

Exploration of Breastfeeding Concepts among Current and Future Parents:
Results of Questionnaires Administered to Chinese and US University Students
and to New Mothers in China

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To My Parents
For Their Love and Support

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Abstract

The objectives were to explore breastfeeding knowledge, attitudes, and intention of future parents, and to investigate indicators and causes of perceived insufficient milk (PIM) supply among Chinese mothers. Objectives were accomplished using a cross-sectional study design. Two questionnaires were developed, one targeting Chinese and US undergraduates, and a second targeting Chinese mothers. In total, 597 undergraduates (395 Chinese; 202 US) and 392 Chinese mothers participated in the study. Data cleaning resulted in a final sample size of 572 for undergraduates (383 Chinese; 189 US) and 341 for Chinese mothers. Results showed that undergraduates in both countries possessed some breastfeeding knowledge and expressed similar concerns. These concerns included perceived inconvenience and embarrassment associated with breastfeeding. In general, US students demonstrated a greater knowledge level than their Chinese counterparts. However, Chinese students possessed better attitudes about breastfeeding. For both groups, greater breastfeeding knowledge and attitudes, and having been breastfed as an infant, were associated with a greater likelihood of breastfeeding, or supporting a partner to breastfeed, a future child. The results of the questionnaire administered among Chinese mothers showed that perceived insufficient milk (PIM) supply was a common occurrence, as it was reported by over half of these mothers. In addition, nearly half of those reporting PIM experienced it within 2 days postpartum. Subjective indicators were frequently used by mothers to assess milk quantity, examples of which included not feeling the presence of milk, receiving a hungry look from the infant after a breastfeed, and having an infant that cried after a breastfeed. Objective indicators, such as the number of wet/soiled diapers, were rarely used. Most mothers were unable to explain why they experienced PIM. However, among those who did report perceived reasons for PIM,

these were often diet-related, including having a poor appetite or not being able to “eat enough soup”. Results from both samples indicate the need to develop culturally relevant interventions to address identified misperceptions of future parents and to assist new mothers in correctly identifying and addressing PIM.

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Chapter 1 Introduction

Because of the well-known benefits of breastfeeding, increasing breastfeeding rates has become a public priority worldwide ¹⁻³. Both in China and the US, there are national documents that outline breastfeeding objectives ^{2,4}. For example, in China, a breastfeeding objective is to increase, to half, the number of infants being exclusively breastfed at 6 months, as set by the National Program of Action for Child Development (2011-2020) ². In the US, one objective of Healthy People 2020 is to increase the exclusive breastfeeding rate at 6 months to one-fourth (25.5%) of all infants ⁴. However, current breastfeeding rates fall short of breastfeeding objectives in both countries. In China, though over 90% of mothers initiate breastfeeding, exclusivity is low ⁵. A study, conducted in 26 rural counties of China, found that only 14.0% of infants were exclusively breastfed at 6 months of age ⁶. In the US, though breastfeeding rates have been increasing in the most recent decade, and over three-fourths of mothers (76.9%) initiate breastfeeding, less than half of these (47.2%) were still breastfeeding at 6 months postpartum ⁷. Moreover, only 16.3% of those still breastfeeding at 6 months were doing so exclusively ⁷. Therefore, research aimed at identifying and addressing barriers to initiating and continuing optimal breastfeeding behaviors, and framing breastfeeding as the norm in both China and the US is timely and important.

Multiple studies have shown that breastfeeding intention is a significant predictor of actual breastfeeding behavior ⁸. Breastfeeding intention is often formed prenatally, possibly as early as the adolescent period ^{9,10}. Therefore, helping young adults to make informed infant feeding decisions is likely to be an effective way of improving breastfeeding behaviors, should they be parents in the future ¹¹. Research has shown that breastfeeding intention is associated with attitudes, a concept which is supported by the Theory of Planned Behavior (TPB) ¹². In the context of breastfeeding, the TPB proposes that a combination of a mother's attitudes about

breastfeeding, her perceived ability to breastfeed, and the perception she has of the opinions of important individuals in her life (i.e., fathers, partners, peers, etc), functions collectively to impact breastfeeding intention, and subsequently, actual breastfeeding behavior¹³. Breastfeeding knowledge and exposures are reported to be associated with breastfeeding attitudes¹⁴. Thus targeting antecedents of breastfeeding intention among future parents, such as breastfeeding knowledge and attitudes, may help them make informed breastfeeding decisions, and may impact breastfeeding behavior in the future. Therefore, one objective of this study was to compare breastfeeding knowledge, attitudes, and intention between Chinese and US undergraduates, which may provide clues for future culturally appropriate interventions. Though it appears promising to investigate the breastfeeding knowledge and attitudes of future parents, much work remains to be completed.

Though little is known about the impact of improving breastfeeding knowledge and attitudes long before actual parenthood, there has been a great deal of research conducted among those who are currently pregnant or who are new parents^{1,15-17}. However, very little is known about the infant-feeding knowledge and behaviors among mothers in Mainland China. Research across the world has reported multilevel barriers to optimal infant feeding behavior, including individual, interpersonal, institutional, and social level factors¹⁸⁻²¹. One of the most frequently cited reasons for weaning or supplementing is that of perceived insufficient milk (PIM) supply, defined as mothers' perception that they cannot produce enough milk to satisfy their infants^{22,23}. For example, in the US, around 35% of mothers that stopped breastfeeding during the first few weeks cited PIM as a reason for weaning²⁴. In Mainland China, 51% to 81% of mothers reported not having enough milk⁵. Additionally, mothers may begin worrying about their future milk supply before delivery²⁵. Despite the high prevalence of PIM, there is limited understanding

regarding how mothers decide PIM is present, and why they believe it occurred, especially in a Chinese population. Thus one objective of the study was to explore maternal reported indicators of and reasons for PIM in a sample of Mainland Chinese mothers. The results may shed light on appropriate intervention strategies to inform mothers how to correctly identify and address PIM.

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Chapter 2 Literature Review

Part 1: Life Course Perspective

Defining Life Course Perspective

The life course perspective (LCP) is “a conceptual framework that helps explain health and disease patterns - particularly the persistent health disparities - across populations and over time”.¹ LCP integrates broad individual, interpersonal, social and economic factors with a longitudinal perspective of human health trajectories over multiple generations. It emphasizes that the environment present at conception, during fetal development, and in the first few years of life can have a dramatic effect on the health outcomes of the individual. In addition, the cumulative life experiences of the individual might lead to functional changes in the body, resulting in either an improved or impaired health trajectory.² Furthermore, these functional changes will have ramifications for future generations. Four key concepts are critical to the LCP, and these include *timing*, *timeline*, *environment*, and *equity*.¹ These are defined in **Table 2.1**.

Table 2.1 Life Course Perspective Key Concepts ¹

Concept	Definition
Timing	Health trajectories are mostly impacted by events occurring during critical or sensitive periods
Timeline	The view of an individual’s current health as a reflection of lifelong experiences and behaviors, and that future health is a continuum of this experience
Environment	Beyond genetics and behavior, other factors may impact health trajectory. These include community, social, economic, and biological factors.
Equity	Genetics and personal choices can partially explain health disparities across populations. More importantly, the disparities in social environment significantly contribute to the persisting health inequities across populations.

Importantly, the LCP synthesizes two major theories: “Early Programming”, and “Cumulative Impact”.³ Briefly, the Early Programming theory hypothesizes that early experiences occurring during specific gestational or early life stages can result in differences in cell differentiation and organ growth and development. This change may or may not result in differences in functional outcomes.⁴ In addition, depending on the severity and timing of the experience, these changes may not only impact the individual, but future generations of offspring as well.^{2,5} For example, Roseboom and colleagues conducted multiple studies to investigate the effect of the Dutch Famine on later health outcomes. In a population of adults, *in utero* at the time of the Dutch Famine, it was found that the prevalence of coronary heart disease was higher among those exposed to famine in early gestation than those not exposed at this time point (8.8% vs. 3.2%, OR=3.0 adjusted for sex). For those exposed in mid gestation and late gestation, the prevalence of coronary heart disease did not increase (0.9% and 2.5%, respectively).⁴ In addition, a higher prevalence of obesity, differences in blood coagulability, and increased stress response were detected for those exposed to famine in early gestation, compared to those exposed later in gestation.⁶ However, those exposed to famine in late gestation had decreased glucose tolerance, indicating that the timing of the nutritional deficiency had a differential impact on health outcomes.⁷ These findings indicate that exposures during critical developmental periods may be more important than the same exposure during other periods.

The Cumulative Impact theory suggests that continuous exposure to stresses results in damage to the body and body systems.^{1,8,9} For example, a discreet stressful situation may appropriately result in a temporary hormone response. However, chronic stress may result in inappropriately prolonged hormonal response, which may ultimately contribute to chronic inflammation, resulting in harm to multiple body systems.^{1,9}

In summary, the LCP suggests that individual health trajectory, while somewhat responsive to behaviors and lifestyle choices, is importantly impacted by prior generations, exposures *in utero*, and the lifelong environment in which the individual exists.^{1,8-11} These factors, some of which are thought to be protective (healthy behaviors, economic stability, etc.) and others considered to be risk-factors (poverty, lack of education, etc.), function together to set the trajectory in motion.

Life Course Perspective: Maternal and Child Health

Maternal and child health presents an excellent example application of the LCP, which can be most easily demonstrated by focusing on maternal and infant mortality. Historically, intervention has focused on securing accessible, high-quality prenatal care, targeting a decrease in maternal and infant mortality.¹² This focus has had important impacts, with maternal and infant mortality greatly reduced, and a reduction in premature and low weight births.¹² However, the velocity of the decrease in both the infant and maternal mortality rates has slowed in recent years, and infant mortality rates did not decline from 2000 to 2005, indicating that factors independent of prenatal care may be increasingly important.¹³ In addition, improvements in both maternal and infant outcomes are not experienced equally by all populations. For example, in 2007, the maternal mortality rate for black women was 2.7 times higher than the rate for white women¹⁴ and the preterm birth rate for non-Hispanic black infants (18.3%) was 59% and 49% higher than non-Hispanic white (11.5%) and Hispanic (12.3%) infants, respectively.¹⁵ Reframing these disparities through the lens of the LCP would indicate other, less tangible influences on these differential rates. Therefore, the LCP would suggest that the health of an individual is not the result of just 9 months of pregnancy, but the entire life of the mother prior to conception. Targeting health behaviors thought to be protective of not only the current individual, but also potentially that of future offspring may result in improved health across generations. One such health behavior is

optimal infant nutrition. **Figure 2.1** illustrates how lifelong experiences can impact the health trajectory of mothers, and subsequently potential future children in the US .⁸

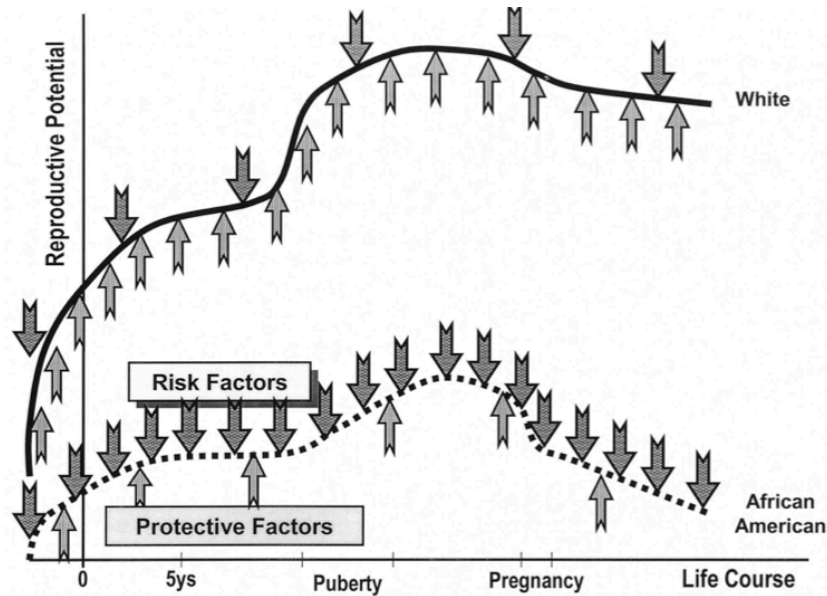


Figure 2.1 How Differential Exposures to Risk Factors and Protective Factors over the Life Course Affect Development Trajectories and Contribute to Disparities in Birth Outcomes in the US⁸

Role of Breastfeeding in the Life Course Perspective

Benefits of Breastfeeding

Breast milk is acknowledged as the best food for infants.^{16,17} The physical, psychological, and economic benefits of breast milk, for infants, cannot be surmounted by any other food. The American Academy of Pediatrics states:¹⁸

“Human milk is species-specific, and all substitute-feeding preparations differ markedly from it, making human milk uniquely superior for infant feeding. Exclusive breastfeeding is the reference or normative model against which all alternative-feeding methods must be measured with regard to growth, health, development, and all other short- and long-term outcomes.”

Breast milk excels over formula in terms of its dynamic contents, which vary with infants’ age and over a discreet feeding.^{17,18} Colostrum, the first breast milk secreted during the first few days postpartum is high in protein, and includes immunoglobulin A and lactoferrin. These proteins, and other immune factors, are important in supporting the immune system of the neonate, as well as providing highly bioavailable minerals.^{19,20} Maternal antibodies, present in this first milk, and for the duration of lactation, provide increased immunity to the infant.²¹ Taken together, these immune factors result in a reduced rate of gastrointestinal disease, respiratory disease, and otitis media among breastfed infants, as compared to formula-fed infants.^{22,23} In addition to these diseases, breastfeeding has been linked to a decrease in asthma, decreased risk of leukemia, and decreased risk of Sudden Infant Death Syndrome (SIDS).²⁴ For preterm infants, breast milk substantially reduces the risk of necrotizing enterocolitis, a disease with a high mortality rate.¹⁶ Longer term outcomes include reduced risk of childhood overweight/obesity and reduced risk of type 2 diabetes.²⁵⁻²⁸

Individual benefits of breastfeeding are not limited to the infant, as breastfeeding has been linked with positive maternal health outcomes as well. Women who breastfeed are at decreased risk of postpartum hemorrhage, tend to return to pre-pregnancy weight more quickly, and may be protected against breast and ovarian cancers.^{29,30} Secondary to the strength of these protective

factors, breastfeeding objectives have been included in Healthy People (HP) 2020, as outlined in

Table 2.2. ^{31, 32}

Table 2.2 Healthy People 2020 Breastfeeding Objectives in the US ^{31, 32}

Increase the proportion of infants who are breastfed	
Ever	81.9%
At 6 months	60.6%
At 1 year	34.1%
Exclusively through 3 months	46.2%
Exclusively through 6 months	25.5%

Economic benefits are also significant. In 2001, the rates of *ever breastfeeding* and *any breastfeeding at 6 months*, was 64% and 29%, respectively.³³ A 2001 study concluded that a minimum of \$3.6 billion would be saved if breastfeeding rates increased to those recommended by the U.S. Surgeon General (75% and 50%, *ever breastfeeding* and *any breastfeeding at 6 months*, respectively).³³ The 2001 study, however, only included three diseases: otitis media, gastroenteritis, and necrotizing enterocolitis, thus underestimating the total savings.³³ Over the prior decade, rates of *ever breastfeeding* and *any breastfeeding at 6 months* have increased to 74.6% and 44.3%, respectively.³² Economic benefits have to be reevaluated. Bartick and colleagues, in a similar subsequent study included a broader range of diseases, including hospitalization for lower respiratory tract infections, atopic dermatitis, sudden infant death syndrome, childhood asthma, childhood leukemia, type 1 diabetes mellitus, and childhood obesity (type 2 diabetes was excluded due to insufficient data). The results indicated that if 90% of U.S. families complied with AAP recommendation of exclusive breastfeeding for 6 months

(using 2005 breastfeeding rates, when exclusive breastfeeding at 6 months was 12.3%), \$13 billion (2007 dollars) would be saved per year and an excess of 911 deaths could be prevented.³⁴ Recognizing that breastfeeding is not free, in another study Bartick evaluated increased costs associated with breastfeeding, such as lactation support, and concluded that cost savings would still be nearly 8.7 billion 2010 US dollars annually.³⁵ In an analysis of disease risk associated with formula-feeding, Ball and colleagues found that during the first year of life, never breastfeeding was significantly associated with excess doctors' office visits, increased days of hospitalization, and prescription dispensation.³⁶ The diseases reviewed by Ball and colleagues included lower respiratory tract infection, otitis media, and gastrointestinal disease. The contribution of breastfeeding to the economic stability of breastfeeding families would be considered a positive reinforcement to the health trajectory of the infant and mother.

Breastfeeding and obesity

Chronic over nutrition, in the form of high calorie and fat intake, increases risk for overweight and obesity, and associated co-morbidities, such as type 2 diabetes, cardiovascular disease, and hypertension.³⁷ Multiple studies have reported the protective effect of breastfeeding on overweight and obesity later in life.³⁸⁻⁴³ For example, breastfeeding for 9 months reduces the odds of becoming overweight by more than 30%.⁴⁴ Gillman and colleagues conducted a survey among 9553 school age students, aged 9 to 14 years, and concluded that based on dose-response, infants who consumed breast milk more than infant formula, or who were breastfed for longer periods, had lowered risk of being overweight during older childhood and adolescent.⁴⁵ Data from a longitudinal study in Australia were used by Shields and colleagues to determine the influence of breastfeeding on obesity at 14 years of age.⁴⁶ The results indicated that breastfeeding for longer than 6 months was protective of obesity, but not overweight. The effect

size lost statistical significance when controlling for confounding variables. In addition, breastfeeding for less than 6 months was not related to overweight or obesity, though a trend of a protective effect of breastfeeding was found.⁴⁶ In another study reported by Shields, longer duration of breastfeeding was associated with reduced risk of obesity at 21 years, supporting the theory of the potential long-term protective effect of breastfeeding against adult obesity.²⁵

In light of the current global epidemic of overweight and obesity,^{26,47,48} the protective effect of breastfeeding against development of obesity and type 2 diabetes mellitus is noteworthy. This protective effect has been proposed to function via two overarching mechanisms, biochemical and behavioral.⁴⁹ Biochemical mechanisms include bioactive components of breastmilk, acting on the satiety center of the central nervous system.⁴⁹ The biochemical mechanism, though intriguing, is not the subject of this review. Behavioral mechanisms, which are somewhat more readily evaluated and modified, include fostering of inherent self-regulation of energy intake and exposure to healthy eating habits upon weaning.^{45,49}

Inherent Self-regulation of Energy Intake

Research indicates that most infants are born with the ability to self-regulate energy intake.^{50,51} In the absence of maternal control, infants are capable of adjusting the energy intake according to internal hunger signals.^{49,50} It is believed that breastfeeding, which allows the infant to decide when a feed is terminated, fosters this self-regulation and is largely explanatory of the less-rapid rate of weight gain seen in breastfed infants, compared to formula-fed infants.⁵⁰ During formula feeding caregivers can visually assess consumption and may feel compelled to encourage finishing the bottle, regardless of infant cues of fullness.⁴⁹ In this situation, the caregiver is in control of the feed and, if fullness cues are chronically ignored, the inherent ability to self-regulate may be degraded or lost completely.^{52,53} In summary, breastfeeding may preserve a

child's ability to self-regulate energy intake, and therefore promote an energy balance consistent with optimal growth. Conversely, formula feeding increases the risk that this ability is destroyed and is thus associated with increased risk of overeating and overweight.

