeeding. If the woman is not breastfeeding at all, please move to Question 70.**

48. Is your breastmilk enough for your baby?

No -----0

Yes -----1 GO TO Q51

Don't know -----2 GO TO Q52

49. If NO, how do you know?

Baby sucks hard and long but is not satisfied -----1

Baby is hungry in a short time after breastfeeding-----2

Breast is not full before feeding -----3

Others (please specify) \_\_\_\_\_

50. After you realized your breastmilk might be inadequate, what did you do? (**You can have more than one answer**)

Let baby suck more often-----1

Give baby more infant formula-----2

Change to bottle feeds-----3

Eat some special food to increase milk-----4

Take some medicines to increase milk-----5

Others (please specify) \_\_\_\_\_

51. Did you ask for advice or help from anyone when you realized your breastmilk might be inadequate?

No -----0 GO TO Q50

Yes -----1

52. If Yes, who did you ask for? (**You can have more than one answer**)

Doctor-----1

Other health professional e.g. nurse, midwife-----2

My mother or mother-in-law-----3

Other family members or relatives-----4

Friends-----5

Breast massagist -----6

Other (please specify) \_\_\_\_\_

53. If you didn't ask for advice or help from others, what is the reason?

---

54. **If your breastmilk is enough**, how do you know?

Breast is engorge -----1

Feel that baby is full-----2

Baby is satisfied after feeding-----3

Can feel effective sucking -----4

Baby sleeps well after feeding-----5

My breastmilk overflows-----6

Others (please specify) \_\_\_\_\_

55. Have you experienced any of the following since you started breastfeeding? (**You can have more than one answer**)

Inverted nipples -----1

Cracked or sore nipples-----2

Breast engorged -----3

Breastfeeding is painful-----4

Baby gets too much milk -----5

Baby gets milk too fast -----6

Baby too tired to feed -----7

Baby doesn't wake up for feeds -----8

Baby has problems sucking -----9

Baby not gaining enough weight -----10

Takes a long time before milk starts flowing at start of feed -----11

Feeling that I'm not doing very well at breastfeeding -----12

Trouble positioning and/or attaching the baby to the breast-----13

None of the above-----14

Other (please specify) \_\_\_\_\_

56. If you have experienced any problems above, did you ask for advice or help from anyone to solve them?

No -----0 GO TO Q55

Yes-----1

57. If Yes, who did you ask for? (**You can have more than one answer**)

Doctor-----1

Other health professional e.g. nurse, midwife-----2

My mother or mother-in-law-----3

Other family members or relatives-----4

Friends-----5

Breast massagist-----6

Other (please specify) \_\_\_\_\_

58. If you didn't ask for advice or help from others, what is the reason?

---

59. Have you experienced a painful, red and swollen area on breasts since you started breastfeeding?

No -----0 GO TO Q62

Yes -----1

60. If Yes, in which part(s) of your breast did the painful, red and swollen area(s) exist? (**You can have more than one answer**)

Upper outer region of the right breast-----1

Upper inner region of the right breast-----2

Lower outer region of the right breast-----3

Lower inner region of the right breast-----4

Upper outer region of the left breast-----5

Upper inner region of the left breast-----6

Lower outer region of the left breast-----7

Lower inner region of the left breast-----8

61. Did you ask for advice or help from anyone when suffering this problem?

No -----0 GO TO Q60

Yes-----1

62. If Yes, who did you ask for? (**You can have more than one answer**)

Doctor-----1

Other health professional e.g. nurse, midwife-----2

My mother or mother-in-law-----3

Other family members or relatives-----4

Friends-----5

Other (please specify) \_\_\_\_\_

63. If you didn't ask for advice or help from others, what is the reason?

---

64. Have you had the following symptoms that **last at least 24 hours** while you were experiencing a painful, red, swollen area on breasts? (**You can have more than one answer**)

An elevated temperature (either estimated or measured as being  $\geq 38^{\circ}\text{C}$ ) -----1

Body aches-----2

Headaches-----3

Chills-----4

- None of the above-----5  
 Don't know -----6
65. Were you diagnosed with mastitis from a doctor **while you were experiencing** a painful, red, swollen area on breasts?  
 No-----0  
 Yes-----1
66. Have you worn a bra at night while sleeping since you started breastfeeding?  
 No, I haven't-----0  
 Yes, occasionally / less often than weekly -----1  
 Yes, at least weekly (not daily) -----2  
 Yes, daily-----3
67. Have you applied cream on nipples since you started breastfeeding?  
 No, not at all-----0  
 Yes, less often than weekly/occasionally-----1  
 Yes, at least weekly (not daily) -----2  
 Yes, daily-----3
68. Have you felt tired or stressed since you started breastfeeding?  
 Never-----1  
 Seldom-----2  
 Sometimes-----3  
 Often-----4
69. Were you diagnosed with mastitis from a doctor before this delivery?  
 No-----0  
 Yes-----1
70. **When you feel that your breasts are very full**, do you empty the breast? (e.g. by feeding the baby or expressing the milk)  
 No-----0  
 Seldom-----1  
 Sometimes-----2  
 Often-----3  
 It's seldom that my breasts are very full. -----4
71. How many times, on average, do you breastfeed your baby or express your milk between the hours of 10.00 pm and 6.00 am?  
 \_\_\_\_\_times
72. At what age do you plan to stop breastfeeding your baby?  
 Before baby is 6 weeks old -----1  
 Between 6 weeks and 2 months-----2  
 Between 2 and 3 months-----3