The protection against these infant diseases, as well as longer term health outcomes work together to reinforce a positive health trajectory of both the infant and the mother. Understanding current infant-feeding behaviors, and developing successful breastfeeding interventions based on this understanding, will likely be critical to future global health, especially in developed countries where formula-feeding is considered to be the norm.^{54,55}

Part 2: Breastfeeding Trends

Breastfeeding in the United States

Breastfeeding rates in the United States have changed dramatically during the last few decades (**Figure 2.2**).⁵⁴ After infant formula became largely acceptable, allowing mothers to fully participate in the workforce in the 1940s, 50s and 60s, in 1970, breastfeeding initiation rate dropped to a nadir of 22%.⁵⁶⁻⁵⁸ Thereafter, aggressive breastfeeding campaigns resulted in raising the initiation rate to slightly above 60% in the early 1980s.⁵⁷ Though there was a decrease throughout the 1980s, rates of initiation, exclusivity and duration have been increasing since the early 1990s.^{59,60} By 2008, the breastfeeding initiation rate (74.6%) reached the Healthy People 2010 objective of 75%, resulting in an upward revision of the objective in Healthy People 2020, to 81.9% of new mothers initiation breastfeeding.^{31,32} Though the national initiation rate is good, rates of exclusivity and duration continue to lag behind national objectives. Data from 2009 showed that 47.2% of mothers were breastfeeding at 6 months postpartum, with only 16.3% of mothers exclusively breastfeeding at 6 months postpartum.⁶¹

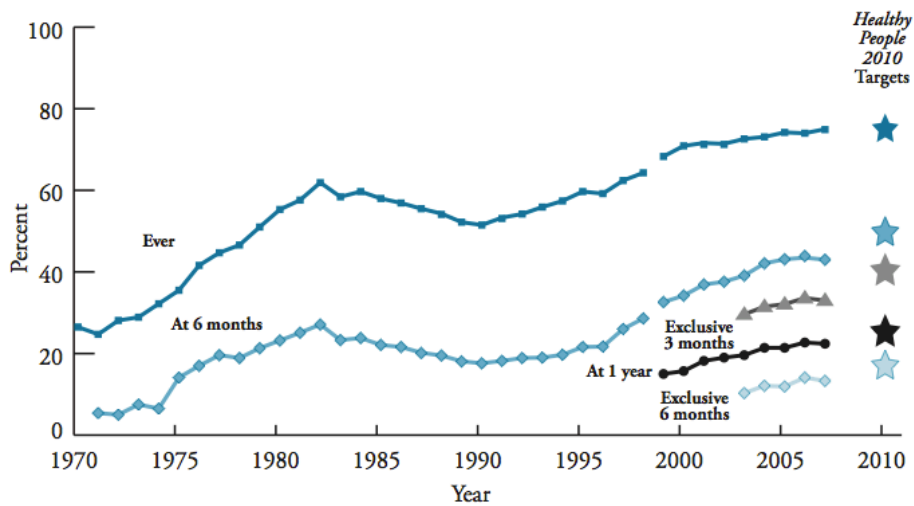


Figure 2.2 National Trends in Breastfeeding Rates in the US ⁵⁴

Though the nation as a whole has moved toward achievement of both the new and revised Healthy People breastfeeding objectives, there are significant disparities among subgroups. For example, based on 2003-2006 data, non-Hispanic black women exhibit the lowest initiation rate (54.4%), and the lowest rates of breastfeeding at 6 (26.6%) and 12 months (11.7%).⁶⁰ For comparison, rates of initiation and breastfeeding to 6 and to 12 months among non-Hispanic white women are 74.3%, 43.2%, and 21.4%, respectively. Among Hispanic women these rates are 80.4%, 45.1%, and 24.0%, respectively, and, among Asian/Pacific Islander women, the same rates are 80.9%, 52.4%, and 29.7%, respectively.⁶⁰

Besides the disparities among different ethnic groups, breastfeeding rates vary depending on the geographic areas.⁵⁵ For example, the southeastern US lags behind the rest of the nation in all breastfeeding outcomes.⁵⁵ According to Ryan and colleagues, *ever breastfeeding* rates in 2002 reached 81.3% for mothers residing in the Western U.S. compared to 65.1% in the Southeastern US. Similarly, the breastfeeding rate at 6 months of age was 42.5% for Western mothers,

whereas only 28.8% of Southeastern mothers were still breastfeeding by this time.⁶² With Oregon rates as the reference, mothers in southern states were 2.5 – 5.15 times less likely to breastfeed. Even after controlling for demographic and maternal covariates, such as race/ethnicity, poverty level, family structure, presence of a smoker in the household, maternal health status, etc., geographic area remains a strong predictor of breastfeeding initiation.⁵⁵ In other words, merely being born in the southern area of the U.S. reduces the likelihood that a child will be breastfed.

Breastfeeding in China

Nutrition Transition

China, one of the world's rapidly growing countries, is currently experiencing changes akin to the modernization experienced by America in the 40s, 50s, and 60s.^{57,63-65} Important changes are occurring in lifestyles, including a nutrition transition.⁶⁶ After the social and economic reforms of 1978, urbanization and globalization reconstructed the Chinese dinner plate. The percentage of animal source and energy-dense foods increased, while the consumption of cereal decreased. In adolescents, energy from fat increased, from 17% in 1989 to 30% in 1993.^{67,68} In addition, the successful marketing of fast food chains, such as KFC and McDonald's, worsens the situation. According to data from the early 2000s, China has over 800 KFCs and 400 McDonald's.⁶⁹ These western restaurants mostly attract the young generation.⁶⁹ In 2000, in coastal big cities, the prevalence of overweight and obesity in males, aged 7 to 18 years, was 4.5% and 9.9%, respectively, and, in same-aged females, 2.8% and 5.9%, respectively.⁷⁰ In 2005, the prevalence of overweight and obesity in northern coastal big cities of 7 to 18 age group has increased to 19.3% and 13.2% for males, and 10.8% and 6.8% for females.⁷¹ For adults, in a study completed in Dehui, located in northeastern China, 34.77% of females and 41.11% of males was reported as

“obese”, which was defined in this article, as having a Body Mass Index above 25.⁷² The alarming increasing rate of overweight and obesity has placed nutrition induced non-communicable diseases as a top killer in China.⁴⁸

Breastfeeding Behaviors

Modernization brings more and more women into the workforce, which sets the stage for the replacement of breast milk by infant formula. As has occurred in the U.S., the infant-feeding method is constantly influenced by the advancement of technology, the scientific knowledge of breast milk components, the modification and advertisement of infant formula, and the chase of freedom of mothers accompanied by the modernization of society.^{56,73} Formula companies utilize various ways to advertise and promote infant formula, including free samples in hospitals, promotion through obstetrician offices, commercial advertisement, etc.⁷³⁻⁷⁵ The cost of formula feeding to the public, however, is ultimately an increase in infant diseases.^{29,54,76} Advances in technology and the booming economy have also popularized TV across China. A survey of 8 randomly sampled provinces reported that 91.4% of households owned a TV by 1997.⁷⁷ TV commercials, usually reflecting local traditions, are now experiencing subtle changes mirroring westernization. Advertisement of infant formula through TV profoundly boosts popularity of infant formula.⁷⁸ Infant formula is considered as an ideal gift for new parents. For expectant parents, buying infant formula to welcome their infants is a common practice in China.⁷⁹ Currently, China is the world’s largest consumer of infant formula,^{79,80} growing at an estimated rate of 20% per year.⁸¹

Under the joint influence of domestic and foreign culture, breastfeeding rates in China have fluctuated a great deal over the last few decades, and have been negatively influenced by factors that may otherwise be seen as improvements in living conditions. Though there is limited

literature about infant feeding practices before the 1970s, generally speaking, breastfeeding rates decreased during the 1970s after the introduction of infant formula, and hit a nadir during the 1980s.^{65,80,82} Though the Baby Friendly Hospital Initiative has been active in China since the early 1990s,^{83,84} and has increased breastfeeding rates to some extent, these rates remain suboptimal. Currently, the national breastfeeding initiation rate is high, with more than 90% of mothers initiating breastfeeding after delivery. Breastfeeding duration also appears to be adequate, with greater than 75% of mothers still breastfeeding at 6 months of age.^{79,85} However, exclusivity is of concern, as there are issues with both the definition of exclusivity and with cultural patterns of introducing other foods before 6 months of age.^{86,87} For example, exclusivity rates can vary tremendously, from as low as 0.2% to as high as 70%.^{80,86,88} Adding water or culturally valued foods (such as herbal tea), before 6 months of age is a normal behavior in most areas of China.⁷⁹ Therefore, in some studies, adding water or these specific foods is counted as exclusive breastfeeding, whereas in other studies, water is excluded from the exclusive breastfeeding group, but the traditional foods are not. Using the WHO definition of exclusive breastfeeding (excluding water and traditional foods), the rate of exclusive breastfeeding at 6 months of age is likely to be ~ 0.2%, indicating an important area of culturally-specific intervention.⁸⁶ These trends of initiation, duration, and exclusivity appear to be largely similar throughout China.^{80,85,89} In Chengdu, where the proposed project will be implemented, pilot work indicates that exclusivity at 4 months is ~35.6% and at 6 months has dropped to 6.6%, indicating need for interventions.

In summary, breastfeeding initiation and duration rates are high in China, but exclusivity is far behind both the WHO recommendation and the Chinese National Program of Action for Child Development (2011-2012) objective.^{89,90} In light of the vast changes in dietary patterns in China,

maintaining breastfeeding as a positive health behavior is likely to be an important public health issue that could assist China in making a healthy transition into modernization, and greatly impact global health.

Part 3: Barriers to Breastfeeding

Though breastfeeding is recognized as the optimal mode of infant-feeding, breastfeeding rates in both the US and China indicate that participating in this behavior is not automatic. In fact, though breastfeeding is often considered to be a behavior between mother and infant, it occurs in a broad family, institutional, and social context. These factors act independently and collaboratively to impact infant feeding behavior. Breastfeeding is not merely a personal behavior, but impacted by social norms and local cultures. Barriers outlined in the literature include individual-, interpersonal-, community-, and social-level factors.^{54,91,92} Individual-level factors include maternal education, age, marital status, smoking status and race/ethnicity, as well as breastfeeding knowledge, attitudes, and prior breastfeeding experiences.^{91,93,94} Interpersonal-level factors include both physical and mental support from family members. Institutional factors include support for women as they return to work or school.⁹⁵⁻⁹⁷ Community- and social-level factors include support for the breastfeeding mother in the workplace and policy protecting the breastfeeding dyad in public spaces.^{54,98} At each level, and for each barrier, specific intervention is required.

Individual-level Factors

Multiple studies report low maternal education, maternal smoking, marital status, maternal age, and maternal race/ethnicity as indicators of suboptimal infant feeding practices.^{91,99} Lee and colleagues investigated factors associated with intention to breastfeeding among low-income,

inner-city, American women, and found that low education, not living with the infant's father, and smoking were all negative indicators of breastfeeding intention.⁹³ A prospective study, completed in Sweden, found that maternal education and maternal unemployment benefit were strongly and positively related to breastfeeding duration.⁹¹ Research in the United States has found that, according to 1999-2006 data, the *ever breastfeeding* rate was significantly higher among those with higher incomes, compared with those with lower incomes (74% vs. 57%). Maternal age is also related to breastfeeding outcomes, with younger populations less likely to breastfeed.¹⁰⁰ Race is also an important predictor of breastfeeding outcomes, as breastfeeding rates among Black women consistently fall short of other race/ethnicities.¹⁰⁰

Breastfeeding attitudes are also importantly related to breastfeeding outcomes.¹⁰¹ For example, Avery and colleagues studied factors that could distinguish those who weaned during the 1 month postpartum period from those who continued beyond this point.¹⁰² Positive attitudes towards bottle-feeding rather than breastfeeding, the intention to breastfeed for only a short time, and lower breastfeeding knowledge score were all factors associated with early weaning. Multiple studies have indicated that breastfeeding knowledge is positively associated with breastfeeding attitude, and that these factors work together to influence infant feeding behavior.¹⁰³⁻¹⁰⁵ Susin and colleagues¹⁰⁶ examined the influence of parental breastfeeding knowledge on breastfeeding rates in Brazil, and found that greater breastfeeding knowledge of both the mother and the father could improve breastfeeding rates. Mothers with the highest level of knowledge were 6.5 times more likely to exclusively breastfeed at the end of third month, and 1.97 times more likely to report any breastfeeding at the end of sixth months, compared to other mothers. It is theorized that breastfeeding knowledge and attitudes could impact breastfeeding behavior via intention, which is a strong predictor of actual behavior.¹⁰⁷ This is supported by the

Theory of Planned Behavior (TPB). According to TPB, breastfeeding behavior can be predicted by breastfeeding intention, which is influenced by a combination effect of breastfeeding attitudes, attitudes expressed by mothers' significant others (subjective norm), and maternal perceptions of behavioral control. Breastfeeding intention is often formed prenatally, possibly as early as the adolescent period.¹⁰⁸ Therefore, increasing breastfeeding knowledge and attitudes of future parents could help them make informed infant feeding decisions, possibly increasing the likelihood of breastfeeding a future child.

In general, mothers possess some breastfeeding knowledge, but lack knowledge about specific benefits to mothers or infants and management of breastfeeding.¹⁰⁹ Archabald and colleagues investigated prenatal concerns regarding breastfeeding during the time of infant feeding decision-making among a convenience sample in Yale-New Haven Hospital.¹¹⁰ These researchers found that most women have already worried about inadequate milk supply and pain associated with breastfeeding, even before delivery. In addition, mothers who chose to formula feed were more concerned about embarrassment/anxiety about breastfeeding when they made the infant feeding decision, compared to those choosing mixed feeding or breastfeeding.¹¹⁰ A Finnish study exploring breastfeeding knowledge among pregnant mothers and partners concluded that the participants lacked knowledge of how to increase lactation success, and the sufficiency of breast milk in hot weather and during the first 4 months postpartum.¹¹¹ The gap in breastfeeding knowledge might lead to supplementation or discontinuation of breastfeeding when faced with breastfeeding problems.

Globally, there is some research investigating the breastfeeding knowledge and attitudes of adolescents or university students.^{103,112-114} These potential future parents generally understand that breastfeeding is good for infants.¹⁰⁴ However, research has shown deficits in some critical

concepts, some of which are commonly expressed by most populations, and others that are uniquely expressed by populations from certain geographic areas and cultures.^{115,116} For example, studies spanning multiple continents have reported common concerns about restricted freedom and pain associated with breastfeeding, and breastfeeding in public.^{103,113,116,117} An example of differences among populations, in terms of breastfeeding knowledge and attitudes is that while over 90% of southeastern US university students believed that breastfeeding facilitates the return to pre-pregnancy weight, less than one-third of UK adolescents appeared to have this belief.^{116,118}

Prior breastfeeding experiences, both with a current and/or previous infant, or knowing of the experiences of others, are also important factors related to breastfeeding outcomes. Kelleher investigated the challenges of breastfeeding among Canadian and American mothers at 1 month postpartum, using the methodology of semi-structured in-depth interviews, and concluded that many mothers experienced unexpected and prolonged breastfeeding challenges.¹¹⁹ The discomfort and pain was an inhibitor to continued breastfeeding. Similarly, Taylor and colleagues reported that 14.9% of women who did not breastfeed and 26.9% of women who had stopped breastfeeding cited “physical or medical problem”, of either the current or prior child, as the reason for their infant-feeding behaviors.¹²⁰ Using data from the Infant Feeding Practice Study, Li and colleagues found that 11.3% of mothers considered breastfeeding to be “...too painful”, and an important factor influencing their infant feeding decision. In addition, 19.2% cited “my baby had trouble sucking or latching on.”¹²¹

Worldwide, perceived insufficient milk (PIM) supply is a common reason for discontinuation of any or exclusive breastfeeding.¹²²⁻¹²⁵ Studies conducted in multiple countries have reported PIM as a major barrier to breastfeeding. Chan and colleagues reported that 44% of Hong Kong

mothers cited PIM as the reason for weaning or supplementing breastfeeding.¹²⁶ Importantly, these results were based on a population which expressed intention to exclusively breastfeed for at least 3 months.¹²⁶ A study completed in the United States concluded that “not enough milk” was the most common reason for weaning through the first 6 weeks postpartum, with 35% of women reporting this phenomenon.¹²⁷ In another US study, Lewallen and colleagues reported that a third of participants (34.7%) who planned to exclusively breastfeed for at least 8 weeks cited PIM as a reason for weaning.¹²⁸ In Japan, 73% of mothers cited PIM as the principle reason for weaning or supplementing with other food.¹²⁹ It is evident that PIM is also a major barrier to breastfeeding in Mainland China, with the percentage of mothers reporting this phenomenon, ranging from 51% to 81%.⁸⁰

However, most of these studies did not measure actual breast milk production, but simply reported maternal PIM. Hill and colleagues measured actual milk production, by weighing infants before and after each feeding, and found that those with adequate milk supply during the 6th week postpartum might still report PIM 2 weeks later.¹³⁰ The authors concluded that mothers might interpret some factors as indicators of PIM, regardless of whether or not their breast milk production was adequate. Mothers reported infant crying as the most commonly used indicator of PIM.^{122,124,131} A qualitative study among Mexican mothers showed that infant crying was the most common indicator of PIM used by mothers, and the most common strategy to cope with the problem was supplementing other food.¹²³ Perez-Escamilla also found Mexican mothers used infant crying as an indicator of PIM, instead of poor growth.¹³² Hill and colleagues stated that “infant was not satisfied and was fussy after feeding” was the major reason expressed by mothers (65%) for interpreting a low milk supply.

PIM is not a new phenomenon, but has been present for generations and in multiple countries.^{128,133-135} Thus, more fully understanding this perception, and developing meaningful, targeted interventions could prevent a substantial number of current and future mothers from early weaning or supplementing with other food. Researchers have endeavored to identify at-risk populations and predictors of PIM.^{129,136,137} Hill and Humenick developed an “insufficient milk supply” (IMS) conceptual framework, and pointed out potential determinants and indicators of insufficient milk supply.¹³⁶ The determinants included both indirect and direct factors. Maternal time constraints (hospital schedules, household responsibilities, family demands, and employment), sociocultural factors (education, ethnicity, rural/urban, religion, family/friends/care provider support/experiences), maternal comfort factors (nipple tenderness, engorgement, incision pain, modesty/privacy) and infant factors (birth weight, temperament, health status, and gender) were counted as indirect determinants of milk production, whereas breastfeeding behavior (initiation time, frequency, duration, infant nursing behavior, and night feeding), maternal psychological factors (perception of cost/benefit, personality, attitudes, knowledge of breastfeeding), and maternal physiologic factors (health status, nutrition, fluid intake, medication, age, smoker, and oral contraceptive use) were categorized as direct determinants.¹³⁶ The indicators of PIM include milk maturation rate, infant rate of weight gain, infant satisfaction, supplementation, maternal expectation, satisfaction and relaxation. Based on the IMS conceptual framework, the H & H lactation scale was developed, to identify those at risk of reporting insufficient milk supply. The scale is comprised of 3 concepts, including maternal confidence/commitment to breastfeeding, perceived infant breastfeeding satiety, and maternal-infant breastfeeding satisfaction.¹³⁸ This tool has been validated in and outside of America. Research done in U.S. populations proved the scale to be valid and reliable.¹³⁸ A study done in

Thailand, however, concluded that modifications to the scale are needed when applied to populations outside America.¹³⁹ Huang and colleagues used H & H Lactation Scale to assess insufficient milk supply, and related the results to predicting factors among Taiwanese mothers.¹³⁷ However, no modifications to the original English questionnaire were reported. This study showed that infant-feeding methods, planned breastfeeding duration, infant suckling behavior, and family support were significantly related to perceptions of insufficient milk supply. The concept of PIM is one that is influenced by both individual and interpersonal factors, and may be a critical concept to explore.

Interpersonal-level Factors

After discharge from the hospital, mothers are surrounded by family members, especially the husband and grandmothers. The infant's father and maternal grandmother are usually acknowledged as important significant others impacting infant feeding behaviors. Support from the woman's mother and her partner has been associated with more positive breastfeeding outcomes.^{109,140,141} Rempel and colleagues studied the paternal role in the breastfeeding family in Canada, and demonstrated that fathers play an important role in supporting breastfeeding by understanding, encouraging and assisting mothers to breastfeed, valuing breastfeeding mothers, and sharing housework and childcare.⁹⁶ Infants whose fathers demonstrated greater breastfeeding knowledge were 1.76 times more likely to be exclusively breastfed at the end of the first month, and 1.91 times more likely to receive any breast milk at the end of the third month.⁹⁶ A study in Italy included fathers in the breastfeeding promotion, and compared breastfeeding outcomes with a control group.¹⁴² More mothers continued breastfeeding until 6 months (25% vs. 15%) and 12 months (19% vs. 11%) in the intervention group than control group. Tarrent and colleagues surveyed Hong Kong mothers with the purpose of identifying factors associated with early

weaning. Mothers whose husbands preferred breastfeeding were more likely to continue breastfeeding over 1 month.¹⁴¹

In the extended family, grandmothers have been shown to be influential in infant feeding behaviors, although their advice might derive from local cultures and traditions and may contradict current infant feeding recommendations.¹⁴³ Susin and colleagues studied the influence of grandmothers on breastfeeding practices in Brazil, and reported that the advice from grandmothers, to add water, tea, or other foods to the infant diet, were significantly related to discontinuation of exclusive breastfeeding at 1 month postpartum and complete weaning by 6 months postpartum.⁹⁷ In China, grandmothers usually take care of the mother for at least one month after delivery; a concept referred to as, “zuoyuezi”.¹⁴⁴ During this time, grandmothers will cook nutritious food for the mother and give advice on how to feed the neonate. However, the specific foods prepared may vary by region. Thus, recommendations from grandmothers are likely to be critical in shaping infant feeding practices. Infant feeding beliefs of the older generation are passed to the new mothers, regardless of accuracy. Though grandmothers may lack correct breastfeeding knowledge, encouragement and support of breastfeeding from grandmothers is valued by mothers.¹⁴⁵ This is not a particularly novel concept as in the US, *The Surgeon General’s Call to Action to Support Breastfeeding* targets developing “programs to educate fathers and grandmothers about breastfeeding”, emphasizes the role of the extended family in supporting breastfeeding.⁵⁴ Therefore, the process of imparting correct breastfeeding knowledge to the new mothers should likely include educating grandmothers and combating any potentially incorrect traditional beliefs.