- Between 4 and 6 months-----4
- Between 7 and 9 months-----5
- Between 10 and 12 months-----6
- Over 12 months-----7
- Don't know -----8
- Other (please specify) \_\_\_\_\_

*For the following questions, there is no right or wrong answer.*

*Please circle the response that you first think of.*

*For example, if you feel very confident in breastfeeding, circle 5, if you don't feel confident, circle 1. If you fall somewhere in-between please circle the appropriate number between 1 and 5.*

*If it is too early to tell, please circle 9.*

73. How would you rate your confidence in breastfeeding?

not		very		too early to tell	
confident		confident			
1	2	3	4	5	9

74. How enjoyable do you find breastfeeding?

not		very		too early to tell	
enjoyable		enjoyable			
1	2	3	4	5	9

75. How satisfied are you with your breastfeeding experience?

not		very		too early to tell	
satisfied		satisfied			
1	2	3	4	5	9

76. In general, how comfortable do you feel while breastfeeding in front of other female people?

not		very		too early to tell	
comfortable		comfortable			
1	2	3	4	5	9

77. How comfortable do you feel while breastfeeding in front of other male people?

not		very		too early to tell	
comfortable		comfortable			
1	2	3	4	5	9

78. How often did you drink tea **before pregnancy**?
- More than 3 cups a day-----1
  - 1-3 cups a day-----2
  - A few cups a week-----3
  - Only on special occasions-----4
  - I didn't drink tea -----5 GO TO Q77
79. What kind of tea did you drink?
- Green tea-----1
  - Black tea-----2
  - Jasmine tea-----3
  - Chrysanthemum tea-----4
  - Tie Guanyin tea-----5
  - Oolong tea-----6
  - Puer tea-----7
  - bitter-buck wheat tea-----8
  - Don't know the name of tea-----9
  - Other (please specify) \_\_\_\_\_
80. How often did you drink tea **during pregnancy**?
- More than 3 cups a day-----1
  - 1-3 cups a day-----2
  - A few cups a week-----3
  - Only on special occasions-----4
  - I didn't drink tea-----5
81. Did the mother change her tea drinking habit during pregnancy? (**Interviewer answer this question**)
- No -----0 GO TO Q80
  - Yes-----1
82. If you changed your tea drinking habit during pregnancy, what was the reason?
- Drinking tea is not good for baby-----1
  - Drinking tea is not good for mother-----2
  - Drinking tea is good for baby-----3
  - Drinking tea is good for mother-----4
  - I didn't like drinking tea during pregnancy-----5
  - I liked drinking tea during pregnancy-----6
  - Other reasons (please specify) \_\_\_\_\_
83. Did you eat spicy food during pregnancy?
- No-----0 GO TO Q82
  - Yes-----1

84. If Yes, how often did you eat spicy food?  
 Nearly every meal-----1  
 At least one meal a day (not every meal) -----2  
 A few meals a week-----3  
 A few meals a month-----4
85. Did you smoke cigarettes during pregnancy?  
 No -----0 GO TO Q84  
 Yes-----1
86. If Yes, how many cigarettes did you smoke a day on average? \_\_\_\_\_
87. Did your husband smoke in front of you or smoke in home during your pregnancy?  
 No-----0  
 Sometimes-----1  
 Often-----2
88. Did other people smoke in front of you besides your husband during pregnancy?  
 No-----0  
 Few people ( $\leq 2$  persons/day) -----1  
 Often meet smoking people ( $>2$  persons/day) -----2
89. Did you drink alcohol during pregnancy?  
 No -----0 GO TO Q90  
 Yes-----1
90. If Yes, how often did you drink alcohol?  
 At least once a day-----1  
 A few times a week-----2  
 A few times a month-----3  
 Only on special occasions-----4
91. How much, on average, did you drink every time? \_\_\_\_\_ ml
92. What kind of alcohol did you drink? (**You can have more than one answer**)  
 Beer-----1  
 Red wine-----2  
 Rice wine-----3  
 Spirits or liqueurs-----4  
 Other (please specify) \_\_\_\_\_
93. How long have you been in hospital before the delivery? \_\_\_\_\_ days
94. How was your baby delivered?  
 Vaginal without forceps or suction ----1  
 Vaginal with forceps or suction -----2  
 Caesarean-----3

95. How would you prefer to deliver baby during **pregnancy**?

Vaginal-----1

Caesarean-----2

Don't care-----3

96. Can baby's father stay with you during delivering baby?

No-----0

Yes-----1

Don't know-----2

97. How many times have you been pregnant (including this time)? \_\_\_\_\_ times

98. Is this the first child you have given birth to?

No-----0

Yes -----1 GO TO Q97

99. If not, how long each child was breastfeed? Please write how many weeks or months each child was breastfed. OR please write bottle fed if bottle fed from birth

Order of Children	Gender	Birthday (DD/MM/YY)	Exclusive breastfeed		Total breastfeed period		Height (one year old)(cm)
			Week	Month	Week	Month	