Exposure to breastfeeding, either because one was breastfed themselves, or one has interacted with a breastfeeding dyad in some capacity, has been linked to increased likelihood of

breastfeeding intent.¹⁴⁶ For example, Murimi and colleagues investigated factors influencing the breastfeeding decision among Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participants, and reported that mothers who were breastfed as children were more likely to breastfeed their own child, compared to those who were not breastfed as children.¹⁴⁷ Similarly, Bolton and colleagues found that previous breastfeeding experiences were significantly positively associated with longer breastfeeding duration among low-income U.S. women.¹⁴⁸ Hoddinott and colleagues examined the relationship between vicarious breastfeeding experience and breastfeeding intention in North East Scotland. They found that women who witnessed breastfeeding within the previous 12 months were significantly more likely to agree with the statement “It was lovely to see her breastfeed.” Agreement with the statement was associated with 6 times greater likelihood of breastfeeding intention, compared to those in disagreement with the statement.¹⁴⁹

Institutional Factors

The modernization, technological advancements, and economic development of societies around the world have increased the percentage of working women considerably during the last few decades.^{56,150} In 2004, more than 70% of American women of childbearing age (20 to 44 years) were in the civilian labor force.^{29,54,151} A full one-third of women return to work within 3 months postpartum.¹⁵² Although more mothers today breastfeed after returning to work, compared to decades ago, returning to work remains a barrier to continued breastfeeding.¹⁵³

Ryan and colleagues investigated employment status and its impact on breastfeeding.¹⁵² Mothers recalled infant feeding methods while in the hospital and 6 months postpartum. The study found that, at 6 months, mothers who were not employed were more than twice as likely to breastfeed, compared to those who worked full time.¹⁵² According to Ogbuanu and colleagues the likelihood

of U.S. full-time working women initiating breastfeeding and, among those initiating, continuing to breastfeed for more than 6 months was 10% and 19% lower, respectively, than those not employed.⁹⁵ Similarly, in Australia, full-time employment before 6 months was negatively associated with breastfeeding over 6 months, OR=0.35.¹⁵⁴ These findings are repeated in a study completed in the United Kingdom, with results indicating that mothers planning to return to work before 6 weeks postpartum were significantly less likely to initiate breastfeeding, compared to those not planning to return to work within this timeframe.¹⁵⁵

Social Factors

Individual, interpersonal, and community-level factors impacting breastfeeding function within the larger context of the public domain. Acceptance of breastfeeding as the normal mode of infant feeding is currently not the situation in the United States. For example, a survey of US adults, designed to assess any changes in public attitudes about infant feeding, indicated that in 2003, 25.7% of participants agreed with the statement that “Infant formula is as good as breast milk”, an increase from 14.3% in 1999.¹⁵⁶ Geographically, the southeast area of the United States lags behind in breastfeeding knowledge and social acceptance of breastfeeding. To map regional differences, the southeast central region was defined as Tennessee, Alabama, Kentucky and Mississippi. The mountain region includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming, and consistently boasts the highest breastfeeding rates of any region.^{62,157} In the southeast central region, slightly more than half of participants thought breastfeeding is healthier for babies than formula feeding, compared with three-fourths of participants in the mountain region (55.3% vs. 75.1%). In addition, only 13.7% of southeast central respondents agreed that “Feeding a baby formula instead of breast milk increases the

chance the baby will get sick”, whereas 38.1% of respondents in the mountain region supported the statement.¹⁵⁷

In China, very little research exists that explores public attitudes towards breastfeeding and/or breastfeeding as the “norm” for infant feeding. However, what does exist indicates that infant formula is considered as an ideal gift for new parents, indicating formula’s potential status in the culture.⁷⁹

It is realistic to expect that mothers following the breastfeeding recommendations, and especially those complying with exclusively recommendations, will be faced with feeding their infant outside of the home at some point. Therefore, in a supportive society, breastfeeding in public spaces, however discretely performed, should be acceptable. However, especially in the U.S. population and among populations of current and future parents, it appears that breastfeeding in public spaces is not particularly acceptable.^{117,158,159} For example, a 2003 survey of the general U.S. adult population showed that 37% of participants agreed with the statement that “mothers who breastfeed should do so in private places only, and only slightly less than half of the participants (48.1%) agreed with statement “I am comfortable when mothers breastfeed their babies near me in a public place, such as shopping center, bus station, etc”.¹⁵⁶ Geographically, the southeast central region is least likely to agree with the statement that it is appropriate to show a woman breastfeeding her baby on TV programs (20.4% vs. 36.1% in the mountain region), and that women should have the right to breastfeed in public (37.2% in southeast central region vs. 58.8% in the mountain region).¹⁵⁷ For future parents, data from the U.S. and other countries, indicate concern over public breastfeeding.^{103,113,117,160,161} For example, a survey conducted among high school and college students in Alabama indicated that less than half of participants thought breastfeeding should be done publicly, though the overall attitudes were

positive.¹⁶⁰ Another study, conducted among college students in the southeast region of the U.S. showed that though the overall attitude towards breastfeeding was positive, 67.8% of participants believed public breastfeeding to be unacceptable, and 77.7% indicated that breastfeeding is an intimate behavior that should be kept private.¹¹³ Studies outside the U.S., including Hong Kong,¹⁰³ Korea,¹¹⁷ and Northern Ireland,¹⁶¹ indicated similar concerns over public breastfeeding among the future parents.

If society as a whole considers public breastfeeding to be embarrassing and unacceptable, mothers may feel compelled to breastfeed only at home or in private spaces, which will limit their ability to comply with infant feeding recommendations. Currently limited public spaces provide adequate facilities for breastfeeding mothers.¹⁶² If mothers do not feel accepted in public spaces, they may transition to formula feeding, as the more accepted feeding method. In this way, they can meet the needs of the infant while complying with social norms.

Conclusion

The method of feeding their infants is among one of the first choices parents make for their children. The abundant immunological factors and the highly bioavailable nutrients presented in breast milk, together with the reduced risk of developing several chronic diseases, are likely to support and sustain an optimal health trajectory for those infants receiving breast milk. However, breastfeeding rates are suboptimal in both the United States (duration, exclusivity) and China (exclusivity). Barriers to compliance with infant feeding recommendations encompass personal, interpersonal, community, and social level factors, and each level requires specific, culturally appropriate intervention. Potential intervention points for future research include increasing accuracy of breastfeeding knowledge and optimizing attitudes among future and current parents, creating a breastfeeding friendly hospital and family environment, and encouraging broader

social support for breastfeeding as the normal method of infant feeding. To successfully promote and support breastfeeding, it is necessary to target the whole breastfeeding chain, and cultivate a breastfeeding friendly culture.

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**Chapter 3 Breastfeeding Knowledge, Attitudes, and Intention in A Sample of
Undergraduate Students in Mainland China**

Abstract

Background: Despite the high breastfeeding initiation rate in China (>90%), the low exclusivity rate is of concern. Some traditional behaviors, combined with increasing popularity of infant formula, may negatively impact future breastfeeding rates. Understanding breastfeeding beliefs of young adults may help identify and address misperceptions of future parents, supporting maintenance of the current initiation rate while increasing rates of exclusivity and duration. To the authors' knowledge, no research has evaluated these factors among young adults in Mainland China.

Objective: The objective was to explore any relationships between breastfeeding knowledge, attitudes, previous experiences, and future intention among undergraduate students in Mainland China.

Methods: This was a cross-sectional quantitative study, conducted from May to June 2012. A convenience sample of 395 students from a major public university in southwest China participated in the survey.

Results: Breastfeeding knowledge was moderate (76.7% of total score), and breastfeeding was also considered to be painful (34.2%), to make breasts sag (43.1%), and to restrict the freedom of mothers (52.5%). In addition, 58.2% of students reported they would feel embarrassed if they/their partners were to breastfeed in public, and acceptability of breastfeeding in public was low (34.7%). Three fourths of the students (75.1%) expressed the intention to breastfeed or support a partner to breastfeed a future child, though males were more likely to do so than females (81.3% vs. 71.7%, $p=0.04$).

Conclusions: In order to create a more breastfeeding-friendly culture, future research is warranted to explore these negative beliefs about breastfeeding and to counter misunderstandings among future parents in Mainland China.

Key words: breastfeeding knowledge, breastfeeding attitudes, breastfeeding intention, China, undergraduate students

Background

Breastfeeding is beneficial to infants, mothers, families, and society as a whole ¹. In the short term, breastfeeding provides infants with protection from some illnesses, and assists with mothers' postpartum recovery ². A long term benefit of breastfeeding for infants is reduced risk of later overweight and obesity ³ and, for mothers long term benefits include reduced maternal breast and ovarian cancer risk ^{4,5}. The reduced burden of disease results in decreased employee absenteeism and decreased healthcare costs, leading to economic benefits for families and general society ⁶. These significant benefits have compelled global recommendations to increase breastfeeding initiation, exclusivity, and duration rates ⁷.

Because of these benefits, increasing breastfeeding rates has become a public health priority in many countries, including China ⁸⁻¹⁰. Nationally, the current breastfeeding initiation rate in China is high, at greater than 90% ^{11,12}. However, duration and exclusivity are more problematic ^{13,14}. Traditional practices that threaten exclusivity, such as offering water and complementary food to infants before 6 months of age, are prevalent ^{15,16}. Additionally, infant formula has been gaining popularity in China, ¹⁷ and its perceived convenience is likely to further impact exclusivity and duration ¹⁸. These social norms function subconsciously to influence an individual's breastfeeding attitudes and practices ¹⁹. Therefore, research in support of one objective of the National Program of Action for Child Development in China (2011-2020), to increase the exclusive breastfeeding rate at 6 months to 50% of infants, is critical and timely ¹⁰.

Research has found that breastfeeding knowledge and prior exposures are positively associated with breastfeeding attitudes ²⁰, which are, in turn, important predictors of breastfeeding intention ^{21,22}. Though the focus on increasing knowledge and positive attitudes towards breastfeeding has been conducted among pregnant women ²³⁻²⁵, the infant feeding decision is likely formed long

before a pregnancy occurs and adolescents appear already able to express infant feeding intentions ²⁶. Therefore, understanding young adults' breastfeeding knowledge, attitudes, prior exposures, and future intent, may reveal critical gaps that could lead to targeted intervention. Globally, there have been only a small number of studies investigating these factors among young people: in the U.S. ²⁷⁻²⁹, Hong Kong ³⁰, Canada ³¹⁻³³, the UK ³⁴, Korea ³⁵, Kuwait ³⁶, and in Australia ³⁷. To the authors' knowledge, this study is the first study to explore these concepts among young adults in Mainland China. Understanding current breastfeeding knowledge, attitudes, and prior exposures within this specific population may reveal culturally unique areas to target, in an effort to maintain current high levels of initiation, in addition to increasing exclusivity and duration. Therefore, the objectives of this study were to describe breastfeeding knowledge and attitudes among Chinese undergraduates, to evaluate factors associated with breastfeeding knowledge and attitudes, and to identify factors that may influence future breastfeeding intention.

Methods

Design and Sample

This was an exploratory, cross-sectional study, conducted among undergraduate students attending Sichuan University, a major public university in southwest China with ~ 40,000 enrolled undergraduates. From May to June of 2012, 395 questionnaires were distributed in 6 undergraduate classrooms. The return rate was 99.7% (394/395). Prior to implementation, the study protocol was approved by the Institutional Review Board of the University of Tennessee, Knoxville. Participation was voluntary and completion of the survey was considered to be consent.

Measures

Translation and Pilot Testing of Questionnaire

To increase accuracy, two Nutrition graduate students, bilingual in Mandarin and English, translated and back-translated the questionnaire. Inconsistencies between the original and final English versions were discussed and revised. The questionnaire was then pilot tested among 20 students (10 undergraduate and 10 graduate), and subsequently revised based on their feedback. The final version, consisting of one page front and back, included 46 questions covering three domains: Demographics; Breastfeeding Knowledge and Attitudes; and Breastfeeding Exposure, Family Involvement in Decision-Making, and Intent.

Demographics, Breastfeeding Exposure, Family Involvement in Decision-Making, and Intention

Demographic data included gender, current age (in years), major (checklist provided), and class-standing (freshman, sophomore, junior, senior, and others).

Prior exposure questions included, “Were you breastfed when you were a baby?” “Have you ever witnessed a woman breastfeeding her baby?” and “Do you know someone who has breastfed a baby?”. Available responses were “yes”, “no”, or “unsure”. Family involvement in the decision to breastfeed was explored by asking participants to respond to the statement, “The decision to breastfeed should be made”, by checking one of the following options: “Entirely by the baby’s mother”, “Mostly by the baby’s mother”, “A joint decision by both mother and father”, “Mostly by the baby’s father”, “By the whole family, including grandparents”, or participants could provide their own responses in a space provided. The intent to breastfeed future children was assessed with the question, “Would you breastfeed/support your partner to breastfeed in the future?”.

Breastfeeding Knowledge and Attitudes

The breastfeeding knowledge and the breastfeeding attitude scales were derived from a combination of statements from Tarrant and colleagues³⁰, Giles and colleagues³⁸, and the Iowa Infant Feeding Scale³⁹, and were previously tested among undergraduates attending a large university in the southeastern U.S.⁴⁰. The internal consistency reliability of the 3 original attitude scales was good.

Breastfeeding Knowledge Scale

The breastfeeding knowledge scale consisted of 13 statements covering benefits to mothers and infants, as well as behaviors related to breastfeeding. Respondents could choose “agree” or “disagree”, which were later recoded as “1” (correct) or a “0” (incorrect). This allowed for a total score ranging from 0 to 13.

Breastfeeding Attitude Scale

The attitude scale consisted of 16 statements, with responses linked to a 5-point Likert Scale. Possible responses included “strongly disagree”, “disagree”, “neutral”, “agree”, and “strongly agree”. Responses were coded from 1 (“strongly disagree”) to 5 (“strongly agree”).

Statistical Analysis

Data were double entered into Epidata3.1, cleaned, and analyzed using IBM SPSS 20.0. Missing value analysis was performed to identify patterns of missing values using IBM SPSS 20.0. Questionnaires deemed incomplete (defined as more than 10 missing responses) and careless response (all knowledge statements were answered one way; all attitude statements received the same response) were dropped from analysis (n=8). Additionally, students less than 18 years of

age were excluded (n=3) as the Institutional Review Board did not approve inclusion of these underage participants. Therefore, the final sample size was 383.

Data imputation was performed to estimate missing values on the breastfeeding knowledge and attitude scales, separately. Prior to data analysis, responses to breastfeeding attitudes statements favoring formula feeding were reverse-coded, allowing higher numbers to be representative of more positive attitudes towards breastfeeding. Sample demographics, as well as responses to individual statements/questions, were generated using descriptive analysis. Exploratory factor analysis with un-weighted least squares extraction and promax rotation was utilized to identify potential underlying constructs in the attitude scale. To determine the influence of demographic characteristics (gender, age, major, and grade) on breastfeeding knowledge and attitude scores, independent T-tests were used. Chi-square analysis was performed to examine relationships between categorical variables. To identify potential indicators of breastfeeding intention, hierarchical logistic regression was completed. Because breastfeeding knowledge scale and attitude scale was not measured on the same metric, the total scores were standardized before entering into the regression model. Demographics and factors that were associated with breastfeeding intention in univariate analysis were entered into step 1. Breastfeeding knowledge and attitude scores were entered in step 2.

Results

Demographic Characteristics

Sample characteristics are shown in **Table 3.1**. The mean age of students was 20.0 years (1.04) (mean (SD)). Male students were significantly older than females (20.34 vs. 19.86, male vs. female, $p=0.000$). There were more females (64.8%) than males in the sample, more than half the

students were freshmen (61.8%), and over half were ≥ 20 years of age (67.1%). The sample was almost evenly split between health-related (53.3%) and non-health-related majors (46.7%).

Breastfeeding Exposures, Intention and Decision-making

The majority of students reported some prior breastfeeding exposure: 87.9% reported being breastfed as an infant; 93.7% reported knowing someone who had breastfed; and 92.6% reported having witnessed someone breastfeeding. Nearly half of the sample expressed the opinion that the decision to breastfeed should be made jointly by the mother and father (46.7%) and 14.4% believed it to be a decision that should include the whole family, including grandparents. Three-fourths of the sample (75.1%) expressed the intention to breastfeed/support a partner to breastfeed in the future. Comparing by gender indicated that female students were more likely than males to report witnessing breastfeeding (95.5% vs. 87.0%, $p=0.003$) and knowing someone who had breastfed (96.4% vs. 88.8%, $p=0.004$), females vs. males, respectively. However, males were significantly more likely to report the intention [to support a partner] to breastfeed in the future (81.3% vs. 71.7%, males vs. females, $p=0.04$).

Table 3.1 Demographic Characteristics, Breastfeeding Prior Exposure and Intention to Breastfeeding of Southwestern Chinese Undergraduates (n=383)

Questions ^a		Male n (%)	Female n (%)	Total n (%)
Age, in years ^b	<20	30 (22.6%)	95 (38.5%)	125 (32.9%)
	≥20	103 (77.4%)	152 (61.5%)	255 (67.1%)
Major ^b	Health-related	49 (39.2%)	146 (60.6%)	195 (53.3%)
	Non-health-related	76 (60.8%)	95 (39.4%)	171 (46.7%)
Class-standing ^b	Freshman	69 (51.5%)	166 (67.5%)	235 (61.8%)
	Non-freshman	65 (48.5%)	80 (32.5%)	145 (38.2%)
Were you breastfed when you were a baby?	Yes	113 (84.3%)	222 (89.9%)	335 (87.9%)
	No	9 (6.7%)	15 (6.1%)	24 (6.3%)
	Unsure	12 (9.0%)	10 (4.0%)	22(5.8%)
Do you know someone who has breastfed a baby? ^{b, c}	Yes	119 (88.8%)	238 (96.4%)	357 (93.7%)
	No	2 (1.5%)	3 (1.2%)	5 (1.3%)
	Unsure	13 (9.7%)	6 (2.4%)	19 (5.0%)
Have you ever witnessed a woman breastfeeding her baby? ^{b, c}	Yes	114 (87.0%)	234 (95.5%)	348 (92.6%)
	No	13 (9.9%)	10 (4.1%)	23 (6.1%)
	Unsure	4 (3.1%)	1 (0.4%)	5 (1.3%)
Would you breastfeed/support your partner to breastfeed your baby in the future? ^{b, c}	Yes	109 (81.3%)	177 (71.7%)	286 (75.1%)
	No	2 (1.5%)	7 (2.8%)	9 (2.4%)
	Unsure	23 (17.2%)	63 (25.5%)	86 (22.6%)
The decision to breastfeed should be made	Entirely by the mother	8 (6.0%)	22 (8.9%)	30 (7.9%)
	Mostly by the mother	34 (25.4%)	79 (32.0%)	113 (29.7%)
	By both mother and father	70 (52.2%)	108 (43.7%)	178(46.7%)

Table 3.1 Continued

Questions ^a		Male n (%)	Female n (%)	Total n (%)
The decision to breastfeed should be made	Entire big family	18 (13.4%)	37 (15.0%)	55 (14.4%)
	Others	4 (3.0%)	1 (0.4%)	5 (1.3%)

^a The total number of participants of some questions may not add up to 383 due to missing answers.

^b Significantly different by gender (Chi-square analysis, $p < 0.05$)

^c To increase cell size, responses of “no” and “unsure” were combined and compared to “yes”.

Breastfeeding Knowledge

The percent of correct responses to each breastfeeding knowledge statement is provided in **Table 3.2**. The mean score was 9.97 ± 1.68 out of a possible 13, indicating that 76.7% of responses were correct. However, nearly three-fourths of the students (73.5%) disagreed with the statement that breastfeeding should be initiated within the first hour after birth, and slightly more than one-third (34.6%) believed that the size of breasts influences breast milk production. Respondents younger than 20 years of age scored significantly higher on the breastfeeding knowledge scale (10.2 vs. 9.8, $p = 0.025$).

Table 3.2 Percentage of Chinese Undergraduates Correctly Responding to Breastfeeding Knowledge Statements (n=383)

	Male n (%)	Female n (%)	Total n (%)
“Agree” is the correct answer			
Breastfeeding should be started within the first hour after birth.	37 (27.6%)	64 (25.9%)	101 (26.5%)
The first food for babies should be breast milk. ^a	118 (88.1%)	184 (74.5%)	302 (79.3%)
Breastfeeding alone provides sufficient nutrition in the first 6 months of life for the baby.	115 (85.8%)	205 (83.0%)	320 (84.0%)
Breastfeeding helps prevent respiratory infections in the baby.	124 (92.5%)	227 (91.9%)	351 (92.1%)
Formula-fed babies may suffer from more illness than breastfed babies. ^{a, c}	106 (79.1%)	171 (69.2%)	277 (72.7%)
The benefits of breastfeeding for babies continue even after weaning.	120 (89.6%)	215 (87.0%)	335 (87.9%)
Breastfeeding will help a mother feel closer to her baby.	123 (91.8%)	235 (95.1%)	358 (94.0%)
Women who have breastfed have lowered risk of breast cancer.	97 (72.4%)	193 (78.1%)	290 (76.1%)
Most women can make enough breast milk to adequately feed their baby.	105 (78.4%)	188 (76.1%)	293 (76.9%)
Alcohol is passed from the mother’s body to breast milk.	94 (70.1%)	187 (75.7%)	281 (73.8%)
“Disagree” is the correct answer.			
The nutrients in breast milk and infant formula are the same. ^b	125 (93.3%)	237 (96.0%)	362 (95.0%)
Breastfeeding prevents a woman from returning to her pre-pregnancy weight.	94 (70.1%)	183 (74.1%)	277 (72.7%)
Women who have small breasts cannot make enough breast milk.	83 (61.9%)	166 (67.2%)	249 (65.4%)

^a Significantly different by gender (Chi-square analysis, $p < 0.05$)

^b Significantly different by age (<20 vs. ≥20, respectively):

98.4% vs. 93.4%; $p = 0.033$

^c Significantly different by major (health-related vs. non-health-related, respectively):

67.3% vs. 78.5%; $p = 0.017$

Breastfeeding Attitudes

The Cronbach's alpha for the attitude scale was 0.675, indicating acceptable internal consistency reliability. Due to small cell sizes, responses to breastfeeding attitude statement responses were combined to allow for performance of valid statistical analysis (responses of "strongly disagree" and "disagree" were combined and recoded as "disagree"; responses of "strongly agree" and "agree" were combined and recoded as "agree"). This resulted in 3 response categories, instead of 5.