100. Did you go to prenatal school during pregnancy?

No -----0

Yes, during this time of pregnancy -----1

Yes, during a pregnancy before -----1

101. What is your marital status?

Married -----1

Never married-----2

Divorced or separated-----3

Common law married-----4

Other (please specify) \_\_\_\_\_

102. What is your occupation?

Farmer-----1

Worker-----2

Public servant-----3

Teacher-----4

Medical staff -----5

- Private businesswoman-----6
  - Temporary worker-----7
  - Unemployed-----8
  - Housewife-----9
  - Service industry-----10
  - Company employee-----11
  - Other (please specify) \_\_\_\_\_
103. What is the highest level of education you have completed?
- Never gone to school before-----1
  - Drop out of primary school-----2
  - Finished primary school -----3
  - Secondary school -----4
  - High school/ Occupational School -----5
  - University-----6
104. What is baby father's age? \_\_\_\_\_
105. What is the highest level of education baby's father have completed?
- Never gone to school before-----1
  - Drop out of primary school-----2
  - Finished primary school -----3
  - Secondary school -----4
  - High school/ Occupational School -----5
  - University-----6
106. What is baby father's occupation?
- Farmer-----1
  - Worker-----2
  - Public servant-----3
  - Teacher-----4
  - Medical staff -----5
  - Private businessman-----6
  - Temporary worker-----7
  - Unemployed-----8
  - Service industry-----9
  - Company employee-----10
  - Driver-----11
  - Soldier-----12
  - Cook-----13
  - Other (please specify) \_\_\_\_\_
107. Who are you living with now?

- With my husband's family-----1
- With my parents family-----2
- With my own family-----3
- With my husband's family or with my parents family-----4
- With my husband's family and with my parents family-----5
- With others (please specify) \_\_\_\_\_

108. What is the family size which you are living with?  
 \_\_\_\_\_ people in my family

109. Your present living place is \_\_\_\_\_

110. Approximately, what is the monthly income of your family?(try best to probe the income per month of the family in RMB Yuan)

≤500	501— 1000	1001— 1500	1501— 2000	2001— 3000	3001— 4000	4001— 5000	>5000

111. Did you take any dietary supplements during pregnancy?

No-----0 Go To Q 113

Yes-----1

112. Dietary supplement usage by frequency, duration and dosage

Supplement	≤ 1 time /month	2-3 times /month	1 time /week	2-3 times /week	4-6 times /week	1 time /day	2 times /day	3 times /day	Dosage (number of tablets)	Duration
multivitamins & minerals										
Vitamin C										
Vitamin E										
Fish oil										
Calcium										
Folic acid										
Others (Please specify)										

113. If you took any dietary supplements during pregnancy, who recommended these supplement to you? (You can have more than one answer)

No one-----1

Hospital staff -----2

Private health workers-----3

Pharmacy salesman/saleswoman-----4

My mother/ mother-in-law-----5

Other family members or relatives-----6

Friends-----7

Others (please specify) \_\_\_\_\_

114. Did you take any Chinese medicine during pregnancy?

No-----0

Yes-----1

115. What are the main ingredients in the Chinese medicine that you took during pregnancy?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

116. Chinese Medicine usage by frequency and duration

Chinese Medicine	≤ 1 time /month	2-3 times /month	1 time /week	2-3 times /week	4-6 times /week	1 time /day	2 times /day	3 times /day	Duration

117. If you took any Chinese medicine during pregnancy, who recommended these supplement to you? (You can have more than one answer)

No one-----1

Hospital staff -----2

Private health workers-----3

Pharmacy salesman/saleswoman-----4

My mother/ mother-in-law-----5

Other family members or relatives-----6

Friends-----7

Others (please specify) \_\_\_\_\_

**THANK YOU VERY MUCH FOR YOUR PARTICIPATION!**

Your next follow up ring will be \_\_\_/\_\_\_/\_\_\_ (DD /MM/ YYYY)

The possible place for next interview will be \_\_\_\_\_

The possible telephone number for next contact is:

\_\_\_\_\_ or \_\_\_\_\_ or \_\_\_\_\_

The best time for next interview

Daytime: \_\_\_\_\_ evening: \_\_\_\_\_ weekend: \_\_\_\_\_

Interviewer sign: \_\_\_\_\_

## Appendix 5 Follow-up questionnaire A (English version)

### Infant feeding study in Jiangyou rural areas (follow-up questionnaire within 6 months postpartum)

Mother identification number

Date of interview: \_\_\_/\_\_\_/\_\_\_ (DD /MM/ YYYY)

Name of interviewer: \_\_\_\_\_ This is the  time of follow-up

1. What is your name? \_\_\_\_\_
2. How old is the baby today? \_\_\_\_\_ Days/weeks/months
3. In the last interview, the feeding method I observed was: (Interviewer fills this question)  
Mainly breastfeeding, and with some water-----1  
Mainly breastfeeding, and with some juice-----2  
Breastfeeding only -----3  
Mainly breastfeeding but “topping up” with infant formula-----4  
Mainly bottle feeding but also breastfeeding -----5  
Mix feeding (breastmilk and formula)-----6  
Bottle feeding only-----7  
Other (please specify) \_\_\_\_\_
4. How are you feeding your baby now?  
Mainly breastfeeding, and with some water-----1  
Mainly breastfeeding, and with some juice-----2  
Breastfeeding only -----3  
Mainly breastfeeding but “topping up” with infant formula-----4  
Mainly bottle feeding but also breastfeeding -----5  
Mix feeding (breastmilk and formula)-----6  
Bottle feeding only-----7  
Other (please specify) \_\_\_\_\_
5. Is the way the mother feed the baby the same as that in last interview?  
(Interviewer answer this question)  
No-----0  
Yes -----1 GO TO Q11
6. If No, how old the baby was when you made the change?  
\_\_\_\_\_ Days/weeks/months
7. Why did you make the change? (**You can have more than one answer**)  
Not enough breastmilk-----1