Exploratory factor analysis suggested the presence of 2 factors within the attitude scale. Upon review of the statements loading within each factor, it was determined that one factor represented "Breastfeeding Advantages", while the second factor represented "Breastfeeding Concerns" (**Table 3.3**). The "Advantages" subscale included 6 statements, allowing a subscale score from 6 to 30, and had a Cronbach's alpha of 0.698. Dividing the total score by the total number of items resulted in a mean subscale score of 3.76. In this subscale, more than 80% of students agreed with the statement that breastfed babies grow better than formula-fed babies, and more than 70% believed that babies enjoy breastfeeding more than formula feeding. However, only about half the sample considered breastfeeding to be cheaper (53.5%) or more convenient (46.5%) than formula feeding.

Table 3.3 Responses of Chinese Undergraduates to Breastfeeding Attitude Scale Statements (n=383)

	Disagree n (%)		Neutral n (%)		Agree n (%)	
	Male	Female	Male	Female	Male	Female
Factor 1: “Breastfeeding advantages”						
Breast milk is cheaper than formula.	30 (22.4%)	56 (22.7%)	38 (28.4%)	53 (21.5%)	66 (49.3%)	138 (55.9%)
Breastfed babies are smarter than formula-fed babies.	28 (20.9%)	50 (20.2%)	36 (26.9%)	58 (23.5%)	70 (52.2%)	139 (56.3%)
Breastfed babies grow better than formula-fed babies.	12 (9.0%)	17 (6.9%)	20 (14.9%)	19 (7.7%)	102 (76.1%)	211 (85.4%)
Babies enjoy breastfeeding more than formula-feeding.	14 (10.2%)	20 (8.1%)	30 (22.4%)	41 (16.6%)	90 (67.2%)	189 (75.3%)
I respect women who breastfeed.	4 (3.0%)	15 (6.1%)	6 (4.5%)	4 (1.6%)	124 (92.5%)	228 (92.3%)
Breastfeeding is more convenient than formula feeding.	35 (26.1%)	57 (23.1%)	36 (26.9%)	76 (30.8%)	63 (47.0%)	114 (46.2%)
Factor 2: “Breastfeeding concerns”						
Formula feeding gives more freedom to the mother.	30 (22.4%)	46 (18.6%)	38 (28.4%)	68 (27.5%)	66 (49.3%)	132 (53.4%)
Nursing a baby would be painful. ^a	52 (38.8%)	67 (27.1%)	47 (35.1%)	86 (34.8%)	35 (26.1%)	94 (38.1%)
Breastfeeding can make breasts sag. ^a	45 (33.6%)	46 (18.6%)	54 (40.3%)	71 (28.7%)	35 (26.1%)	130 (52.6%)
Mothers should wean their babies before they return to work or school. ^a	43 (32.1%)	42 (17.0%)	27 (20.1%)	41 (16.6%)	64 (47.8%)	164 (66.4%)
Seeing a woman breastfeed makes me uncomfortable.	84 (62.7%)	136 (55.1%)	32 (23.9%)	82 (33.2%)	18 (13.4%)	29 (11.7%)
Seeing a woman breastfeed on television makes me uncomfortable.	84 (62.7%)	140 (56.7%)	33 (24.6%)	73 (29.6%)	17 (12.7%)	34 (13.8%)
Seeing a magazine picture of a woman breastfeeding makes me uncomfortable.	84 (62.7%)	144 (58.3%)	32 (23.9%)	74 (30.0%)	18 (13.4%)	29 (11.7%)
Breastfeeding should only be done around friends and family. ^a	48 (35.8%)	56 (22.7%)	41 (30.6%)	70 (28.3%)	45 (33.6%)	121 (49.0%)

Table 3.3 Continued

	Disagree N (%)		Neutral N (%)		Agree N (%)	
	Male	Female	Male	Female	Male	Female
Breastfeeding in public is acceptable. ^a	39 (29.1%)	88 (35.6%)	36 (26.9%)	86 (34.8%)	59 (44.0%)	73 (29.6%)
I will feel embarrassed if I/my partner breastfeed(s) in public. ^a	27 (20.1%)	32 (13.0%)	45 (33.6%)	55 (22.3%)	62 (46.3%)	160 (64.8%)

^a Response to individual attitude statement differed by gender (Chi-square analysis, $p < 0.05$)

The “Concerns” subscale included 10 statements, allowing a subscale score ranging from 10 to 50, and had a Cronbach’s alpha of 0.753. The mean score of this subscale was 3.0, indicating an overall neutral attitude. Although nearly 60% reported that seeing a woman breastfeed does not make them uncomfortable, 58.3% of students reported that they would feel embarrassed if either they or their partner breastfed in public, and 43.6% reported the belief that breastfeeding should only be done around friends and family. Responses concerning breastfeeding in public were nearly evenly divided across the three response categories.

Exploration of demographic factors associated with the subscale scores was performed. Mean scores on the “Advantages” subscale did not differ by gender. However, male students had significantly higher mean scores on the “Concerns” subscale, compared to females (31.8 vs. 29.3, $p = 0.00$). In general, it appears that male students may be less concerned with exposure to breastfeeding. For example, male students were significantly more likely to agree that breastfeeding in public is acceptable (44.0% vs. 29.6%, $p = 0.018$), whereas females were significantly more likely to agree with the statement regarding embarrassment to self or partner breastfeeding in public (64.8% vs. 46.3%, females vs. males, $p = 0.002$). In addition, females were

significantly more likely than males to believe breastfeeding should occur only around friends and family (49.0% vs. 33.6%, $p=0.006$), would be painful (38.1% vs. 26.1%, $p=0.024$), would make breasts sag (52.6% vs. 26.1%, $p=0.000$), and were significantly more likely to agree that weaning should occur before returning to work/school (66.4% vs. 47.8%, $p=0.001$).

Exploring relationships between the two breastfeeding attitudes subscales and breastfeeding knowledge indicated that breastfeeding knowledge scores were significantly positively related to “Advantage” subscale scores ($r=0.318$, $p=0.000$) and “Concerns” subscale scores ($r=0.131$, $p=0.011$). No statistically significant relationship was found between the two attitude subscale scores.

Relationships between Exposures and Breastfeeding Knowledge, Attitudes, and Intention

Secondary to small sample size, responses of “no” and “unsure” to the 3 questions assessing previous breastfeeding exposures and the future intention question were later combined and compared with those responding “yes”. Those reporting being breastfed as an infant scored significantly higher on the “Advantages” subscale (22.9 vs. 20.2, $p=0.000$), and were more likely to express intention to breastfeed a future child (77.4% vs. 54.3%, $p=0.001$), compared to those who were unsure or were not breastfed. Similarly, knowing someone who has breastfed an infant was associated with a higher knowledge score (10.0 vs. 9.3, $p=0.042$), and with a higher score on the “Advantages” subscale (22.7 vs. 20.8, $p=0.019$). However, those with previous breastfeeding exposures did not score differently on the “Concerns” subscale.

Hierarchical logistic regression was performed to investigate the influence of breastfeeding knowledge and attitudes on intention (**Table 3.4**). Gender and the dichotomized variables for prior breastfeeding exposure were entered in step 1. The standardized knowledge score and the

two attitudes subscale scores were entered in step 2. Results of the full model indicated that being breastfed as an infant, breastfeeding knowledge scale scores, and the two attitude subscale scores, were predictive of breastfeeding intention.

Table 3.4 Hierarchical Logistic Regression Predicting Breastfeeding Intention among a sample of Undergraduate Students in Mainland China (n=383)

	B	P value	Odds ratio	95% CI for OR	
				Lower	Upper
Step 1					
Gender ^a	-0.73	0.01	0.48	0.28	0.84
Breastfed as an infant ^a	1.12	0.001	3.06	1.57	5.99
Knew someone who has breastfed	0.50	0.31	1.64	0.63	4.27
Witnessed breastfeeding	0.14	0.78	1.15	0.45	2.92
Step 2					
Gender	-0.38	0.22	0.68	0.37	1.26
Breastfed as an infant ^a	0.99	0.01	2.69	1.28	5.67
Knew someone who has breastfed	0.41	0.45	1.50	0.53	4.28
Witnessed breastfeeding	-0.36	0.50	0.70	0.24	2.00
Standardized breastfeeding advantages score ^a	0.52	0.00	1.69	1.26	2.25
Standardized breastfeeding concerns score ^a	0.94	0.00	2.55	1.86	3.51
Standardized breastfeeding knowledge score ^a	0.32	0.02	1.38	1.05	1.82
Constant	0.14	0.92	1.15		

^a p<0.05

Discussion

To the authors' knowledge, this is the first investigation of any relationships between breastfeeding knowledge, attitudes, previous breastfeeding exposures, and intention, among undergraduate students in Mainland China. Review of the limited existing literature from populations in other countries reveals some striking similarities and differences^{27,30,38,40}. For example, just over 60% of Southeastern U.S. undergraduates⁴⁰ and nearly 90% of Chinese students reported having been breastfed as infants, compared to 30% of Hong Kong undergraduates³⁰. In addition, over 90% of U.S.⁴⁰ and Chinese undergraduates reported knowing someone who had breastfed and reported having witnessed breastfeeding, in comparison to 61.4% and 47.8% of Hong Kong students, respectively. These differences between the Hong Kong sample and the Mainland China sample are striking and warrant further exploration.

Comprehensive understanding of breastfeeding knowledge is a prerequisite of making an informed breastfeeding decision⁴¹. Therefore, providing accurate breastfeeding information to those who are not yet parents may be an important step in improving future breastfeeding rates. Awareness of how rapidly an infant should be put to the breast after delivery was surprisingly lacking in this sample, especially when compared to other similar samples. Both Tarrant and colleagues³⁰, and Kavanagh and colleagues⁴⁰, found greater than 90% of Hong Kong and U.S. undergraduate students were aware of the need to offer the breast shortly after birth. However, these differences may be reflective of the high initiation rate in Mainland China, which is supported by the high percentage of sample reporting being breastfed as an infant. In other words, the lack of awareness may be driven by the absence of any perceived need for education on this concept.

In this sample, just over one-third of the undergraduates believed that breast size influence breast milk production. This was in keeping with that reported by both Tarrant and colleagues and Kavanagh and colleagues^{30,40}, who found a general understanding that these were unrelated. However, these results were quite different from those reported by Giles and colleagues, from a sample of UK adolescents³⁸. In the UK sample, half of females and greater than 60% of males believed mothers with small breasts would not make enough milk. Students in this sample were in agreement with students from Hong Kong³⁰ and the Southeastern U.S.⁴⁰, in terms of believing that breastfeeding provides enough nutrition for infants for the first six months of life, with all three samples reporting greater than 2/3rds agreement with this statement. However, what appears to be common across these populations is that exclusivity of breastfeeding remains an issue in the geographical areas each sample represents⁴²⁻⁴⁴, making these results somewhat perplexing. These examples of similarities and differences highlight the importance of understanding current knowledge of specific populations prior to providing education.

Consistent with other studies, acceptability of witnessing breastfeeding outside of a private space appeared to be an issue^{27,28,40}. For example, in this sample, only one-third of students accepted public breastfeeding, which is comparable to Southeastern U.S. undergraduates^{27,40}, but less than Hong Kong undergraduates (60%)³⁰. Additionally, the majority of these students reported the likelihood of feeling embarrassed if they or their partner were to breastfeed in public, and nearly half believed the behavior should be constrained to only when around friends and family. Similar concerns of embarrassment and privacy were also expressed by Hong Kong and U.S. undergraduates^{27,30}. It was somewhat surprising to find that Chinese male students were less likely to express these concerns, and more likely to intend to [support a partner to] breastfeed a future child, though research suggests that females are more likely to pay attention to

breastfeeding exposures than are males, which should positively influence breastfeeding attitudes and intention³². Interestingly, studies among students from Korea, the U.S., and Canada have all reported that female students have significantly higher knowledge scores than males, and have more positive attitudes about breastfeeding in general^{29,31,35}. However, Tarrant found no differences in knowledge and attitude score by gender³⁰. Kavanagh and colleagues, though finding female undergraduates to be more knowledgeable about breastfeeding than males, also found females to be more concerned with breastfeeding in public, with the inconvenience of breastfeeding, and with pain⁴⁰. Further research is needed to differentiate the sources of these ideas and to develop effective methods to address the negative beliefs.

Studies among pregnant women and new mothers have reported the decisive role of the father in the breastfeeding decision and continuation⁴⁵. Several action steps, outlined in *The Surgeon General's Call to Action to Support Breastfeeding*, support that it is imperative to “develop programs to educate fathers and grandmothers about breastfeeding”⁴⁶. Results of this study indicate that familial breastfeeding education may be particularly important when considering Chinese cultural norms, as half of the students thought the breastfeeding decision should be made jointly by both the mother and father, and nearly one-fifth believed grandparents should be included in the decision. That grandparents would be considered in this decision is less surprising when put into the context of “zuoyuezi”, or the concept describing the Chinese cultural practice of grandparent-provided care of the mother and infant during the first month postpartum⁴⁷. It also highlights the central role the father and the extended family play in infant feeding practice.

In this sample, approximately 75% of students expressed the intention to breastfeed in the future, which is slightly higher than that reported by Hong Kong (63%)³⁰ and by U.S. undergraduates

(69.1%)²⁹. However, this is lower than that reported by a different sample of U.S. undergraduates (86.3% of females and 85.6% of males)²⁷. Gender, knowing someone who had breastfed an infant, and having witnessed breastfeeding were all unrelated to future intent. This finding is strikingly similar to that reported by Tarrant and colleagues, who found intent to be predicted by having been breastfed as an infant and by breastfeeding attitudes, though having known someone who had breastfed remained significant in their final predictive model³⁰. Given the specific differences in gaps in breastfeeding knowledge unique to the two samples, it may be that personal relationships become more powerful in developing intent when specific knowledge is limited.

In summary, though breastfeeding knowledge was moderate and most had prior breastfeeding exposure, these Chinese undergraduates perceive pain, discomfort, limited freedom, and embarrassment to be associated with breastfeeding. These differences and similarities between samples from all over the world highlight the need for understanding populations of interest, and targeting messages to the unique needs of each.

Limitations

Limitations of this study include issues of generalizability and internal reliability consistency of the breastfeeding knowledge scale in this sample. Results presented here may only be generalized to undergraduate students from the southwestern area of China, as the country is vast and cultural values, practices, attitudes and intention may vary a great deal. This work should be repeated in multiple regions of the country. Because the Cronbach's alpha for the knowledge scale (0.33) was below what is considered to be acceptable (0.7), actual overall breastfeeding knowledge could not be assessed. However, the individual items did reveal some potential

concepts that should be explored in future work and the scale should continue to be refined in order to increase internal reliability consistency.

Conclusions

These results provide important information on breastfeeding knowledge, attitudes, and intention among future Chinese parents. The negative feelings about public breastfeeding, and perceived inconvenience and discomfort associated with breastfeeding, highlight the importance of creating a supportive culture where breastfeeding is widely accepted. Interventions aimed at promoting breastfeeding as the norm in infant feeding, starting well before pregnancy, should result in a shift in breastfeeding attitudes, and an improvement in breastfeeding outcomes.

Funding and Conflict of Interest

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**Chapter 4 Comparison of Breastfeeding Knowledge, Attitudes, and Intention
Between Chinese and US Undergraduates**

Abstract

Objective: To compare breastfeeding knowledge, attitudes, and intent between Chinese and US undergraduates.

Design: Cross-sectional questionnaire.

Setting: Two public universities, one in China and the other in the US.

Participants: A total of 395 Chinese and 202 US undergraduates completed the questionnaire. The return rates were 99.7% (394/395) and 99.5% (201/202), Chinese and US, respectively.

Main Outcome Measure(s): Similarities and differences between Chinese and the US undergraduates in breastfeeding knowledge and attitudes, breastfeeding exposures, breastfeeding decision-making and intention to breastfeed a future child.

Analysis: Data were analyzed using descriptive analysis, Chi-square, and logistic regression.

Results: The mean knowledge scores were 9.97 (China) and 10.47 (US), out of a possible 13. Students in both countries expressed some common concerns, such as limitations on freedom and embarrassment associated with breastfeeding in public. Though somewhat similar, there were also areas of difference. For example, compared to US students, Chinese students were less likely to consider breastfeeding to be cheaper (53.5% vs. 86.8%, $p=0.00$), but more likely to perceive infant enjoyment of breastfeeding (72.3% vs. 36.0%, $p=0.00$). Greater knowledge and attitude levels and having been breastfed as an infant, were associated with a greater likelihood of intending to breastfeed, or support a partner to breastfeed, a future child. US students were more likely to express the intention to breastfeed, compared to Chinese students.

Conclusions: The study reveals some variations in breastfeeding beliefs between China and the US, highlighting the importance of tailoring intervention strategies to the specific population.

Key words: breastfeeding knowledge, breastfeeding attitudes, China, United States, undergraduates

Introduction

It has been well documented that breastfeeding is beneficial to infants, mothers, families, and the society as a whole ¹. Because of the benefits, the World Health Organization recommends exclusive breastfeeding to 6 months ². Many countries have endeavored to improve breastfeeding rates ³⁻⁵. In both China and the US, there are national documents, such as US Healthy People ⁶ and China National Program of Action for Child Development ⁵, that outline breastfeeding objectives. For example, one objective in the US is to increase exclusive breastfeeding rate at 6 months to one-fourth of infants (25.5%) by 2020. In China, it is to increase this to half of infants. However, current breastfeeding rates in both China and the US are suboptimal, especially those of breastfeeding exclusivity^{7,8}. In the US, the exclusive breastfeeding rate at 6 months was only 16.3%, according to 2009 data ⁷. In China, it is only about one-sixth of infants (14.0%) ⁹. Therefore, strategies that support breastfeeding and bridge the gap between current breastfeeding rates and objectives are timely and important.

Research has shown that breastfeeding knowledge and attitudes are associated with actual behavior ^{10,11}. For example, Scott and colleagues examined breastfeeding attitudes of expectant parents, and found that mothers' infant feeding attitude was a significant predictor of infant feeding behavior ¹⁰. In a study completed among Brazilian parents, examining the influence of breastfeeding knowledge on actual behavior, Susin and colleagues found that mothers with the highest level of breastfeeding knowledge were 6.5 times more likely to exclusively breastfeed at 3 months postpartum, compared to other mothers ¹². A higher level of paternal breastfeeding knowledge was also associated with increased likelihood of exclusive breastfeeding at 1 month after delivery. These findings are supported by the Theory of Planned Behavior (TPB). According to the TPB, breastfeeding attitudes could influence breastfeeding behavior via

intention, which is a strong predictor of actual behavior^{13,14}. The infant feeding decision is often made prenatally, possibly as early as the adolescent period^{15,16}. Therefore, identifying and addressing misperceptions of breastfeeding beliefs among future parents may increase the intent to breastfeed and the likelihood of longer breastfeeding duration and exclusivity, should they become parents in the future.

Breastfeeding beliefs are influenced by and reflective of cultural norms^{17,18}. For example, in the last few decades, infant feeding behavior in the US has been influenced by many factors, such as the popularity of infant formula and the increasing knowledge of components of breast milk¹⁷. Additionally, there are great variations in breastfeeding rates among different states in the US, likely indicating different breastfeeding sub-cultures¹⁹. For example, mothers in the southern states are less likely to breastfeed, compared to those in northwestern states^{19,20}. In China, over 90% of mothers initiate breastfeeding⁸. However, traditional beliefs, such as offering water to newborns, though conflicting with breastfeeding recommendations, are still important factors influencing breastfeeding behavior²¹. For example, depending on ethnic group and geographic area, as much as half of mothers have introduced water by hospital discharge, which is normally a week after delivery²². Additionally, the rapid modernization of China, accompanied by westernization of infant feeding, is threatening the breastfeeding environment²³. For example, in the past decade, infant formula has become a common gift for new parents²⁴. Exploring breastfeeding beliefs among future parents, and comparing these beliefs between China and the US, may reveal distinct differences and similarities in cultural beliefs, and inform researchers of culturally appropriate interventions. Therefore, the objective of the study was to compare breastfeeding knowledge, attitudes, and intention between Chinese and US undergraduates.

Methods

Research Design

This was a cross-sectional study, conducted among a convenience sample of undergraduate students in Sichuan University, China, and the University of Tennessee at Knoxville, in the US. Both universities are public, with over 40,000²⁵ and 20,000²⁶ undergraduate students, respectively. Prior to study implementation, the Institutional Review Board of the University of Tennessee approved the project.

Recruitment Strategies

Students were recruited from undergraduate classrooms in both universities. During May and June of 2012, 395 questionnaires were distributed in 6 Sichuan University classrooms, and 3 University of Tennessee classrooms. The return rate was 99.7% (394/395) for Chinese students and 99.5% (201/202) for US students.

Measurement Instruments

Based on prior use in a US population²⁷, the questionnaire was revised. Two graduate students in nutrition, both of whom were proficient in English and Chinese, translated the questionnaire into Chinese and back-translated it into English. Any inconsistencies were discussed and revised. Therefore, the questionnaire was available in both Chinese and English²⁷. The questionnaire was one-page, front and back, and consisted of 3 domains: demographics, breastfeeding knowledge and attitudes, and breastfeeding exposure, family involvement in decision-making, and intention.

Demographics, Breastfeeding Exposures, Intention, and Decision-making

Demographic questions included gender, current age (in years), major (health-related or non-health-related), and class standing (freshmen, sophomore, junior, senior, or other).

Three questions were used to explore prior breastfeeding exposures, including “Were you breastfed when you were a baby?”, “Do you know someone who has breastfed a baby?”, and “Have you ever witnessed a woman breastfeeding her baby?” Intention to breastfeed a future child was obtained by asking students to indicate whether or not they would breastfeed, or support a partner to breastfeed, in the future. Possible responses to these questions included “yes”, “no”, and “unsure”. In order to explore perceptions of family involvement in the breastfeeding decision, students were asked to select from a list of choices, in response to the statement: “The decision to breastfeed should be made...”. Possible responses included “entirely by the baby’s mother”, “mostly by the baby’s mother”, “a joint decision by both mother and father”, “mostly by the baby’s father”, “by the whole family, including grandparents”, and “other”. If choosing “other”, students could write in what “other” meant. To increase the sample size for the purpose of data-analysis, “no” and “unsure” responses to breastfeeding exposure and intention questions were combined into one group, and compared to those responding “yes” to these questions.

Breastfeeding Knowledge and Attitudes

The breastfeeding knowledge and attitude scales were derived from those used by Tarrant and colleagues²⁸, Giles and colleagues²⁹, and from the Iowa Infant Feeding Scale (IIFS)³⁰, and these methods have been described in detail elsewhere.^{27,31} The Cronbach’s alpha of the original attitude scales were 0.7 (Tarrant and colleagues), 0.92 for females/0.94 for males (Giles and

colleagues), and 0.86 (IIFS), respectively, indicating good internal consistency reliability^{32,33}. Briefly, the breastfeeding knowledge scale included 13 statements, with possible responses being either “agree” or “disagree”. Correct responses received a score of “1”, and incorrect responses received a “0”, allowing for a total score ranging from 0 to 13. The attitude scale consisted of 16 statements on a 5-point Likert scale. Responses included “strongly disagree”, “disagree”, “neutral”, “agree”, and “strongly agree”. Questions favoring formula feeding were reverse coded to ensure that a higher number was representative of a more positive attitude towards breastfeeding. From least positive to most positive, 1 to 5 was assigned to each response, allowing for the total attitude score to range from 16 to 80. To increase the cell size of attitude statements, responses of “strongly disagree” and “disagree” were combined into “disagree”. Similarly, “strongly agree” and “agree” were combined into “agree”, resulting in 3 groups.

Data Analysis

Data were double entered into Epidata 3.1, cleaned, and analyzed using IBM SPSS 20.0. Descriptive analysis, including frequencies and means, was used to describe demographic characteristics and to review responses to individual questions. Three questionnaires, from underage individuals, were dropped from analysis (Chinese sample), as use of these data was not included in the protocol approved by the Institutional Review Board. Missing data analysis methodology was utilized to identify patterns of missing values. A total of 10 questionnaires (7 Chinese and 3 US) were determined to be incomplete (defined as having > 10 questions missed), and these were excluded. One careless response (the same answer for all knowledge responses and the same answer for all attitude responses) was also excluded (1 Chinese questionnaire). The age of US students ranged from 18 to 48 years, whereas, with the removal of the underage students, Chinese students were between 18 and 24 years of age. Due to the objective of the

study of targeting adolescents and young adults, it was determined that 9 US questionnaires, from those greater than 24 years of age, would be removed from analysis. Therefore, the final sample size for China and the US was 383 and 189, respectively. Data imputation was performed to estimate missing values on breastfeeding knowledge and attitude scales. To maintain the differences between Chinese and the US students in breastfeeding knowledge and attitudes, data imputation was performed separately in the two samples. In total, 373 and 370 Chinese students completed the knowledge scale and attitude scale, respectively, without any missing values. Among US students, 178 and 182 responded to all knowledge and attitudes statements, respectively.

Chi-square analysis was utilized to examine the relationships between categorical variables. Two-way ANOVA was used to examine any differences in breastfeeding knowledge and attitude scores by country and by gender. Binary logistic regression examined the influence of country on individual knowledge statements, controlling for gender, age, major, and class standing. To estimate the influence of country on each attitude statement, ordinal logistic regression was used, adjusting for gender, age, major, and class standing.

Hierarchical logistic regression was utilized to explore any difference in breastfeeding intention by country. Demographic variables and other factors, determined in univariate analysis to be significantly related to breastfeeding intention in either country ($p < 0.05$), were entered in step 1. The knowledge and attitude scores were entered in step 2. Country was entered in step 3. Prior to entering into the model, breastfeeding knowledge and attitude total scores were standardized, so that they were on the same metric. A level of 0.05 was used to determine statistical significance.

Results

Demographic Characteristics

The distribution of gender, age, and major were similar between the Chinese and US student groups. The mean age of Chinese and US students was 20.02 (1.04) and 20.09 (1.09) ((mean (SD)), respectively. About two-thirds of participants in both universities were female (64.8% vs. 66.1%, China vs. the US) (**Table 4.1**). Over half of students in both countries were in a health-related major (53.3% vs. 60%). Class standing was collapsed into “freshman”, “sophomore”, and “junior or above”, in order to increase cell sizes. Chi-square analysis showed that, compared to US students, Chinese students were more likely to be freshmen (61.8% vs. 13.3%, $p=0.00$).

Breastfeeding Exposures, Intention and Decision-making

The majority of students reported prior breastfeeding exposure(s). For example, over 90% of students in each country reported knowing someone who had breastfed (93.7% vs. 90.4%), or that they had witnessed breastfeeding (92.6% vs. 92.6%); (China vs. the U.S., respectively). However, significantly more Chinese students were aware of being breastfed as an infant (88.0% vs. 64.0%, $p=0.00$), compared to their US counterparts. About three-fourths of students in each country expressed the intention to breastfeed [or support their partners to breastfeed] a future child (74.7% vs. 78.3%), China vs. the US. Results of Chi-square analysis showed that major, age, and grade were not associated with breastfeeding intention in each country. Gender was significantly related to breastfeeding intention among Chinese students, with males being more likely to express the intention than females.

Table 4.1 Demographic Characteristics, Breastfeeding Exposures, Intention, and Decision-making of Chinese and US Undergraduates (n=572: 383 from China and 189 from the US)

		China ^a (n=383) n (%)	US ^a (n=189) n (%)
Gender	Male	134 (35.2%)	64 (33.9%)
	Female	247 (64.8%)	125 (66.1%)
Age, in years	<20	126 (33.0%)	55 (29.6%)
	≥20	256 (67.0%)	131 (70.4%)
Ethnicity	Han in China/White in the US	348 (91.6%)	161 (85.2%)
	Others	32 (8.4%)	28 (14.8%)
Major	Health-related	196 (53.3%)	111 (60.0%)
	Non-health-related	172 (46.7%)	74 (40.0%)
Class-standing ^b	Freshman	236 (61.8%)	25 (13.3%)
	Sophomore	128 (33.5%)	81 (43.1%)
	Junior and above	18 (4.7%)	82 (43.6%)
Were you breastfed when you were a baby ^b	Yes	337 (88.0%)	121 (64.0%)
	No	24 (6.3%)	42 (22.2%)
	Unsure	22(5.7%)	26 (13.8%)
Do you know someone who has breastfed a baby?	Yes	359 (93.7%)	170 (90.4%)
	No	5 (1.3%)	10 (5.3%)
	Unsure	19 (5.0%)	8 (4.3%)
Have you ever witnessed breastfeeding?	Yes	350 (92.6%)	174 (92.6%)
	No	23 (6.1%)	11 (5.9%)
	Unsure	5 (1.3%)	3 (1.6%)
Breastfeeding intention	Yes	286 (74.7%)	148 (78.3%)
	No	9 (2.3%)	6 (3.2%)
	Unsure	88 (23.0%)	35 (18.5%)
Breastfeeding decision should be made	Entirely by the mother	30 (7.8%)	26 (14%)
	Mostly by the mother	114 (29.8%)	59 (31.7%)
	By both mother and father	179(46.7%)	101 (54.3%)
	Entire big family	55 (14.4%)	0
	Others	5 (1.3%)	0

^a The total number of participants of some questions may not add up to 572 due to missing answers.

^b Significantly different by country (Chi-square analysis, $p < 0.01$)

About half of the students in each country stated that the breastfeeding decision should be a joint decision made by both the mother and the father (46.7% vs. 54.3%, China vs. the US). However, while nearly one sixth (14.4%) of Chinese students believed that the whole family, including grandparents, should be part of the decision-making process, none of US undergraduates chose the option.

Breastfeeding Knowledge

The percentage of correct responses to the knowledge scale is listed in **Table 4.2**. Breastfeeding knowledge scores ranged from 4 to 13 among both Chinese and US undergraduates. The total scores of Chinese and US students were 9.97 (± 1.68) and 10.47 (± 1.93), respectively (mean \pm SD), indicating 76.8% and 80.5% of correct responses. The results of two-way ANOVA showed that there was a significant interaction between country and gender (**Figure 4.1**). While there was no significant difference between Chinese and US males (10.01 vs. 9.88), the knowledge score of US females was significantly higher than their Chinese counterparts (9.94 vs. 10.78, $p = 0.00$).

Table 4.2 Percentage of Chinese and US Undergraduates Correctly Responding to Breastfeeding Knowledge Statements (n=572: 383 from China and 189 from the US)

	China (n=383)	U.S. (n=189)
“Agree” is the correct answer		
Breastfeeding should be started within the first hour after birth. ^a	26.6%	68.8%
The first food for babies should be breast milk. ^a	79.4%	93.7%
Breastfeeding alone provides sufficient nutrition in the first 6 months of life for the baby.	84.1%	77.2%
Breastfeeding helps prevent respiratory infections in the baby. ^b	92.2%	85.7%
Formula-fed babies may suffer from more illness than breastfed babies.	72.8%	65.6%
The benefits of breastfeeding for babies continue even after weaning.	88.0%	84.7%
Breastfeeding will help a mother feel closer to her baby.	94.0%	89.4%
Women who have breastfed have lowered risk of breast cancer. ^a	76.0%	47.6%
Most women can make enough breast milk to adequately feed the baby.	76.8%	83.1%
Alcohol is passed from the mother’s body to breast milk.	73.9%	83.6%
“Disagree” is the correct answer		
The nutrients in breast milk and infant formula are the same. ^b	95.0%	89.4%
Breastfeeding prevents a woman from returning to her pre-pregnancy weight.	72.6%	86.8%
Women who have small breasts cannot make enough breast milk. ^a	65.3%	91.5%
Mean score	9.97	10.47

^a p<0.001, binary logistic regression, controlling for gender, age, major, and grade

^b p<0.05, binary logistic regression, controlling for gender, age, major, and grade

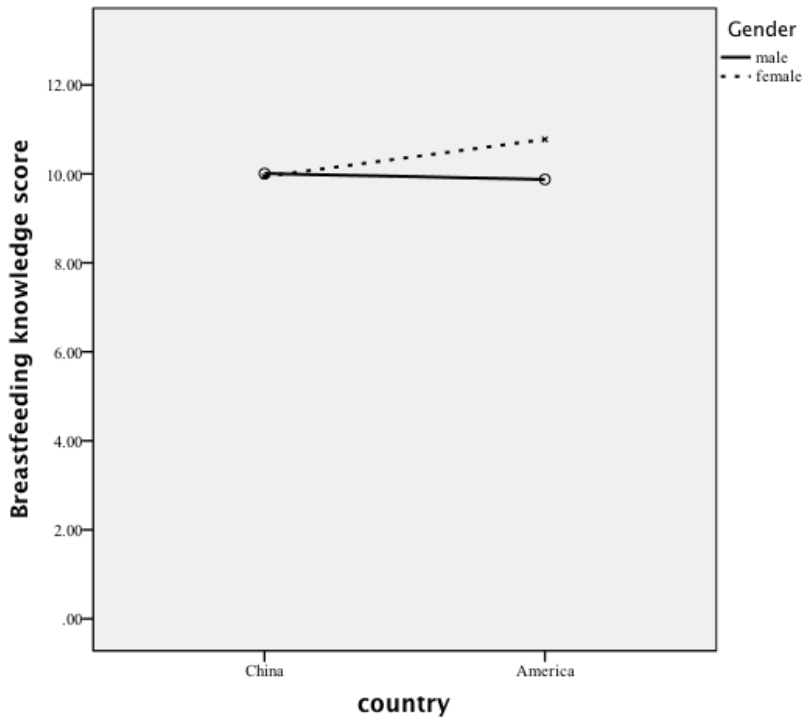


Figure 4.1 Differences in Breastfeeding Knowledge by Country and Gender

Country, $p=0.033$; gender, $p=0.012$; country and gender interaction, $p=0.003$ (two-way ANOVA)

Binary logistic regression was used to detect differences in each individual question by country, adjusting for gender, age, major, and grade. The results revealed some similarities and differences (**Table 4.2**). For example, around 90% of students in both countries understood the bonding that occurs between breastfeeding mothers and infants, over 80% were aware of the continuation of breastfeeding benefits after weaning, and around 70% believed that formula-fed infants may be ill more often than breastfed infants. However, US students were more likely to understand that infants should be put to the breast within an hour after delivery (26.6% vs. 68.8%, $p=0.000$), that breast milk should be the first feed (79.4% vs. 93.7%, $p=0.00$), and the irrelevance between breast size and breast milk production (65.3% vs. 91.5%, $p=0.000$), China vs. the US, respectively. However, Chinese students were more likely to identify that breastfeeding women are at reduced risk of developing breast cancer (76.0% vs. 47.6%, $p=0.00$, China vs. the US).

Breastfeeding Attitudes

The Cronbach's alpha for the attitude scale was acceptable in the two samples (0.675 vs. 0.782, China vs. the US). The mean attitude scores of Chinese and US students were 52.76 (6.69) and 49.0 (7.49), respectively. Dividing the total score by the number of items in the attitude scale resulted in an item score of 3.30 (China) and 3.06 (U.S.) (**Table 4.3**). The results of two-way ANOVA showed that there was no interaction between gender and country. However, there was a significant main effect for country, indicating that Chinese students scored significantly higher than their US counterparts (52.76 vs. 49.0, $p=0.00$) (**Figure 4.2**).

Table 4.3 Responses of Chinese and US Undergraduates to Breastfeeding Attitude Statements (n=572: 383 from China and 189 from the US)

	Disagree		Neutral		Agree	
	China	U.S.	China	U.S.	China	U.S.
Breastfeeding can make breasts sag.	23.8%	12.7%	33.2%	47.1%	43.1%	40.2%
Mothers should wean their babies before they return to work or school.	22.5%	14.8%	17.8%	34.4%	59.8%	50.8%
Breastfeeding is more convenient than formula feeding.	24.0%	34.9%	29.5%	24.9%	46.5%	40.2%
Formula feeding gives more freedom to the mother.	19.8%	14.8%	27.7%	28.6%	52.5%	56.6%
Breastfeeding should only be done around friends and family.	27.5%	21.7%	29.0%	23.3%	43.5%	55.0%
I will feel embarrassed if I/my partner breastfeed(s) in public.	15.7%	24.3%	26.1%	23.3%	58.2%	52.4%
Breast milk is cheaper than formula. ^a	22.7%	3.7%	23.8%	9.5%	53.5%	86.8%
Breastfed babies are smarter than formula-fed babies. ^a	20.4%	36.5%	24.5%	40.7%	55.1%	22.8%
Breastfed babies grow better than formula-fed babies. ^a	7.6%	20.1%	10.4%	27.0%	82.0%	52.9%
Babies enjoy breastfeeding more than formula-feeding. ^a	8.9%	15.9%	18.8%	48.1%	72.3%	36.0%
I respect women who breastfeed. ^a	5.0%	0.5%	2.6%	20.1%	92.4%	79.4%
Nursing a baby would be painful.	31.1%	23.8%	34.7%	39.2%	34.2%	37.0%
Seeing a woman breastfeed makes me uncomfortable. ^a	58.0%	37.6%	29.8%	29.6%	12.3%	32.8%
Seeing a woman breastfeed on television makes me uncomfortable. ^a	59.0%	46.6%	27.7%	28.0%	13.3%	25.4%
Seeing a magazine picture of a woman breastfeeding makes me uncomfortable. ^a	59.8%	48.1%	27.7%	28.0%	12.5%	23.8%
Breastfeeding in public is acceptable. ^a	33.2%	46.6%	32.1%	30.7%	34.7%	22.8%

^a p<0.001, ordinal logistic regression, controlling for gender, age, major, and grade

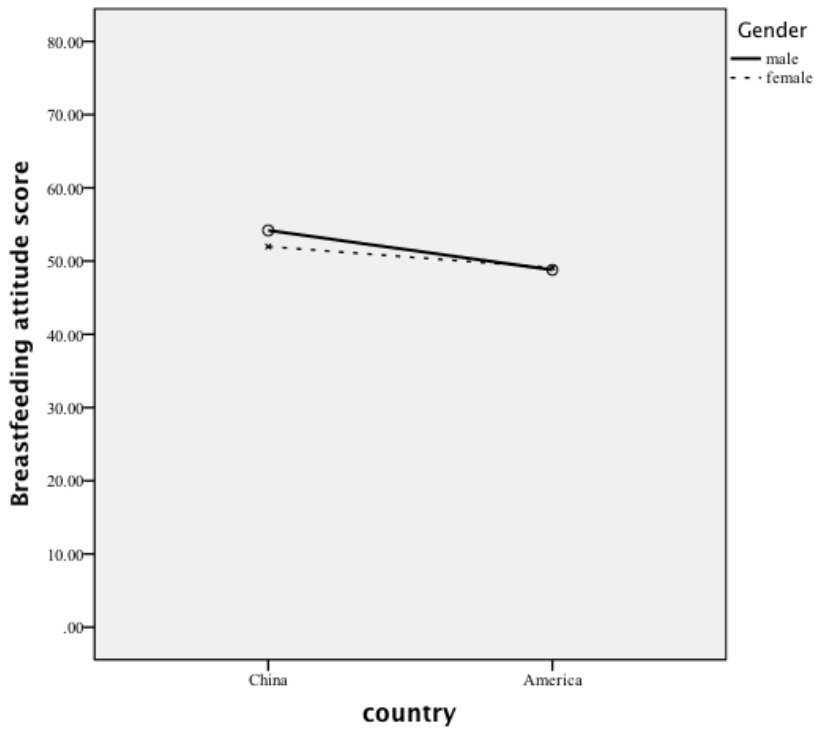


Figure 4.2 Differences in Breastfeeding Attitudes by Country and Gender

Country, $p=0.00$; gender, $p=0.146$; country and gender interaction, $p=0.053$ (two-way ANOVA)

Ordinal logistic regression was performed to examine any difference in individual attitude statement by country, controlling for gender, age, major, and grade. The results indicated some common concerns expressed by students in both countries. For example, about half of students in each country believed that breastfeeding would be freedom restricting (52.5% vs. 56.6%), should occur in private spaces (43.5% vs. 55.0%), and would potentially interfere with return to work (59.8% vs. 50.8%), China vs. the US, respectively. No statistically significant differences were found in responses to these statements between China and the US. However, Chinese and US students diverged in some other attitude statements. For example, US students were more likely to agree that breastfeeding costs less (53.5% vs. 86.8%, $p=0.00$), whereas Chinese students were more likely to believe that breastfed infants are smarter (55.1% vs. 22.8%, $p=0.00$), grow better (82.0% vs. 52.9%, $p=0.00$), and that infants enjoy breastfeeding more than formula feeding (72.3% vs. 36.0%, $p=0.00$), China vs. the US. Though only one-third of Chinese students (34.7%) considered breastfeeding in public spaces to be acceptable, US students were significantly less likely to approve of this behavior (22.8%, $p=0.001$). Additionally, US students were more likely to report feeling uncomfortable seeing women breastfeeding (12.3% vs. 32.8%, $p=0.00$, China vs. the US).

Relationship between Breastfeeding Knowledge, Attitudes, Exposures, and Intention

The association between breastfeeding exposures and breastfeeding knowledge and attitudes varied between China and the US. For example, in China, witnessing breastfeeding was not related to either knowledge or attitude scores. However, being breastfed as an infant was associated with greater attitude scores ($p=0.04$), and knowing someone who has breastfed was related to higher knowledge scores ($p=0.04$). In the US, being breastfed as an infant, knowing someone who has breastfed, and witnessing breastfeeding were all significantly positively

associated with attitudes towards breastfeeding ($p=0.00$, 0.01 , and 0.005 , respectively). Additionally, US students who were breastfed as infants scored significantly higher in knowledge than those who responded “no” or “unsure” ($p=0.00$).

Previous breastfeeding exposures were also associated with future breastfeeding intention. For example, in China, students who were breastfed as infants were more likely to intend to breastfeed a future child ($p=0.00$). In the US, in addition to the influence of infant feeding method as an infant ($p=0.00$), intention was also positively associated with knowing someone who has breastfed ($p=0.005$). In both countries, students with higher breastfeeding knowledge and attitude scores were significantly more likely to express this intention ($p=0.00$ for all analyses).

The results of hierarchical logistic regression are presented in **Table 4.4**. Breastfeeding knowledge, attitudes, infant feeding method as an infant, and country were all significant predictors of breastfeeding intention. Students with a higher knowledge and attitude scores, being breastfed as an infant, and being in the US were more likely to intend to breastfeed a future child.