- Nipple problems-----2 (What is the problem?  
\_\_\_\_\_)
- Breast problems-----3 (What is the problem?  
\_\_\_\_\_)
- Return to work-----4
- Baby sick-----5 (Name of the disease\_\_\_\_\_)
- Mother tired-----6
- Mother sick-----7 (Name of the disease\_\_\_\_\_)
- Have enough breastmilk-----8
- Drinking water is good for the baby-----9
- I have more breastmilk than before-----10
- The baby refuses formula-----11
- The baby refuses water -----12
- The baby refuses bottle -----13
- The baby refuses breast -----14
- The baby is thirsty -----15
- The baby did not refuses water then -----16
- The baby's lips are dry -----17
- The doctor advised me not to feed the baby with water -----18
- Other reasons (please specify) \_\_\_\_\_
8. Did anyone help you decide to change in feeding method?  
No, I decided myself -----0 GO TO Q11  
Yes-----1
9. If Yes, who helped you to decide? (**You can have more than one answer**)  
Hospital staff -----1  
Private health workers-----2  
My husband-----3  
My mother/ mother-in-law-----4  
Other family members or relatives-----5  
Friends-----6  
Others (please specify) \_\_\_\_\_
10. Since you have been home, how helpful as your husband been in caring for the baby?  
Not helpful-----1  
Sometimes helpful or tries-----2  
Very helpful-----3  
Baby's father not around-----4

11. Who is the most important person to support your breastfeeding now? (GO TO Q13 if not breastfeeding)
- No one-----1
  - My husband-----2
  - My mother-----3
  - My mother-in-law-----4
  - The whole family-----5
  - Others (please specify) \_\_\_\_\_
12. Can you have enough sleep and relax?
- No -----0
  - Yes-----1
13. How many hours do you sleep on average now? (including the noon break)
- \_\_\_\_\_hours/day
14. How many times per day on average do you feed your baby (24 hours)?
- \_\_\_\_\_ times
15. How many of these feeds are breastfeeds? (use 00 if none)\_\_\_\_\_feeds
16. How many of these feeds are formula feeds? (use 00 if none)\_\_\_\_\_feeds
17. How many times, on average, do you feed your baby between the hours of 10.00 pm and 6.00 am? \_\_\_\_\_ times
18. What is the average length of each feed?
- <15 minutes-----1
  - ≥15 minutes but <30 minutes-----2
  - ≥30 minutes but < 1 hour-----3
  - ≥1 hour-----4
19. After you stop feeding, what is the average length of time before baby wants another feed in daytime?
- <30 minutes-----1
  - ≥30 minutes but < 1 hour -----2
  - ≥1 hour but < 2 hours-----3
  - ≥2 hours but < 3 hours -----4
  - ≥3 hours but < 4 hours -----5
  - ≥4 hours -----6
  - No regular time -----7
20. After you stop feeding, what is the average length of time before baby wants another feed in the evening time?
- <30 minutes-----1
  - ≥30 minutes but < 1 hour -----2
  - ≥1 hour but < 2 hours-----3

≥2 hours but < 3 hours -----4

≥3 hours but < 4 hours -----5

≥4 hours -----6

No regular time-----7

**Breastfeeding only go to Q26**

21. When do you usually give your baby bottle feeds?

No particular time-----1

Mainly during the day-----2

Mainly during the night-----3

Late afternoon (around dinner time) -----4

Others (please specify)\_\_\_\_\_

22. When do you prepare the formula in general?

Before feeding-----1

About half hour before feeding-----2

Half hour to one hour before feeding-----3

1-2 hours before feeding-----4

2-3 hours before feeding-----5

More than 3 hours before feeding-----6

Within one day-----7

Others (please specify)\_\_\_\_\_

23. How do you keep the rest bottle milk if you prepare too much?

Throw it away-----1

Keep in refrigerator-----2

Baby's parents drink it-----3

Others (please specify)\_\_\_\_\_

24. How do you clean the milk bottle?

I use boiling water for sterilization-----1

I use the tap water to clean-----2

I use well water to clean-----3

Other method (please specify)\_\_\_\_\_

25. Have you expressed your milk since we last spoke (or since you left hospital)?

No -----0 GO TO Q29

Yes-----1

26. What method did you use to express your milk?

Hand express-----1

Manual pump-----2

- Electric pump-----3  
 Other method (please specify)\_\_\_\_\_
27. Why did you express your milk?  
 Had too much milk/uncomfortable-----1  
 Sore nipples-----2  
 Engorgement-----3  
 Inverted nipples-----4  
 Wanted extra breastmilk just in case-----5  
 Feed to be given by someone else-----6  
 Baby ill-----7  
 Self ill-----8  
 Baby refuses breast-----9  
 Breastfeed after doing exercises-----10  
 The breastmilk overflows-----11  
 To see if I have breastmilk-----12  
 To see how much breastmilk I have-----13  
 Other reasons (please specify)\_\_\_\_\_
28. Have you seen any advertisements for infant formula since we last spoke (or since you left hospital)?  
 No -----0 GO TO Q31  
 Yes -----1
29. If Yes, where did you see the advertisements? (**You can have more than one answer**)  
 In market-----1  
 In MCH clinic visiting-----2  
 In TV/Radio-----3  
 In newspaper/magazine-----4  
 From the relatives or friends-----5  
 From selling promotion persons-----6  
 Others (please specify) \_\_\_\_\_
30. Have you used with any type of infant formula?  
 No -----0 GO TO Q34  
 Yes-----1
31. What type of infant formula? (Don't prompt, unless 'I don't know', it could be multiple choice)  
 Domestic infant formula-----1 (name of the brand\_\_\_\_\_)  
 Imported infant formula-----2 (name of the brand\_\_\_\_\_)  
 Specialised infant formula/ other-----3

32. Why did you choose this particular formula? (Do not prompt but probe for more than one answer)
- Recommended by hospital staff-----1
  - Recommended by private health workers-----2
  - Recommended by my mother/mother-in-law-----3
  - Recommended by my friends or relatives-----4
  - Recommended by markets selling persons-----5
  - Saw it advertised-----6
  - It was the cheapest-----7
  - It is safe for baby no fake formula-----8
  - Available in trial size-----9
  - Saw it being used in the hospital-----10
  - I heard other people use this brand-----11
  - The hospital gave me this formula for free-----12
  - My husband bought it-----13
  - Other reason (please specify) \_\_\_\_\_
33. Have you given the baby complementary foods?
- No -----0 GO TO Q39
  - Yes-----1
34. If Yes, what complementary foods is your baby having? (Do not prompt, but probe for more than one answer)
- Yolk only-----1
  - Whole egg-----2
  - Rice -----3
  - Rice soup-----4
  - Infant cereal-----5
  - Porridge-----6
  - Fresh or powdered cow's milk -----7
  - Milk-based desserts/ yoghurt-----8
  - Fruit paste-----9
  - Fruit juice-----10
  - Vegetable paste-----11
  - Vegetable juice-----12
  - Bone broth-----13
  - Tofu-----14
  - Fish-----15
  - Shellfish (e.g. prawns, crab) -----16
  - Pork or beef-----17

- Chicken-----18
- Biscuit/cakes -----19
- Fish soup-----20
- Soy milk-----21
- Walnut/peanut juice-----22
- Noodles-----23
- Corn paste-----24
- Pig's liver soup-----25
- Rice paste-----26
- Pig's trotters soup-----27
- Others (please specify) \_\_\_\_\_

35. How often did you give baby these complementary foods?

Food name	Day time (times/hour or day)	Night (times/hour or day)

36. Do these complementary foods change the length between breastfeed?

- No-----0
- Yes-----1
- Baby is bottle feeding only-----2

37. Your main sources of information about giving baby the complementary foods?

**(You can have more than one answer)**

- Booklets-----1
- TV/ Radio-----2
- Lectures-----3
- Individual consultation with hospital health professional-----4
- Individual consultation with private health workers-----5
- Books and magazines-----6
- My mother or mother-in-law-----7
- Other family members or relatives-----8
- Friends-----9
- Never got information-----10
- Others sources (please specify) \_\_\_\_\_

38. Do you give baby water?

- No -----0 GO TO Q43
- Yes-----1

39. If give baby water, what is the reason? **(You can have more than one answer)**

- Baby is thirsty-----1
- Baby needs medicine or nutritional supplements-----2
- Baby's stool is dry-----3
- More water could help baby quiet-----4
- It's good for baby-----5
- Reduce baby's internal heat -----6
- It's hot; the baby needs water-----7
- Good for the baby's digestive system-----8
- The baby hiccups-----9
- The weather is dry-----10
- The doctor advised me to feed the baby with water-----11
- Other reasons (please specify) \_\_\_\_\_

40. How old is baby when you feed water? \_\_\_\_\_ Days/weeks/months

41. How often did you feed baby water?

Day time (times/hour or day)	Night (times/hour or day)

42. Is your baby using any of the following? (**You can have more than one answer**)

- Dummy-----1
- Bottle-----2
- Feeding spoon -----3
- Feeding cup-----4
- None of the above-----5

43. Do you feed baby tea since last interview?

- No -----0 GO TO Q48
- Yes-----1

44. If yes, how old baby was when you fed tea? \_\_\_\_\_ Days/weeks/months

45. What kind of tea do you feed?

- Green-----1
- Black-----2
- Jasmine tea-----3
- Other (please specify) \_\_\_\_\_

46. The reason for feeding baby tea? \_\_\_\_\_

47. How much does your baby weigh? \_\_\_\_\_ grams

When was that weight taken? Date: \_\_\_/\_\_\_/\_\_\_ (DD /MM/YYYY)

48. How do you feel about your baby's weight change since I spoke to you last time (or you left hospital)?

- Satisfied/pleased-----1
- A little concerned-----2

Very concerned -----3

Don't know-----4

49. How much is your weight? \_\_\_\_\_kg

When it be taken? Date: \_\_\_/\_\_\_/\_\_\_ (DD /MM/YYYY) or \_\_\_\_\_months  
postpartum

**The following questions are for mothers who are breastfeeding. If the woman has not breastfed since last interview, please move to Question 90.**