Table 4.4 Hierarchical Logistic Regression Predicting Breastfeeding Intention by Country

Variables	B	P value	OR	95% CI	
				Lower	Upper
Step 1					
Gender	-0.46	0.05	0.63	0.40	0.99
Being breastfed as an infant	1.26	0.00	3.51	2.22	5.55
Knowing someone who has breastfed	0.61	0.10	1.84	0.88	3.84
Witnessing breastfeeding	0.27	0.48	1.31	0.62	2.77
Step 2					
Gender	-0.34	0.18	0.71	0.43	1.17
Being breastfed as an infant	0.84	0.00	2.32	1.39	3.85
Knowing someone who has breastfed	0.48	0.23	1.61	0.74	3.51
Witnessing breastfeeding	-0.03	0.95	0.97	0.44	2.14
Z ^c breastfeeding knowledge score	0.51	0.00	1.67	1.34	2.08
Z ^c breastfeeding attitude score	0.81	0.00	2.24	1.72	2.92
Step 3					
Gender	-0.27	0.29	0.76	0.46	1.26
Being breastfed as an infant	1.20	0.00	3.30	1.89	5.74
Knowing someone who has breastfed	0.47	0.24	1.60	0.73	3.52
Witnessing breastfeeding	-0.08	0.85	0.93	0.41	2.07
Standardized breastfeeding knowledge score	0.43	0.00	1.54	1.22	1.93
Standardized breastfeeding attitude score	0.99	0.00	2.70	2.01	3.60
Country	1.10	0.00	3.00	1.70	5.30

Discussion

To our knowledge, this is the first study comparing breastfeeding knowledge, attitudes, and intention between Chinese and US undergraduate students. Chinese and US students share some common beliefs. However, they disagree with each other in some areas, highlighting the importance of understanding and addressing these variations in future interventional research.

The majority of students in both China and the US had some prior breastfeeding exposures. For example, over 90% reported knowing someone who has breastfed or reported having witnessed breastfeeding. However, significantly more Chinese students were aware of how they were fed as infants. The percentages of students reporting breastfeeding exposures in this sample are higher than that reported among Hong Kong undergraduates²⁸, but are comparable to young adults in other studies^{34,35}. For example, Tarrant and colleagues found that only one-third of Hong Kong undergraduates (30.3%) reported being breastfed as an infant, two-thirds knew someone who had breastfed (61.4%), and fewer than half had ever witnessed breastfeeding (47.8%)²⁸. In a study completed in the southeastern US, three-fourths of college students (76.9%) reported receiving breast milk as an infant, which is a little higher than the US students in this sample (64%)³⁴. A study among Canadian female university students reported that 83.8% of participants knew that they were breastfed as an infant, which is comparable to Chinese students in this study, but higher than that reported by this US student sample³⁵. Research has indicated that personal experiences may play an important role in shaping breastfeeding beliefs³⁶. In this study, previous breastfeeding exposures were positively related to breastfeeding knowledge, attitudes, and intention, and this is supported by other studies, reporting that those being breastfed as an infant and having more breastfeeding exposures were more likely to have better knowledge and attitudes, and to intend to breastfeed in the future^{27,28,37}. Thus novel

avenues aimed at expanding positive exposures to breastfeeding might be an effective way of promoting breastfeeding as the norm.

Research has shown that greater breastfeeding knowledge is associated with more positive breastfeeding attitudes and better breastfeeding outcomes³⁸. For example, mothers with higher knowledge levels are more likely to breastfeed for a longer period¹². Students, in both China and the US, demonstrated moderate levels of breastfeeding knowledge. For example, they appeared to understand that there are nutritional differences between breast milk and infant formula, and that breastfeeding may strengthen the bond between mothers and infants. These findings are in line with other studies reporting a general understanding of the benefits of breastfeeding^{28,29}. However, this comparison between undergraduates in China and the US also revealed some differences in knowledge. For example, Chinese students appear to lack knowledge of when to put a newborn to the breast and what should be the first feed offered to infants, as compared to their US counterparts. These misperceptions appear to support other research which indicates that delays in breastfeeding initiation and a lack of breastfeeding exclusivity are current issues among new mothers in China^{40,41}. For example, in some areas of China, research indicates that only half of infants may receive breast milk as the first feed⁴².

In addition, US students appeared to be more likely to understand that the size of breasts and breast milk production are not related. The tendency of relating greater breast size with greater breast milk production was also reported by Goulet and colleagues in a study examining breastfeeding attitudes among Canadian adolescents⁴³. In another study, conducted among Northern Ireland adolescents, Giles and colleagues found that less than half of them appeared to understand the lack of relationship between breast size and breast milk production (51.4% and 64% for females and males, respectively)²⁹. In this sample, Chinese students were more likely to

know the reduced risk of breast cancer among breastfeeding women (76.0%), compared to US students (47.6%). The percentage was higher than that found in the study completed by Giles and colleagues, in that only half of females (51.7%) and one-third of males (35.5%) knew that breastfeeding could reduce risk breast and ovarian cancer. Misperceptions of breastfeeding behaviors may increase maternal concerns over the feasibility of breastfeeding³⁹. Thus, understanding and addressing misperceptions of breastfeeding behaviors among future parents may result in more informed infant feeding decisions and more optimal behaviors.

Though Chinese students scored significantly lower than US students in breastfeeding knowledge, they were more positive towards breastfeeding. For example, Chinese students were more likely to believe that breastfed infants grow better than formula-fed infants, are smarter, and that infants enjoy breastfeeding more than formula feeding. In addition, Chinese males were even more positive towards breastfeeding. These findings might reflect a more breastfeeding-friendly culture in China, which may nurture positive attitudes despite the lower knowledge level. Conversely, it may be that the positive attitudes reduce the need for specific knowledge transmission from health care organizations. The positive attitudes of Chinese males may indicate likely support from these future fathers. It would be worthwhile to explore the concept, to increase support from mothers' significant others.

Students in both countries voiced some common concerns. For example, around half of students in each country believed that breastfeeding would be freedom-restricting, should be kept private, and would interfere with the return to work. In addition, participants in both China and the US expressed the concern over breastfeeding in public spaces and US students expressed greater concern. Similar concerns were reported by other researchers, completing studies among future parents, expectant parents, and new parents in other areas of the US, and in other countries.

^{34,44,45}. For example, in a study completed among college students in the southeastern US, two-thirds (67.8%) disagree with breastfeeding in public, and nearly 80% thought that breastfeeding should be kept private ³⁴. According to Li and colleagues, on average, only half of US adults found breastfeeding acceptable in public ⁴⁴. Archabald and colleagues investigated US women's prenatal concerns regarding breastfeeding, and reported that ability to work, pain, embarrassment, and restriction of social life were among the 8 most common concerns expressed by this population ⁴⁵. Greene and colleagues examined breastfeeding attitudes among adolescents in Northern Ireland, and found that over 60% disapproved of breastfeeding in public⁴⁶. These negative feelings towards breastfeeding may well deter mothers from making an informed infant feeding decision, or may encourage breastfeeding mothers to supplement or wean too soon. Therefore, research aimed at dispelling the misunderstandings of breastfeeding among future parents, well before they become parents, might be helpful in branding breastfeeding as the norm, preserving the high initiation rate in China and increasing breastfeeding exclusivity in both China and the US.

In this study, about three-fourths of students in each country reported the intention to breastfeed a future child. This was greater than intent reported by Hong Kong undergraduates (63.0%) ²⁸, but less than that reported by undergraduate students in Kuwait (87%) ⁴⁷ or by female students in Canada (97%) ³⁵. In the study of undergraduate students in Hong Kong, Tarrant and colleagues reported results of multiple logistic regression, and found that breastfeeding intention was significantly associated with breastfeeding knowledge, attitudes, and being breastfed as an infant ²⁸. These results are similar to the findings in the sample presented here. However, in their model knowing someone who has breastfed was also a significant predictor of intent ²⁸, which was not found to be a factor in this sample. In addition, after adjusting for gender, breastfeeding

exposures, and knowledge and attitude scores, US students were more likely to report intention than were Chinese students. This is of concern considering the increasing popularity of infant formula in China²³. It is possible that targeting breastfeeding intention is critical and timely in this context, as China continues to prosper and adopt more “Western” ideals and practices^{48,49}.

Research has shown that fathers play an important role in infant feeding^{50,51}. Though it is possible that fathers may have concerns about breastfeeding, such as paternal bonding with infants if mothers do all the feeding⁵², they are also likely to positively influence breastfeeding behavior^{53,54}. For example, in a controlled trial with the objective of educating fathers about lactation management and breastfeeding support, results showed that mothers with partners in the intervention group were more likely to breastfeed for a longer period, and less likely to report insufficient milk supply⁵³. In this study, about half of students in both China and the US believed that the breastfeeding decision should be made by both the mother and father, which is supported by literature indicating the importance of fathers in infant feeding behaviors^{52,54}.

An interesting difference between these two samples was that of the role of extended family members in the decision of how to feed an infant. That 15% of Chinese students reported that they would include grandparents in the infant feeding decision-making process compared to none of the US students, may reflect different cultural beliefs in these countries. This may suggest that, specific to China, grandparents might also be important targets of education promoting optimal infant-feeding behaviors. It is important to note that though grandmothers are not included in the decision-making process among this sample of US students, research has indicated that grandmothers in the US provide important support for new mothers⁵⁵. The results might be different in other US populations. The Surgeon General’s *Call to Action to Support Breastfeeding* outlines several action steps to support breastfeeding in the US, including to

“develop programs to educate fathers and grandmothers about breastfeeding”³. Future research that explores the beliefs of fathers in both countries, and particularly grandmothers in the Chinese culture, might provide clues for the development of effective strategies targeting these specific family members.

Limitations

The study has several limitations. The first is that of limited generalizability. This sample is a convenience sample in both countries, thus the results might be different if completed among other populations. Second, because of the cross-sectional study design, it is not possible to report on actual behaviors as they occur in the future. Though the literature supports that breastfeeding intention is associated with subsequent breastfeeding behavior, these concepts have yet to be explored in the populations that are not yet parents. Finally, the Cronbach’s alpha of the knowledge scale was below the recommended level of 0.70, and might not represent the actual breastfeeding knowledge level of this sample. However, the knowledge scale was developed from existing scales in the literature, and the results did reveal some areas worthy of further exploration. Therefore, future study is needed to revise and validate the breastfeeding knowledge scale in diverse populations.

Conclusion

The results revealed some similarities and differences in breastfeeding beliefs between undergraduate students in China and the US. Breastfeeding knowledge scores were moderate in both countries. However, US females demonstrated better breastfeeding knowledge. Despite the lower knowledge level among Chinese students, this population appears to possess better attitudes, which may reflect a more breastfeeding-friendly environment. However, students in

both countries expressed concerns towards breastfeeding in public and with the perceived limited freedom associated with breastfeeding. These variations in breastfeeding beliefs between students in China and the US imply that, when constructing effective intervention strategies, it would be important to consider the target culture.

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**Chapter 5 Maternal Indicators and Reported Causes of Perceived Insufficient
Milk Supply among a Sample of Chinese Mothers**

Abstract

Though the breastfeeding initiation rate is high in China, exclusivity is low. Not having enough breast milk has been frequently reported as a reason for supplementing in China. The objective was to explore indicators and causes of perceived insufficient milk (PIM) supply among a sample of southwestern Chinese mothers. This was a cross-sectional study, conducted in a Maternal and Child Hospital, China. A questionnaire relevant to the population was developed. Of the 392 questionnaires received, 341 were considered complete enough for data analysis. Among mothers initiating breastfeeding (95.3%), over half (54.2%) reported experiencing PIM, with 43.9% of these reporting that PIM occurred during the first 2 days postpartum. Mothers often identified PIM by using subjective indicators, such as not feeling the presence of milk (36.9%), receiving a hungry look from the infant after nursing (33.5%), and the infant continuing to cry after a breastfeed (27.8%). Objective indicators, such as the number of wet/soiled diapers, were rarely used. Most mothers could not express a reason for the occurrence of PIM (34.3%). Among those who identified reasons, there was a tendency to attribute PIM to diet-related reasons, such as poor appetite (21.1%) or not being able to “eat enough soup” (13.1%). Results indicate that PIM appears to be a common barrier among this sample of southwestern Chinese mothers. Culturally appropriate interventions, with the purpose of informing mothers how to correctly identify and address PIM, might be an effective strategy to support optimal infant feeding behaviors in China.

Key words: breastfeeding rates, insufficient milk supply, weaning, China

Introduction

The benefits of breastfeeding extend from infants and mothers, to families and society ¹. It helps prevent infectious diseases for infants, and decreases the risk of breast and ovarian cancer for mothers ². Optimal infant feeding practices benefit the child throughout the life course ³. Given the benefits of breastfeeding, increasing breastfeeding rates have become a global public priority ⁴. In 1991, the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) established the Baby Friendly Hospital Initiative (BFHI) to encourage optimal maternity care to support breastfeeding ⁴. China adopted the BFHI in 1992, and has been making efforts to support breastfeeding ⁵. For example, the Chinese government launched the National Program of Action for Child Development in the 1990s ⁶, a document that produces a set of Actions in ten-year increments, designed to promote the health of the nation's children. The set of Actions from 1991-2000 and from 2001-2010 included breastfeeding duration objectives ^{6,7}. However, the latest Action, 2011-2020, set a breastfeeding exclusivity objective: to increase the exclusive breastfeeding rate during 0-6 months to 50% of infants ⁸.

Limited research suggests that over 90% of Chinese mothers initiate breastfeeding ⁹. However, it appears that exclusive breastfeeding, to 6 months of age, is rare ¹⁰. Providing pre-lacteal feeds, supplementing with water, and the use of infant formula before 4-6 months of age, are prevalent among Chinese mothers ^{11,12}. Because of these behaviors, exclusive breastfeeding has yet to reach the objective of half mothers exclusively breastfeeding at 6 months. Therefore, research is needed to identify barriers to optimal infant feeding behavior, and to design effective strategies to promote beneficial behavioral changes.

Multiple studies indicate that the primary reason for supplementing breastfeeding, or completely weaning, is that of perceived insufficient milk (PIM) supply ^{13,14}. PIM has been defined as

mothers' perception that their milk was not enough to satisfy their infants^{15,16}. It is a common barrier to breastfeeding across countries, socioeconomic levels, and generations¹⁷⁻²⁰. In most studies, however, maternal milk supply was not objectively measured. Therefore it is difficult to establish the true prevalence of actual inability to produce enough milk, though limited research indicates that only 5% of mothers actually cannot produce enough milk to satisfy their infants, secondary to physical problems^{21,22}. Thus factors other than physical difficulties might influence mothers' beliefs. Despite the frequent reports of PIM in the literature, maternal reported indicators and reasons have not been fully explored, especially in a Chinese population. Exploring maternal indicators and causes of PIM might help health professionals to develop targeted interventions.

In China different geographic areas have distinctive traditions and cultures, which may impact infant feeding behavior differently^{9,23}. Most of the studies investigating infant feeding behavior have been conducted in the coastal areas, including northeastern and southeastern China^{10,12,24}, and there has been limited work in the southwest. Chengdu is the capital city of Sichuan Province, and is one of the most important economic and transportation centers of southwestern China²⁵. As of 2010, it was estimated that ~14 million people lived in in the urban and surrounding areas of Chengdu, with ~ 5.3 million residing in the urban area²⁶. A study in the 1990s in Chengdu reported a low breastfeeding exclusivity rate (12% exclusively breastfed to 4-6 months), and that PIM was one of the barriers for continued breastfeeding and exclusive breastfeeding to 4-6 months²⁷. The objectives of the current study were (1) to explore current infant feeding behaviors among a sample of urban mothers in southwestern China, and (2) to determine maternal perceived indicators of and reasons for PIM.

Materials and Methods

Study Design

This was a cross-sectional, survey design, completed in a Maternal and Child Hospital in Jinjiang District of Chengdu during the month of June 2012. This hospital, located in a densely populated region of southwestern China, primarily serves residents of Jinjiang District of Chengdu. The Institutional Review Board of the University of Tennessee at Knoxville approved the project protocol prior to study implementation.

Before the implementation of the project, 8 graduate students and 4 senior undergraduate students were recruited from the School of Public Health in Sichuan University to serve as research assistants. They were trained in interviewing and data-collection techniques by the primary investigator, and were also able to assist with questionnaire completion upon maternal request.

Eligibility and Recruitment

Mothers were recruited during routine well-child visits to the Child Care Clinic. Well-child visits occur on a monthly basis when children are less than 6 months of age and then occur every other month from 6 to 12 months of age.

Two pediatricians staffed the clinic on a daily basis, examining between 40 and 60 children, on average. Research assistants approached all mothers of non-ambulating infants while they awaited examination. They briefly introduced the project to mothers and requested to screen them for eligibility. Upon determination of eligibility, mothers were invited to complete the consent form and the questionnaire. Eligibility criteria, based on maternal self-report, included: mothers 18 years of age or older; infants 1 year of age or younger, who were the result of a

singleton, term pregnancy, and who were healthy at birth. Infants with birth weights less than 2500 grams (low birth weight) were excluded, secondary to the different nutritional needs of these infants.

Questionnaire

A questionnaire, relevant to the population, was developed by the research team and reviewed by three experts in the field of maternal and child health as well as by a hospital-based pediatrician. The questionnaire was then pilot tested among 10 Chinese mothers with children in the target age-range. The final version consisted of 5 domains, 3 of which will be presented here: demographic characteristics, infant feeding behaviors; and perceived indicators of and reasons for PIM.

Demographics

Demographic questions, specific to mothers, included age (in years), ethnicity (Han or minority status), highest level of education completed, household size (open-ended), parity (open-ended), and delivery method (vaginally or caesarean section). Mothers were also asked about current/planned employment status: “not currently working, with no plan to return to work”, “not currently working, but planning to return to work full-time”, “not currently working, but planning to return to work part-time”, “currently working fulltime”, “currently working part-time”. Mothers could also provide other answers. Mothers who indicated that they were not currently working, but who were planning to go back to work were asked to estimate when this would occur (months after delivery). Finally, family income was based on the minimum subsistence allowance of Chengdu (330 RMB per month per person, equal to 52 US dollars using an exchange rate of 6.3 at the time of survey)²⁸, and average annual salary of Chengdu in 2011

(34008 RMB, equal to average monthly income of 2834 RMB per person, or 450 US dollars) ²⁹. Therefore, family income was captured as a categorical variable (<1000, 1000~, 3000~, 6000~, and above 10000 RMB, equal to <\$159, \$159~, \$476~, \$952~, and above \$1587). Questions specific to the infant included gender, birth weight (in kilograms), and date of birth. Infant age, in days, was calculated by subtracting the date of birth from the date of questionnaire completion.

Infant Feeding Behavior

Initiation, and timing of initiation, was collected by asking mothers to respond to one of the following choices: “≤1 hour”, “1-2 hours”, “within 1 day”, “within 2 days”, “after 2 days”, “not sure”, and “did not breastfeed”. Current infant feeding behavior was assessed by asking mothers to indicate all of the following foods their infant was currently consuming: breast milk, water, infant formula, and other food. The definitions of each infant feeding behavior are listed in

Table 5.1. ^{9, 33}

Table 5.1 Infant Feeding Definitions ^{9, 33}

Infant feeding behavior	Definitions
Breastfeeding initiation	Mothers ever offer breast milk.
Exclusive breastfeeding (EBF)	Mothers only offer breast milk, no infant formula, or any other food/liquid, not even water.
Predominant breastfeeding (PBF)	Besides breast milk, the infant also consumes some water, no infant formula or any other food/liquid.
Some breastfeeding (SBF)	Besides breast milk, the infant also consumes infant formula and/or complementary food, regardless of water consumption.

Mothers who had initiated breastfeeding, but reported no longer offering breast milk, were queried about infant age at the time of weaning and reasons for weaning. The thirteen options provided as reasons for weaning were derived from infant-feeding literature ^{9,18,19}. Some examples include “breastfeeding was too tiring”, “I didn’t make enough milk”, and “my baby would bite”. Mothers were allowed to select as many reasons as applicable. In addition, if a reason was not reflected in the list provided, mothers were allowed to write this in via an “other” category.

Perceived Indicators of and Reasons for PIM

Mothers who reported breastfeeding initiation were queried about perceptions of milk-supply, beginning with asking if they believed they were making enough milk for their infants. Among those reporting the perception that their milk was not “enough”, mothers were asked to recall the infant age, in months, when the perception began, and further queried regarding how they decided their milk was insufficient (“indicators”) and why this might have occurred (“reasons”). Twelve choices for perceived indicators of PIM and 15 choices for reasons of PIM, derived from literature ^{16,30}, and revised by the research team were incorporated into the questionnaire. Examples of indicators include, “I thought my baby was not gaining enough weight”, “my baby was not having enough wet/soiled diapers”, “my baby would nurse for a long time”, and “my baby still seemed hungry after nursing”. Perceived reasons include, “I was too nervous about breastfeeding”, “I was tired”, “I did not drink enough liquids”, and “I was not eating well”. As with reasons for weaning, mothers were able to provide additional indicators and reasons via an “other” category. These responses were subsequently coded and categorized.

Statistical Analysis

Data were coded, double entered into Epidata 3.1, cleaned, and imported into IBM SPSS 20.0 for analysis. Questionnaires missing responses to more than 10 questions were excluded from data analysis. Frequencies and means were used to describe the sample and responses to each question. Chi-square analysis was used to analyze the relationship between categorical variables and Independent t-test was used when analyzing differences in continuous variables between dichotomous groups.

Results

A total of 392 mothers completed the questionnaire. However, 10 questionnaires were dropped from analysis, secondary to having more than 10 incomplete responses. Additionally, 23 infants were premature (gestational age < 37 weeks), 1 infant was low birth weight (<2500 g), and 17 were over 1 year of age at the time of questionnaire completion. Therefore, the final sample size was 341. The demographics of the 341 mothers were not significantly different from those who were excluded, except that mothers in the final sample were more likely to be primiparous (90.3% vs. 80.4%, $p=0.035$).