50. Is your breastmilk enough for your baby since I spoke to you last time (or you left hospital)?

No -----0

Yes -----1 GO TO Q57

Don't know -----2 GO TO Q58

51. If NO, how do you know?

Baby sucks hard and long but is not satisfied -----1

Baby is hungry in a short time after breastfeeding-----2

Breast is not full before feeding -----3

Others (please specify) \_\_\_\_\_

52. After you realized your breastmilk might be inadequate, what did you do? (**You can have more than one answer**)

Let baby suck more often-----1

Eat some special food to increase milk-----2

Take some traditional medicine to increase milk-----3

Give baby more bottle feeds-----4

Change to bottle feeding only-----5

Others (please specify) \_\_\_\_\_

53. Did you ask for advice or help from anyone when you realized your breastmilk might be inadequate?

No -----0 GO TO Q56

Yes-----1

54. If Yes, who did you ask for? (**You can have more than one answer**)

Hospital staff -----1

Private health workers-----2

My mother or mother-in-law-----3

Other family members or relatives -----4

Friends-----5

Other (please specify) \_\_\_\_\_

55. If you didn't ask for advice or help from others, what is the reason?

---

56. **If your breastmilk is enough**, how do you know?

Breast is engorge -----1

Feel that baby is full-----2

Baby is satisfied and sleeps well after feeding-----3

Can feel effective sucking -----4

Others (please specify) \_\_\_\_\_

57. Have you experienced any of the following since I spoke to you last time (or since you left hospital) ?(**You can have more than one answer**)

Inverted nipples -----1

Cracked or sore nipples-----2

Breast engorged (too full) -----3

Breastfeeding is painful-----4

Baby gets too much milk -----5

Baby gets milk too fast -----6

Baby not gaining enough weight -----7

None of the above-----8

Other (please specify) \_\_\_\_\_

58. If you have experienced any problems above, did you ask for advice or help from anyone to solve them?

No -----0 GO TO Q61

Yes-----1

59. If Yes, who did you ask for? (**You can have more than one answer.**)

Hospital staff -----1

Private health workers-----2

My mother or mother-in-law-----3

Other family members or relatives -----4

Friends-----5

Other (please specify) \_\_\_\_\_

60. If you didn't ask for advice or help from others, what is the reason?

---

61. Did you do any changes of feeding your baby because any of these problems?

No -----0 GO TO Q64

Yes-----1

62. If Yes, can you please specify what the changes were?

---

63. Have you experienced a painful, red and swollen area on breasts since I spoke to you last time (or since you left hospital)?  
 No -----0 GO TO Q74  
 Yes -----1
64. If Yes, in which part(s) of your breast did the painful, red and swollen area(s) exist? (**You can have more than one answer**)  
 Upper outer region of the right breast-----1  
 Upper inner region of the right breast-----2  
 Lower outer region of the right breast-----3  
 Lower inner region of the right breast-----4  
 Upper outer region of the left breast-----5  
 Upper inner region of the left breast-----6  
 Lower outer region of the left breast-----7  
 Lower inner region of the left breast-----8  
 Other region (please specify) \_\_\_\_\_  
 Don't know-----10
65. If you have experienced it, did you ask for advice or help from anyone?  
 No -----0 GO TO Q68  
 Yes-----1
66. If Yes, who did you ask for? (**You can have more than one answer**)  
 Hospital staff -----1  
 Private health workers-----2  
 My mother or mother-in-law-----3  
 Other family members or relatives -----4  
 Friends-----5  
 Other (please specify) \_\_\_\_\_
67. If you didn't ask for advice or help from others, what is the reason?  
 \_\_\_\_\_
68. Did you do any changes of feeding your baby because of this problem?  
 No -----0 GO TO Q71  
 Yes -----1
69. If Yes, can you please specify what the changes were?  
 \_\_\_\_\_
70. Have you had the following symptoms that **last at least 24 hours while you were experiencing** a painful, red, swollen area on breasts? (**You can have more than one answer**)  
 An elevated temperature (either estimated or measured as being  $\geq 38^{\circ}\text{C}$ ) -----1  
 Body aches-----2

Headaches-----3

Chills-----4

None of the above -----5 GO TO Q74

I don't know -----6 GO TO Q74

71. Since last interview, how many times have you experienced a painful, red and swollen area on breasts **while** having an elevated temperature (either estimated or measured as being  $\geq 38^{\circ}\text{C}$ ) and/or body aches and/or headaches and/or chills which last at least 24 hours \_\_\_\_\_times GO TO Q74

72. Since last interview, were you diagnosed with mastitis from a doctor **while you were experiencing** a painful, red, swollen area on breasts?

No-----0

Yes-----1 (How many times since last interview? \_\_\_\_\_)

73. Have you worn a bra at night while sleeping since I spoke to you last time (or since you left hospital)?

No, I haven't-----0

Yes, less often than weekly/occasionally-----1

Yes, at least weekly (not daily) -----2

Yes, daily-----3

74. Have you applied cream on nipples since I spoke to you last time (or since you left hospital)?

No, not at all-----0

Yes, less often than weekly/occasionally-----1

Yes, at least weekly (not daily) -----2

Yes, daily-----3

75. Have you felt tired or stressed since I spoke to you last time (or since you left hospital)?

No-----0

Seldom-----1

Sometimes-----2

Often-----3

Always-----4

76. Since I spoke to you last time (or you left hospital), how often do you feed your baby or express your milk **when you feel that your breasts are very full**?

No-----0

Seldom-----1

Sometimes-----2

Often-----3

Always-----4

- I seldom feel that my breasts are very full -----5
77. How many times, on average, do you breastfeed your baby or express your milk between the hours of 10.00 pm and 6.00 am?  
\_\_\_\_\_times
78. How often do you drink tea during breastfeeding period?  
More than 3 cups a day-----1  
1-3 cups a day-----2  
A few cups a week-----3  
Only on special occasions-----4  
I don't drink tea -----5 GO TO Q81
79. What kind of tea do you drink?  
Green tea-----1  
Black tea-----2  
Jasmine tea-----3  
Other (please specify) \_\_\_\_\_
80. Do you think tea drinking will influence breastfeeding?  
No-----0  
Yes-----1 (Why? \_\_\_\_\_)  
Don't know -----2
81. Do you eat spicy food during breastfeeding period?  
No-----0 GO TO Q84  
Yes-----1
82. If Yes, how often do you eat spicy food?  
Nearly every meal-----1  
At least one meal a day (not every meal) -----2  
A few meals a week-----3  
A few meals a month-----4
83. Do you smoke cigarettes during breastfeeding period?  
No -----0 GO TO Q86  
Yes-----1
84. If Yes, how many cigarettes do you smoke a day on average? \_\_\_\_\_
85. Do you drink alcohol during breastfeeding period?  
No -----0 GO TO Q90  
Yes-----1
86. If Yes, how often do you drink alcohol?  
At least once a day-----1  
A few times a week-----2  
A few times a month-----3

- Only on special occasions-----4
87. How much, on average, do you drink every time? \_\_\_\_\_ ml
88. What kind of alcohol do you drink? (**You can have more than one answer**)
- Beer-----1
- Table wine-----2
- Rice wine-----3
- Spirits or liqueurs-----4
- Other (please specify) \_\_\_\_\_
89. How many days did you stay in hospital before discharge? (**Ask in the first follow-up interview**)
- \_\_\_\_\_Days
90. Have you returned to work?
- No -----0 GO TO Q97
- Yes -----1
- I don't work-----2 GO TO Q97
91. If Yes, when did you return to work?
- When the baby was \_\_\_\_\_days/weeks/months old
92. Can you continue breastfeed after back to work?
- No, I can't -----0 (Why not? \_\_\_\_\_)
- Yes, I can -----1
93. Where are you leaving your baby after returning to work if you are still breastfeeding?
- Baby is bottle feeding after I return to work-----1 GO TO Q97
- Baby comes with me to working place-----2
- Leave baby in day care -----3
- Leave baby to my parents -----4
- Leave baby to parents-in-law -----5
- Others (please specify) \_\_\_\_\_
94. How many times can you breastfeed during work hours? \_\_\_\_\_times
95. Where do you breastfeed baby during work?
- Home -----1
- In public place -----2
- Isolated room (in public place or other people's home) -----3
- Nursing room -----4
- Other place (please specify) \_\_\_\_\_
96. Have you taken any dietary supplements since I spoke to you last time (or since you left hospital)?

No-----0 Go To Q 99

Yes-----1

97. Dietary supplement usage by frequency, duration and dosage

Supplement	≤ 1 time /month	2-3 times /month	1 time /week	2-3 times /week	4-6 times /week	1 time /day	2 times /day	3 times /day	Dosage (number of tablets)	Duration
multivitamins & minerals										
Vitamin C										
Vitamin E										
Fish oil										
Calcium										
Folic acid										
Others (Please specify)										

98. If you have taken any dietary supplements since I spoke to you last time (or since you left hospital), who recommended these supplements to you? (**You can have more than one answer**)

No one-----1

Hospital staff -----2

Private health workers-----3

Pharmacy salesman/saleswoman-----4

My mother/ mother-in-law-----5

Other family members or relatives-----6

Friends-----7

Others (please specify) \_\_\_\_\_

99. Have you taken any Chinese medicine since I spoke to you last time (or since you left hospital)?

No-----0 GO TO Q103

Yes-----1

100. What are the main ingredients in the Chinese medicine that you have taken since I spoke to you last time (or since you left hospital)?

First dose:

---

Second dose:

---

Third dose:

---

101. Chinese Medicine usage by frequency and duration

Chinese Medicine	≤ 1 time /month	2-3 times /month	1 time /week	2-3 times /week	4-6 times /week	1 time /day	2 times /day	3 times /day	Duration

102. If you have taken any Chinese medicine since I spoke to you last time (or since you left hospital), who recommended these supplement to you? (**You can have more than one answer**)

- No one-----1
- Hospital staff -----2
- Private health workers-----3
- Pharmacy salesman/saleswoman-----4
- My mother/ mother-in-law-----5
- Other family members or relatives-----6
- Friends-----7
- Others (please specify) \_\_\_\_\_

I'm going to read out a few statements that are related to breastfeeding. Please just answer True, False or Don't Know. It really doesn't matter if you don't know.