Demographic Characteristics

Mothers in this sample were, on average, 28.5 years of age (range: 20-41), and the majorities were of Han decent (98.5%), had completed at least a high-school education (93.8%), and were primiparous (90.3%). Slightly over one-third had received a bachelor's degree or higher (34.6%). Slightly greater than half of the infants were male (52.9%), and nearly 60% were delivered by caesarean section (58.4%). The average birth weight was 3.35 kilograms (range: 2.5 – 4.45 kg).

Birth weights did not differ by gender. Infant age at questionnaire completion ranged from 23 days to 1 year of age, with approximately two thirds being less than 180 days of age (**Table 5.2**).

One-third of participants (32.4%) had a family size of 3, and two-thirds (67.0%) reported households consisting of more than 3 people. Among mothers that answered the income question, most families' monthly income was over 3000 RMB (97.5%). One third of families earned over 10,000 RMB per month (33.4%), well above the average monthly income of 2834 RMB per person 28. Maternal employment status varied depending on infant age (Table 5.3). For example, among mothers of infants <180 days of age, around one-fifth of mothers had returned to work. However, among those with infants greater than 180 days old, the percentage returning to work increased to 35.6% (181-270 days old) and 47.8% (>270 days old). Among those mothers not currently working, but planning to return to work in the future, nearly 40% (38.1%, data not shown) reported planning to do so after the infant's first birthday.

Based on the distribution of infant age in this sample, and to allow for discussion of results in the context of current breastfeeding recommendations 31,32, infants were categorized into 4 age groups: 0-90, 91-180, 181-270, and >270 days of age.

Table 5.2 Demographics of a Sample of Southwestern Chinese Mothers of Infants Less Than 1 Year of Age (n=341)

		Percentage	Number ^a
Infant gender	Male	52.9	180
	Female	47.1	160
Infant age, in days, at questionnaire administration	<90 days	28.7	98
	91-180 days	36.4	124
	181-270 days	21.4	73
	> 270 days	13.5	46
Maternal ethnicity	Han	98.5	332
	Minority	1.5	5
Maternal education (highest level completed)	Middle school and below	6.2	21
	High school/secondary specialized school	23.2	79
	Community college	36.1	123
	Undergraduate and beyond	34.6	118
Household size ^b	2	0.6	2
	3	32.4	110
	4	24.4	83
	5	37.9	129
	>5	4.7	16
Monthly family income (RMB/US dollar) ^c	<1000 RMB / < \$158.7	0.6	2
	1000-2999 RMB / \$158.7-476.0	1.8	6
	3000-5999 RMB / \$476.2-952.2	21.8	71
	6000-9999 RMB / \$952.4-1587.1	42.3	138
	Above 10000 RMB / above \$1587.3	33.4	109
Parity	1	90.3	307
	2	9.1	31
	3	0.6	2
Delivery method	Vaginally	41.6	142
	Cesarean section	58.4	199
Breastfeeding initiation	≤1 hour	11.1	38
	1-2 hours	9.1	31
	Within 1 day	21.2	72

Table 5.2 Continued

		Percentage	Number ^a
Breastfeeding initiation	Within 2 days	20.2	69
	After 2 days	32.8	112
	Not sure	0.9	3
	Did not breastfeed	4.7	16

^a Some numbers may not add up to 341 due to missing values.

^b Defined as those living in the household, who eat together, including the infant.

^c Exchange rate, at time of questionnaire, was 6.3 (1 US dollar equals 6.3 RMB).

Table 5.3 Maternal Work Status, by Infant Age Group, among a Sample of Mothers in Chengdu, China (n=341)

Working status	Infant age			
	0-90 days (n=98)	91-180 days (n=124)	181-270 days (n=73)	>270 days (n=46)
Not working, no plan to work, or not sure whether to return to work	10.2%	8.9%	11.0%	4.3%
Not working, but plan to work full- or part-time	74.5%	71.0%	53.4%	47.8%
Currently working, full- or part-time	15.3%	20.2%	35.6%	47.8%

Breastfeeding Initiation

More than ninety percent of mothers (95.3%) initiated breastfeeding, indicating a high initiation rate (**Table 5.2**). However, only 11.1% reported doing so within an hour of delivery. One-fifth (20.2%) reported initiation occurring one day postpartum, and over one-third (32.8%) initiated after 2 days postpartum. To increase cell size, mothers who were not aware of breastfeeding initiation time were excluded (n=3), and Chi-square analysis was used to explore relationship between delivery method and breastfeeding initiation time. The results indicated that mothers delivering via caesarean section were significantly more likely to initiate breastfeeding after 2

days postpartum (40.3% vs. 23.2%, caesarean section vs. vaginal birth, $p=0.00$). Mothers experiencing a vaginal delivery were more likely to initiate breastfeeding between 3 to 24 hours postpartum (14.3% vs. 31.0%, caesarean section vs. vaginal birth, $p=0.00$. Data not shown).

Breastfeeding duration and exclusivity were explored among the 325 mothers who reported initiation. When relevant, reasons for weaning, and indicators of and reasons for PIM, were also explored.

Breastfeeding Duration and Exclusivity

Table 5.4 describes breastfeeding duration and exclusivity in this sample. Among mothers of infants < 90 days old, nearly one in ten (8.5%) had already weaned, and nearly one-fifth (17.9%) of those with infants between 91 and 180 days had also done so. The percentage increased to nearly 50% among those with infants between 181 and 270 days of age (42.9%). Among those with infants older than 9 months, nearly 3/4ths of the sample (72.7%) had weaned.

Despite the high initiation rate in this sample, breastfeeding exclusivity was low, with only one-fourth (25.5%) of mothers with infants less than 90 days of age reporting this behavior. Approximately one-fifth (17.0%) of mothers reported having introduced water, and about half of mothers (48.9%) reported having introduced infant formula and/or other food, as indicated by the “predominant breastfeeding” rate and the “some breastfeeding” rate.

Table 5.4 Breastfeeding Behaviors at Time of Questionnaire Completion, among Chengdu Mothers who Initiated Breastfeeding (n=325)

	Infant age, in days			
	0-90 days (n=94)	91-180 days (n=117)	181-270 days (n=70)	>270 days (n=44)
EBF ^a	25.5%	22.2%	7.1%	0
PBF ^a	17.0%	17.9%	1.4%	0
SBF ^a	48.9%	41.9%	48.6%	27.3%
NBF ^a	8.5%	17.9%	42.9%	72.7%

^a EBF, exclusive breastfeeding; PBF, predominant breastfeeding; SBF, some breastfeeding; NBF, not breastfeeding

Reasons for Weaning

Over one-fourth (28.0%, n=91) of mothers reporting initiation had weaned their infants by the time of questionnaire completion, though this is reflective of a wide range of infant ages. Nearly half (44.2%) stopped breastfeeding within 90 days postpartum; one-third (31.4%) between 91 and 180 days postpartum, and one-fourth (24.4%) after 180 days.

Of those who reported weaning during the first 90 days postpartum (n=38), the majority (73.7%) cited perceived insufficient milk supply as a reason for weaning and one-fifth (21.1%) reported maternal illness as a reason. Among those who weaned between 91 and 180 days postpartum (n=27), PIM was also an important reason (66.7%), and almost one-sixth chose return to work (14.8%), and that breast milk was not nutritious enough (14.8%). Among those weaning during the second half of the first year (n=21), PIM (28.6%) was replaced by return to work (38.1%) as the most popular reason for weaning. However, maternal illness (14.3%) and the perception of poor nutritional content of breast milk (14.3%) remained important barriers to continued breastfeeding.

On the contrary, none of the mothers chose lactation difficulties, such as “breast/nipple problems (engorgement, nipple cracks, etc.)”, or maternal life barriers, including “I wanted to return to pre-pregnancy diet” and “I wanted to return to pre-pregnancy figure”, or self-weaning reasons, like “my baby would bite”. Only one mother chose “suckling difficulty or latch-on problems” as a reason for weaning.

Prevalence of PIM

The percentage of mothers reporting PIM changed with infant age, regardless of whether or not mothers reported weaning. Over half of mothers of infants <90 days of age (53.2%, 50/94) had encountered PIM. The percentage decreased slightly, to 42.7% (50/117), among mothers of infants 91-180 days of age. However, PIM appeared to increase in prevalence as infants entered the second half of the first year, with 62.9% (44/70) and 72.7% (32/44) of mothers with infants 181-270 and 271-366 days of age, respectively, reporting PIM.

Compared to those not reporting PIM, Chi-square analysis indicated that mothers who experienced PIM were more likely to wean their infants and were more likely to report use of infant formula. For example, among mothers 91 to 180 days postpartum (n=117), 84% of those experiencing PIM had introduced infant formula, and 36% had weaned their infants, compared to 20.9% and 4.5%, respectively, among mothers without PIM (p=0.00 for both analysis. Data not shown).

The onset of PIM ranged from shortly after delivery to as late as 8 months postpartum. Twelve out of 176 mothers that encountered PIM did not report the starting time. Thus 164 questionnaires were included in the analysis of onset of PIM, and indicators of and reasons for PIM. In the four infant age groups, 57.4%, 38.6%, 32.6%, and 46.7% of mothers reported that

they began to experience PIM within the first two days postpartum. Seven mothers reported that the first sign of PIM occurred during the rest of the first month. Therefore, to increase the sample size, initial onset of PIM was categorized into 4 groups, including “within 30 days”, “31-90 days”, “91-180 days”, and “after 180 days”. Mothers’ responses to perceived indicators of and reasons for PIM were subsequently explored within these 4 groups.

Perceived Indicators of PIM

The perceived absence of milk “coming in”, the perception that an infant “looks hungry” after a breastfeed, and an infant crying after a breastfeed were important indicators of PIM within all 4 groups (**Table 5.5**). Having an infant be receptive to a formula feed, post-breastfeed, was a frequently cited indicator among mothers who reported initial onset of PIM during the first 3 months postpartum. However, among those reporting onset of PIM occurring after these first 3 months, having an infant that nursed frequently emerged as an important indicator. It is important to note that only 3 mothers used the amounts of wet/soiled diapers per day as an indicator of PIM (i.e., “my baby was not having enough wet/soiled diapers”).

Table 5.5 Indicators of and Reasons for Perceived Insufficient Milk (PIM) Supply among a Sample of Mothers in Chengdu, China, Categorized by Time of First Onset of PIM

		Onset of PIM			
		0-30 days (n=79)	31-90 days (n=46)	91-180 days (n=25) ^d	After 180 days (n=14)
Indicators of PIM ^{a, b}	I did not feel any milk.	39.2%	28.3%	48%	35.7%
	My baby still seemed hungry after nursing.	27.8%	47.8%	28%	28.6%
	My baby cried a lot after nursing.	25.3%	28.3%	16%	28.6%
	My baby would take formula even after nursing.	19%	26.1%	4%	7.1%
	I had to nurse too often.	10.1%	15.2%	20%	21.4%
	My doctor thought my baby was not gaining enough weight.	2.5%	2.2%	4%	21.4%
Reasons for PIM ^{a, c}	I do not know the reason.	45.6%	28.3%	33.3%	14.3%
	My appetite was not very good.	16.5%	30.4%	25%	28.6%
	I did not drink enough liquids, like soup.	10.1%	17.4%	8.3%	21.4%
	I stopped breastfeeding for some time, breast milk supply decreased.	5.1%	15.2%	12.5%	0
	I was tired.	0	15.2%	12.5%	14.3%
	I was too stressed with returning to work.	1.3%	2.2%	16.7%	7.1%
	It is natural. My baby had grown up.	0	0	0	35.7%

^a Choices were not mutually exclusive.

^b n=164 (176 mothers reported PIM, 12 did not answer the question about indicators of PIM)

^c n=163 (13 mothers did not answer the question about reasons for PIM)

^d n=24 for “Reasons for PIM” (one mother did not respond to reasons for PIM)

Perceived Reasons for PIM

When asked about why their milk supply might have been insufficient, most mothers appeared unable to answer this question (**Table 5.5**). Of those able to identify a reason, some of these were poor appetite and not being able to drink enough soup. Returning to work became an important reason among mothers reporting initial onset of PIM between 91 and 180 days postpartum. For those who did not have PIM until after 6 months postpartum, 5 out of 14 thought it was natural to have insufficient breast milk because it is expected to experience insufficient breast milk, as infants grow older. On the contrary, not being able to breastfeed enough and inappropriate breastfeeding methods were among the least popular reasons, with only 13 and 12 out of 163 mothers that responded to the question choosing the two options, respectively.

Discussion

Similar to studies completed in other geographic areas of China, the breastfeeding initiation rate in this sample was high^{9,33}. Xu and colleagues⁹ reviewed breastfeeding practices across China, and reported that breastfeeding initiation rates ranged from 71.3% to 99.9%, with the majority of studies reporting an initiation rate of over 90%. The overall high initiation rate across China is comparable to that of Australia (93%)²⁰ and Canada (87.3%)³⁴, but lower than India (99.2%)³⁵ and higher than the United States (76.9%)³⁶.

Despite the high initiation rate reported by mothers in this sample, most mothers did not report initiating breastfeeding within the first hour after delivery, a recommendation from the WHO³⁷ thought to increase breastfeeding success. In this sample only ~10% of mothers started to breastfeed within the first hour and one-third did not initiate until after 2 days postpartum. The delayed breastfeeding initiation may have indicated the introduction of infant formula and/or

other foods, as these may be relatively common behaviors in this culture ^{9,38,39}. For example, in a study completed in a northeast city of China, only half of the 247 infants observed received breast milk as the first feed ³⁹. Over one-fourth (27.1%) received water and 9.3% received formula as the first feed. In another example, researchers found that, in Hangzhou, southeast of China, one-fourth (26%) of infants received infant formula, water or milk as the first feed ³⁸. It is unknown what percent of infants, in this sample, received foods other than breastmilk as the first feed. Future research in this population should explore these behaviors more thoroughly.

It is possible that the delayed initiation detected here could be a function of traditional beliefs such as infants needing something other than breast milk as a prelacteal feed ³⁹, that colostrum cannot satisfy infants, or simply that infants do not need to be breastfed right after birth ^{38,39}. Another potential reason might be the high cesarean section rate in China, which has increased dramatically during the last decade, and has reached as high as 77% in some areas ^{9,38,40}. Cesarean section has been reported to be associated with negative breastfeeding outcomes, including late breastfeeding initiation time ⁴¹. Considering the trend in cesarean delivery in China, research exploring the underlying reasons for cesarean section is imperative.

Despite the high initiation rate, breastfeeding exclusivity in this sample was low, with only one-fourth of mothers of infants < 3 months of age (25.5%) exclusively breastfeeding. This is slightly higher than findings from research among similar populations ⁴¹. For example, among urban mothers in Zhejiang Province, just slightly over one-third (38%) were exclusively breastfeeding at hospital discharge, and the rate declined to 13.7% and 0.2% at 3 and 6 months postpartum, respectively ^{33,42}. A survey in Chengdu in the 1990s reported that half of infants were never exclusively breastfed ²⁷. Exclusive breastfeeding is not only a problem among Chinese mothers, but also a barrier to breastfeeding globally. For example, studies in US ³⁶, Canada ⁴³, Australia ⁴⁴,

and Brazil ⁴⁵ all revealed the problem of low rates of exclusive breastfeeding, especially as infants approach 4-6 months of age. Identifying barriers to reaching national objectives for exclusive breastfeeding, both in the global context and in individual culture, may assist in designing culturally appropriate interventions.

Among those who had weaned, it was uncommon to report “baby biting”, “suckling or latch-on difficulties”, “breast/nipple problems”, or “desire to return to pre-pregnancy weight/diet” as a reason for weaning. This was a surprising finding, as it is in contrast to similar studies conducted in China and the US ^{9,18}. For example, in a study conducted among Chinese mothers, Xu and colleagues found that breastfeeding mothers, especially those in the first month postpartum, often cited “breast problems” as a reason for weaning/introducing water or other food before 4 months of age ⁹. In another study, investigating US mothers’ self-reported reasons for weaning from the breast during the first year found that, among mothers of infants > 6 months of age, approximately one-third cited infant-biting, and nearly half cited infant self-weaning, as the reason for weaning ¹⁸. Among mothers of very young infants, 53.7% and 27.1% chose “suckling or latching on difficulties” as the primary reason for weaning, and 35.8% and 23.2% chose “nipple problems” (<1 month, 1-2 months, respectively) ¹⁸. Breast and/or nipple problems are reported to be common among new mothers, especially during the first month postpartum ⁴⁶. In the current study, though it appears that these were not the primary reasons for weaning, it is unknown whether or not mothers encountered these problems. It would be worthwhile to explore whether mothers in this population do experience these problems during breastfeeding and, if so, how they handled these difficulties. However, it is likely more important to understand what barriers did lead mothers in this sample to wean.

In line with existing literature spanning multiple continents that reports the phenomenon of PIM^{13,17,41}, it also appeared to be an important factor contributing to weaning/supplementing in this sample. In this study, among mothers who initiated breastfeeding, over half reported having encountered PIM. Among those who had weaned by the time of interview, ~60% cited PIM as a reason. Studies in China, the US, and Japan reported similar findings^{9,47,48}. In China, Xu and colleagues reported that mothers' perception of insufficient milk and returning to work were the most frequently cited reasons of weaning/introducing water or other food before 4 months⁹. Li and colleagues found that almost half of US mothers cited "breast milk alone did not satisfy my baby" (49.5%) and "I didn't have enough milk" (45.5%) as the reason for weaning¹⁸. Among participants of a Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), PIM was commonly reported by all ethnic groups, and was associated with shorter breastfeeding duration and earlier formula introduction⁴⁹. In Japan, Otsuka and colleagues reported that 73% of mothers using formula cited PIM as the main reason for introducing other foods or stopping breastfeeding⁴⁷. In keeping with previous literature⁵⁰, in the presence of PIM, most mothers reporting added infant formula to comfort the "hungry" infant. The offering of foods other than breast milk has been well-established as a disruption to breastfeeding success¹, as it decreases infant stimulation of the breast and breast-emptying, subsequently reducing milk production, and possibly leading to true insufficient milk supply^{21,51}. Addressing PIM would possibly help these mothers breastfeed/exclusive breastfeed for a longer period.

In order to address PIM adequately, it will be important to understand both indicators, or how a mother decides PIM is present, and reasons, or why mothers believe PIM has occurred. In terms of indicators, among this sample of Chinese mothers, most reported not feeling any milk. For the majority of mothers, the perceived absence of milk "coming in" occurred within 2 days

postpartum. Though some of this may be explained by introduction of other foods or fluids, as a cultural norm, it is also likely that mothers might be not aware of the physiology of milk production, or that it is normal to have only a little milk during the first few days postpartum⁵².

In addition to the perception of not feeling milk, infant satisfaction cues such as a hungry look and/or crying after a breastfeed were the most popular indicators of PIM among this sample of Chinese mothers. Moreover, mothers would offer infant formula after a breastfeed, in order to determine if infants were truly satiated. It is important to note that these indicators were subjective and that objective indicators such as number of wet/soiled diapers or infant weight gain were less likely to be used. The results are in contrast to those of McCarter-Spaulding and Kearney⁵³, who reported that 48% of mothers in their study assessed milk production by checking the number of wet/dirty diapers infants produced. In addition, nearly one-third (32%) of the mothers in their study assessed supply by tracking infant weight gain. These results imply that increasing Chinese mothers' ability to identify signs of insufficient milk supply may be an effective strategy to increase breastfeeding duration and exclusivity rates.

Understanding reasons mothers decide that PIM has occurred, and exploring potential cultural variation in these reasons, may provide important clues for targeted intervention development. For example, in a study conducted among Mexican mothers, Sacco found that poor maternal diet, including concepts such as “mother doesn't eat well”, and “mother doesn't drink enough liquids”, was the most frequently cited cause of PIM¹⁷. This was similar to that reported by this sample, in that poor appetite and the inability to drink enough liquids (especially soup) were among the most frequent reported reasons for PIM. This is important to note, as it could be a reflection of what is known in Chinese culture as “Zuoyuezi”⁵⁴. This is a common practice in China, when, during the first month postpartum, some foods are considered important for the

mother to consume, though the actual foods may vary by region ⁵⁵. Therefore, the finding that mothers tended to relate food intake with milk production was not surprising. Research that explores the depth of this belief may inform effective nutrition intervention strategies designed to reduce risk of early supplementation in this population.

Segura-Millan and others investigated PIM among low-income Mexican mothers, and reported that 33% to 62% of mothers with infants of different ages did not know the reason for PIM ⁵². This supports what was found in this sample, in that the top reason for PIM reported by these Chinese mothers was also, “I do not know the reason”, regardless of infant age. It has been hypothesized that PIM could be used to obscure actual reasons for adding other foods and/or weaning ⁹. However, this hypothesis is beyond the scope of the current project. Regardless, further research, possibly utilizing qualitative methods, might be helpful in identifying any deeper reasons for the existence of PIM in Chinese culture.

Limitations

China is a vast country, consisting of 56 unique ethnic groups ⁵⁶. Breastfeeding behavior varies geographically and is influenced by sub-cultures. These results represent a sample from a southwestern urban Chinese Han population, which might not be generalized to other geographical areas of China. Additionally, because of the cross-sectional study design, there was potential for recall bias among mothers of older infants. This could increase inaccuracy of responses. Future work should include a longitudinal study design, possibly increasing accuracy of reported infant-feeding behaviors at each time point.