JUST ASK at SECOND FOLLOW-UP

103. Feeding more often increases milk supply.

- True-----1
- False-----2
- Don't know-----3

104. Babies need to feed more when they are having a growth fast.

- True-----1
- False-----2
- Don't know-----3

105. There are lots of women who need to give their babies formula because they can't make enough milk.

- True-----1
- False-----2
- Don't know-----3

106. Breastmilk nutrition will disappear as soon as stopping breastfeeding.

- True-----1
- False-----2

- Don't know-----3
107. Birth control pills can reduce milk supply.  
 True-----1  
 False-----2  
 Some pills will reduce milk and some not-----3  
 Don't know-----4
108. Breastfeeding will change mother's body shape.  
 True-----1  
 False-----2  
 Don't know-----3
109. Getting extra rest and relaxation is necessary to ensure a good milk supply.  
 True-----1  
 False-----2  
 Don't know-----3
110. Feeding formula to a one month old baby will not reduce the amount of milk produced by the mother.  
 True-----1  
 False-----2  
 Don't know-----3
111. Babies naturally know how to breastfeed correctly.  
 True-----1  
 False-----2  
 Don't know-----3
112. Formula-fed babies sleep longer at night.  
 True-----1  
 False-----2  
 Don't know-----3
113. Do you think breastfeeding helps mother to lose weight?  
 No-----1  
 Yes -----2  
 Don't know-----3
114. Would you encourage your friends to breastfeeding?  
 No-----1  
 If she want to -----2  
 Perhaps -----3  
 Probably -----4  
 Yes, definitely -----5
115. If yes, why encourage friend? (**You can have more than one answer**)

- Better for baby -----1
- Better for mother -----2
- Baby could be more quite -----3
- Natural -----4
- Close relationship with baby -----5
- Convenience -----6
- Enjoyment / satisfaction of mother -----7
- No particular reason -----8
- Others (please specify): \_\_\_\_\_

116. If no, why wouldn't encourage friend? (**You can have more than one answer**)

- Inconvenient -----1
- Lack of enjoyment / satisfaction of mother -----2
- Tied to the house -----3
- Embarrassment -----4
- Too emotionally taxing for mother-----5
- Formula is just as good -----6
- Others (please specify): \_\_\_\_\_

**THANK YOU VERY MUCH FOR YOUR PARTICIPATION!**

Your next follow up ring will be \_\_\_/\_\_\_/\_\_\_ (DD /MM/ YYYY)

The possible place for next interview will be \_\_\_\_\_

The possible telephone number for next contact is:

\_\_\_\_\_ or \_\_\_\_\_ or \_\_\_\_\_

The best time for next interview

Daytime: \_\_\_\_\_ Evening: \_\_\_\_\_ Weekend: \_\_\_\_\_

Interviewer sign: \_\_\_\_\_

## Appendix 6 Follow-up questionnaire B (English version)

### Infant feeding study in Jiangyou rural areas (follow-up questionnaire at 12 months postpartum)

Mother identification number

Date of interview: \_\_\_/\_\_\_/\_\_\_ (DD /MM/ YYYY)

Name of interviewer: \_\_\_\_\_ This is the  time of follow-up

1. Currently, do you continue breastfeeding your baby?

Yes-----1 (GO TO Question 3)

No, have stopped breastfeeding-----2

No, I did not initiate breastfeeding -----3 (GO TO Question 3)

2. When did you stop breastfeeding your baby?

\_\_\_ months and/or \_\_\_ weeks

3. Did your baby start to have infant formula within 6 months of life?

Yes -----1

No -----2 (GO TO Question 5)

4. When did your baby start to have infant formula?

\_\_\_ months and/or \_\_\_ weeks

5. How did you feed your baby at 6 months postpartum?

Mainly breastfeeding, and with some water-----1

Mainly breastfeeding, and with some juice-----2

Breastfeeding only -----3

Mainly breastfeeding but “topping up” with infant formula-----4

Mainly bottle feeding but also breastfeeding -----5

Mix feeding (breastmilk and formula)-----6

Bottle feeding only-----7

Other (please specify) \_\_\_\_\_

6. When was your baby introduced to solid foods?

\_\_\_ months and/or \_\_\_ weeks

**THANK YOU VERY MUCH FOR YOUR PARTICIPATION!**

Interviewer sign: \_\_\_\_\_

## Appendix 7 List of publications

1. Tang, L, Hewitt, K & Yu, C 2012, 'Prelacteal Feeds in China', *Curr Pediatr Rev*, vol. 8, no. 4, pp. 304-312.
2. Tang, L, Pan, X, Lee, AH & Binns, CW 2013, 'Progress and challenges in maternal health care in China', in LV Berhardt (ed.) *Advances in Medicine and Biology*, Vol. 62, Nova Science Publisher, New York.
3. Tang, L, Binns, CW, Lee, AH, Pan, X, Chen, S & Yu, C 2013, 'Low prevalence of breastfeeding initiation within the first hour of life in a rural area of Sichuan Province, China', *Birth* (accepted in July 2012).
4. Tang, L, Lee, AH, Qiu, L, Binns, CW 2013, 'Mastitis in Chinese breastfeeding mothers: A prospective cohort study', *Breastfeed Med* (accepted in April 2013).
5. Tang, L, Binns, CW, Luo, C, Zhong, Z & Lee, AH 2013, 'Determinants of breastfeeding at discharge in rural China', *Asia Pac J Clin Nutr* (accepted in May 2013).

## **Appendix 8      Permission to use copyright material**

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Tang, L., Pan, X., Lee, A.H. and Binns, C.W. 'Progress and challenges in maternal health care in China', In *Maternity: Perspectives, Challenges and Social Implications*, New York: Nova Publishers, in press (accepted in September 2012).

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Position: President

Date: February 5, 2013