Conclusion

Though over 90% of mothers initiated breastfeeding, only around one-fourth reported exclusive breastfeeding during the first 3 months. PIM appears to be the most popular reason for weaning and supplementing. Mothers commonly reached the conclusion of PIM by using subjective signs, such as absence of milk coming in, infant crying, a hungry look from the infant, and acceptance of infant formula after breastfeeding. Objective indicators, such as number of wet/soiled diapers, were rarely used. Most mothers reported a lack of awareness of the cause of PIM, which may have made it difficult to identify and to address the barriers. Additionally, mothers tended to attribute PIM to the maternal diet, including poor appetite and the inability to drink enough liquid (especially soup). Culturally appropriate interventions, with the purpose of informing mothers in correct identification of and how to address PIM, should result in improved breastfeeding rates.

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Chapter 6 Conclusion and Future Directions

Conclusion

The study component conducted among undergraduate students in China and the US provided important information about breastfeeding knowledge, attitudes, and intention, among future parents. The results revealed some similarities and some differences between the two samples. In general, students possessed some breastfeeding knowledge, with US students demonstrating greater knowledge levels. However, US students were less positive towards breastfeeding, compared to their Chinese counterparts. These findings may reflect a more breastfeeding-friendly culture in China, which may cultivate more positive breastfeeding attitudes. Conversely, these positive attitudes may function to increase this breastfeeding-friendly culture. However, students in both countries also expressed common concerns towards breastfeeding, including the potential for restricted freedom associated with breastfeeding, embarrassment with breastfeeding in public, and the balance between breastfeeding and returning to work. Differences were also found. For example, US students were more likely to believe that breastfeeding costs less, whereas Chinese students were more likely to perceive infant enjoyment of breastfeeding, and the better growth of breastfed infants compared to formula-fed infants. When constructing intervention strategies, it would be important to consider these variations pertaining to the cultures.

The study component conducted among Chinese mothers revealed indicators of and reasons for perceived insufficient milk (PIM) supply from the mothers' perspective. The results showed that Chinese mothers rarely used objective indicators to assess their milk supply. Subjective indicators were often used, such as the absence of feeling the milk coming in, an infant crying after nursing, or an infant taking formula after nursing. Though the prevalence of PIM is high in this sample of Chinese mothers, most mothers could not express a reason for the onset of PIM.

Among mothers that cited a reason for PIM, diet-related reasons appeared to be the most frequently reported. The results indicate that strategies, developed with the purpose of informing Chinese mothers how to correctly identify and address PIM, may result in improved breastfeeding behavior.

Future directions

Part 1. For the study among undergraduate students

1. Though the knowledge scale was derived from existing scales in the literature, the Cronbach's alpha in both samples (0.33 and 0.55, Chinese and US students, respectively) is below what is considered to be acceptable (0.7). Future research is needed to refine the breastfeeding knowledge scale, to increase the internal consistency reliability and to be applicable to multiple, diverse populations.
2. In China, 15% of students would include the grandparents in the infant feeding decision-making process, compared to none of US students. Because the study recruited a convenience sample in 2 universities, it could not be determined whether or not the results apply to other populations of young adults in China and the US. Therefore, a more representative sample would be helpful in gaining more insightful knowledge into the infant feeding decision-making process. Additionally, it would be important to explore the role of grandparents in both the infant feeding decision and subsequent behavior, as this is likely to provide clues on developing programs to effectively incorporate grandparents into breastfeeding interventions.
3. Though increasing breastfeeding knowledge and attitudes of young adults could potentially increase the intent to breastfeed, the acceptability and feasibility of implementing breastfeeding educational programs among pre-parents is yet to be fully

explored, especially in different cultural contexts. Future research could focus on exploring the acceptability of breastfeeding education in a high school or middle school setting, as well as the preferred delivery content and methods, from both the students' and the educators' perspective.

Part 2. For the study among Chinese mothers

1. This sample of Chinese mothers rarely cited lactation difficulties as reasons for weaning, which was reported to be common in other populations in and outside of China. Thus future research, either in the form of qualitative or quantitative analysis or both, might be helpful in understanding whether mothers in this sample ever experience lactation difficulties, as well as the effect of and the solutions to these difficulties.
2. Infants' weight gain was also rarely used as an indicator of PIM. Since Chinese infants have monthly, mandatory physical examinations in the first 6 months postpartum, parents should have a record of their infants' weight change. Future research could explore whether parents understand the normal growth curve for infants, and are aware of using infant weight gain to assess milk supply. These results could be used to construct targeted interventions for Chinese mothers.
3. Traditional beliefs play an important role in infant feeding behavior, as reflected by the perceived relationship between maternal diet and milk production. Additionally, the relatively late breastfeeding initiation and low breastfeeding exclusivity of this sample may be partially reflective of the traditional belief of offering food other than breast milk to very young infants. Investigating dominant traditional beliefs that may interfere with optimal infant feeding behavior may shed light on intervention strategies aimed at addressing these misunderstandings. Additionally, it would be worthwhile to identify and

evaluate maternal sources of infant-feeding information, such as the Internet, healthcare providers, or parenting books.

Appendix

Appendix A. Questionnaire for Undergraduate Students (English version)

A survey of breastfeeding knowledge and attitudes of university students

- Please note that the return of this questionnaire will constitute your informed consent to participate. All the information will be kept confidential.
- Please answer the following questions: check the box/circle or write in your answer.

-
1. Gender: ① Male ② Female
2. Date of birth (MM/DD/YYYY): _____
3. Race/ethnicity: ① American Indian/Alaska Native ④ Asian
 ② Black or African American ⑤ White
 ③ Native Hawaiian or Other Pacific Island ⑥ Other
4. Major: ① Health-related ② Non-health-related
5. Year in school: ① Freshman ② Sophomore ③ Junior ④ Senior
 ⑤ Other
6. What state(s) did you live in during adolescence?

Please check whether you “agree” or “disagree” with each of the following statements.

	Agree	Disagree
7. Breastfeeding should be started within the first hour after birth.		
8. The first food for babies should be breast milk.		
9. Breastfeeding alone provides sufficient nutrition in the first 6 months of life for the baby.		
10. The nutrients in breast milk and infant formula are the same.		
11. Breastfeeding helps prevent respiratory infections in the baby.		
12. Formula-fed babies may suffer from more illnesses than breastfed babies.		
13. The benefits of breastfeeding for babies continue even after weaning.		
14. Breastfeeding will help a mother feel closer to her baby.		
15. Women who have breastfed have lowered risk of breast cancer.		
16. Breastfeeding prevents a woman from returning to her pre-pregnancy weight.		
17. Most women can make enough breast milk to adequately feed their baby.		
18. Women who have small breasts cannot make enough breast milk.		
19. Alcohol is passed from the mother’s body to breast milk.		

Please check an option for each of the following statements.

(SD=strongly disagree; D=disagree; N=neutral; A=agree; SA=strongly agree)

	SD	D	N	A	SA
20. Formula-fed babies are more likely to be overfed than breastfed babies.					
21. Breastfed babies are smarter than formula-fed babies.					
22. Breastfed babies grow better than formula-fed babies.					
23. Babies enjoy breastfeeding more than formula-feeding.					
24. Breast milk is cheaper than formula.					
25. Breastfeeding is more convenient than formula feeding.					
26. Formula feeding gives more freedom to the mother.					
27. Nursing a baby would be painful.					
28. Breastfeeding can make breasts sag.					
29. Mothers should wean their babies before they return to work or school.					
30. Seeing a woman breastfeed makes me uncomfortable.					
31. Seeing a woman breastfeed on television makes me uncomfortable.					
32. Seeing a magazine picture of a woman breastfeeding makes me uncomfortable.					
33. Breastfeeding should only be done around friends and family.					
34. Breastfeeding in public is acceptable.					
35. I will feel embarrassed if I/my partner breastfeed(s) in public.					
36. I respect women who breastfeed.					

37. Were you breastfed when you were a baby? (1) Yes (2) No (3) Unsure

38. Do you know someone who has breastfed a baby? (1) Yes (2) No (3) Unsure

39. Have you ever witnessed a woman breastfeeding her baby?

(1) Yes (2) No (3) Unsure

40. Did you learn about breastfeeding in High School?

(1) Yes (2) No (3) Unsure

41. Did you learn about breastfeeding in Middle School?

(1) Yes (2) No (3) Unsure

42. Do you think breastfeeding information should be introduced in a classroom?
(1) Yes (2) No (please skip to question 44) (3) Unsure (please skip to question 44)

43. If “yes”, when do you think it is most appropriate to introduce breastfeeding information? (**Choose only one**)

- (1) Elementary School (grades K-5) (2) Middle School (grades 6-8)
(3) High School (grades 9-12) (4) Undergraduate/College
(5) Graduate School (6) Other _____

44. When do you think it is **most important** for you to receive breastfeeding information?
(**Choose only one**)

- (1) Before I am/my partner is pregnant (2) After finding out I am/my partner is pregnant
(3) After I/my partner deliver(s) (4) Not sure
(5) I do not want breastfeeding education

45. The decision to breastfeed should be made: (**Choose only one**)

- (1) Entirely by the baby’s mother (2) Mostly by the baby’s mother
(3) A joint decision by both mother and father (4) Mostly by the baby’s father
(5) By the whole family, including grandparents (6) Other _____

46. Would you breastfeed/support your partner to breastfeed your baby in the future?

- (1) Yes (2) No (3) Unsure

Thank you for your participation!

Appendix B. Questionnaire for Chinese Mothers (English version)

1. Baby's gender: (1) Boy (2) Girl
2. Birth weight:_____.
3. Birth date: _____YYYY_____MM_____DD
4. Mother's age: _____
5. Mother's education level :
(1) Middle school and under (2) High school/technical secondary school
(3) Community college (4) College (5) Graduate school or above
6. Mother's ethnicity: (1) Han (2) Minorities
7. What is your current employment status?
(1) Not currently working, with no plan to return to work
(2) Not currently working, but planning to return to work fulltime
(3) Not currently working, but planning to return to work part-time
(4) Currently working fulltime
(5) Currently working part-time
8. If planning to return to work, when do you plan to do so? _____ months after delivery
9. How many people are in your family (in your household)? _____
10. Family monthly income (RMB):
(1) <1000 (2) 1000~ (3) 3000~
(4) 6000~ (5) ≥10000
11. Parity _____
12. How was your baby delivered? (1) Vaginally (2) By caesarean section
13. Gestational weeks (1) <37 weeks (2) ≥37weeks
14. When did you initiate breastfeeding after delivery?
(1) ≤1 hour (2) 1-2 hours (3) Within 1 day
(4) Within 2 days (5) After 2 days (6) Not sure (7) Did not breastfeed
15. From the following list of foods, please check those the baby is currently consuming
(Check all that apply)

(1) Breast milk (2) Water

(3) Infant formula (4) Other food, such as complementary food

16. If include "water", how old was your baby when you regularly added water?

(1) After my baby was born (2) When my baby was _____ month(s) old

17. If include "infant formula", how old was your baby when you introduced infant formula?

(1) After my baby was born (2) When my baby was _____ month(s) old

18. Have you weaned your baby from the breast?

(1) Yes (2) No (skip to question 21)

(3) Did not initiate breastfeeding (skip to question 24)

19. If "yes", how old was your baby when fully weaned?

When my baby was _____ month(s) old

20. Please mark any of the following reasons you decided to wean your baby (**Check all that apply**):

(1) Breastfeeding was too tiring

(8) Return to work

(2) I didn't make enough milk

(9) Breast/nipple problems

(3) Suckling difficulty or latch-on problems

(engorgement, nipple cracks etc.)

(10) I got sick

(4) My baby did not like breastfeeding

(11) My baby got sick

(5) My baby would bite

(12) My breast milk was not nutritious enough

(6) I wanted to return to pre-pregnancy diet

(13) Suggestions from family/friends

(7) I wanted to return to pre-pregnancy figure

(14) Other _____

21. If you think you "didn't make enough milk", how old was your baby when you began to think you were not making enough milk?

When my baby was _____ month(s) old

22. How did you decide that you were not making enough milk? (**Check all that apply**)

(1) I thought my baby was not gaining enough weight/length

(4) My baby would nurse for a very long time

(2) My doctor thought my baby was not gaining enough weight/length

(5) My baby still seemed hungry after nursing

(3) My baby was not having enough wet/soiled diapers

(6) My baby would take formula even after nursing

- (7) My baby cried after nursing
- (8) My baby was fussy after nursing
- (9) My baby didn't seem to like nursing
- (10) I did not feel any milk

- (11) I just didn't make enough
- (12) I had to nurse too often
- (13) Other _____

23. Why do you think your milk supply "dried up" or decreased? **(Check all that apply)**

- (1) I was too nervous about breastfeeding
- (2) I was tired
- (3) I was in a bad mood
- (4) I was too stressed with returning to work
- (5) My family environment was not good
- (6) I did not drink enough liquids, like soup
- (7) My appetite was not very good
- (8) I was depressed after delivery
- (9) Inappropriate breastfeeding method

- (10) I did not/was not able to breastfeed enough
- (11) I stopped breastfeeding for sometime, breast milk supply decreased
- (12) I got sick
- (13) I had a hard time just learning to be a mom
- (14) Breastfeeding just didn't come naturally to me
- (15) I do not know the reason
- (16) Other _____

24. When did you decide to breastfeed your baby?

- (1) Before pregnancy
- (2) During pregnancy
- (3) After delivery
- (4) Did not plan to breastfeed

25. If you planned to breastfeed, how long did/do you plan to do so?

- (1) <3 months
- (2) 3 months ~
- (3) 4 months ~
- (4) 6 months ~
- (5) 9 months ~
- (6) 1~ years
- (7) Until breast milk dried up
- (8) Until I go back to work
- (9) As long as I can
- (10) Did not make plan
- (11) Did not plan to breastfeed
- (12) Other _____

26. Which of the following, if any, did you learn about before delivery? **(Check all that apply)**

- (1) Correct breastfeeding position
- (2) Solutions to common breastfeeding problems
- (3) The change of breast milk during lactation, such as color and amount
- (4) Appropriate diet for lactation
- (5) The benefits of breastfeeding
- (6) How to increase the amount of breast milk
- (7) Did not learn anything
- (8) Other _____

27. When did you start to pay attention to breastfeeding information?

- (1) Before pregnancy
- (2) During the first trimester
- (3) During the second trimester
- (4) During the last trimester
- (5) After delivery
- (6) Never paid attention

28. Which of the following sources is **MOST important** for you to learn about breastfeeding? (**Choose only one**)

- (1) Internet
- (2) Books
- (3) Health care provider
- (4) TV
- (5) Magazine
- (6) Friends
- (7) Family
- (8) Did not learn
- (9) Other _____

29. Were you breastfed when you were a baby?

- (1) Yes
- (2) No
- (3) Not sure

30. Did your family support you breastfeeding?

- (1) They all support
- (2) Most of them support
- (3) Most of them did not support
- (4) None of them support
- (5) I did not breastfeed

31. In terms of breastfeeding, among your relatives and friends, who influenced you **the MOST? (Choose one)**

- (1) Husband/partner
- (2) Elderly people, like parents
- (3) Friends
- (4) Relatives
- (5) They did not influence me. I made the decision myself
- (6) I did not breastfeed
- (7) Other _____

32. When you encountered breastfeeding difficulties, what did your family/friends do?

(Check all that apply)

- (1) Helped me overcome difficulties
- (2) Suggested that I supplement with infant formula
- (3) Suggested that I offer other food
- (4) Suggested that I completely wean to infant formula
- (5) They did not care much
- (6) I did not encounter difficulties
- (7) I did not breastfeed
- (8) other _____

33. After delivery, did you and your baby stay in the same hospital room after birth?

- (1) Yes
- (2) No

34. After delivery, did health care providers teach you how to breastfeed?

- (1) Yes
- (2) No

35. Did health care providers help you initiate breastfeeding within an hour after delivery?

- (1) Yes
- (2) No

36. After delivery, did health care providers encourage you to breastfeed on demand?

- (1) Yes
- (2) No

37. Did you buy any infant formula before delivery? (1) Yes (2) No
38. Did you ever receive free samples of infant formula? (1) Yes (2) No
39. If "yes", where did you get it? **(Check all that apply)**
- (1) Hospital salesman (2) Infant feeding education/ lectures
- (3) When I bought formula for pregnant mothers
- (4) Others_____

For the following questions, if you think it is right, choose "Yes"; if wrong, choose "No":

	Yes	No
40. Breastfeeding should be started within the first hour after birth.		
41. The first food for babies should be breast milk.		
42. Breastfeeding alone provides sufficient nutrition in the first 6 months of life for the baby.		
43. Breastfeeding helps prevent respiratory infections in the baby.		
44. The benefits of breastfeeding for babies continue even after weaning.		
45. Women who have breastfed have lowered risk of breast cancer.		
46. Breastfeeding prevents a woman from returning to her pre-pregnancy weight.		
47. Women who have small breasts cannot make enough breast milk.		
48. It is normal that there is only a little breast milk in the first few days after delivery.		
49. The amount of breast milk will gradually increase after delivery.		
50. Increasing the frequency of breastfeeding is an effective way of increasing the amount of breast milk.		
51. Breastfeeding self-confidence can help overcome insufficient breast milk supply.		

Please read the following statements, from the 5 choices, choose the one that represent you the most: (SA=strongly agree; A=agree; N=neutral; D=disagree; SD=strongly disagree)

	SA	A	N	D	SD
52. Formula-fed babies are more likely to be overfed than breastfed babies.					
53. Formula feeding gives more freedom to the mother.					
54. Breastfeeding can make breasts sag.					
55. Mother should wean their babies before they return to work or school.					
56. At home, I am comfortable breastfeeding my baby with my family members present.					
57. I feel embarrassed if I breastfeed in public.					
	SA	A	N	D	SD
58. Seeing a woman breastfeed makes me uncomfortable.					
59. Seeing a woman breastfeed on television makes me uncomfortable.					
60. Seeing a magazine picture of a woman breastfeeding makes me uncomfortable.					
61. Before my baby was born I believed I would have enough breast milk.					
62. I adapted myself quickly to motherhood after delivery.					
63. When breastfeeding, I often worried/worry that my baby did/does not get enough.					
64. When breastfeeding, I can recognize if my baby has difficulty nursing.					
65. When breastfeeding, I can recognize if my baby is full.					
66. I can breastfeed my baby whenever he/she wants.					
67. I can tell if my baby is full through tracking wet and soiled diapers.					
68. I feel satisfied about the breastfeeding experience.					

Appendix C. Questionnaire for Undergraduate Students (Chinese version)

大学生母乳喂养知识态度调查表

说明:

- 本调查信息仅用于研究中国母乳喂养现状, 为我国母乳喂养促进工作提供依据
- 我们默许您交回问卷的同时表明您同意参加此次调查, 我们将对相关内容给予保密
- 请回答以下问题, 并在您认可的选项上打“✓”或填写相应答案

-
1. 性别: ① 男 ② 女
 2. 出生日期: ____年__月__日
 3. 民族: ① 汉族 ② 少数民族
 4. 专业: ① 健康相关专业 ② 非健康相关专业
 5. 年级: ① 大一 ② 大二 ③ 大三 ④ 大四 ⑤ 大五 ⑥ 其它
 6. 您青少年时期是在哪个省居住?

以下内容是关于母乳喂养的知识, 请在您认可的选项上打“✓”

	同意	不同意
7. 母乳喂养应该在婴儿出生后 1 小时内开始。		
8. 新生儿的第一口食物应该是母乳。		
9. 母乳喂养能够给 0-6 个月的婴儿提供足够的营养。		
10. 母乳和婴儿配方奶粉的营养成分是一样的。		
11. 母乳喂养有助于预防婴儿患呼吸系统疾病。		
12. 与母乳喂养的婴儿相比, 婴儿配方奶粉喂养的婴儿可能患更多疾病。		
13. 母乳喂养对婴儿的好处可延续至断奶以后。		
14. 母乳喂养会使母亲和婴儿更亲密。		
15. 母乳喂养的母亲患乳腺癌的风险较低。		
16. 母乳喂养的母亲不易恢复到怀孕前的体重。		
17. 绝大部分女性能够分泌足够的乳汁来喂养孩子。		
18. 乳房小的女性常常母乳不足。		
19. 酒会通过乳汁传递给婴儿。		

以下内容是关于母乳喂养的态度，请在您认为能够代表您的态度的选项打“✓”

	非常 不同意	不 同意	一 般	同 意	非常 同意
20.与母乳喂养婴儿相比，配方奶粉喂养的婴儿更容易吃得多。					
21.母乳喂养的孩子比奶粉喂养的孩子聪明。					
22.母乳喂养的孩子比奶粉喂养的孩子体格好。					
23.与奶粉喂养相比，婴儿更喜欢母乳喂养。					
24.母乳喂养比奶粉喂养便宜。					
25.母乳喂养比奶粉喂养方便。					
26.奶粉喂养让母亲比较自由。					
27.母乳喂养会使妈妈感到疼痛。					
28.母乳喂养会导致乳房下垂。					
29.母亲在返回工作岗位（或学校）之前最好给宝宝断奶。					
30.看到别人母乳喂养我会觉得不舒服。					
31.在电视上看到母乳喂养的场面，我会觉得不舒服。					
32.在杂志上看到母乳喂养的图片，我会觉得不舒服。					
33.母乳喂养只应该在家人或者朋友面前进行。					
34.公共场所母乳喂养是可以接受的。					
35.如果我（或者我的伴侣）在公共场所母乳喂养，我会觉得尴尬。					
36.我尊重母乳喂养的女性。					

37. 您小时候吃过母乳吗? ① 是 ② 否 ③ 不清楚
38. 您认识的人中是否有人母乳喂养过? ① 是 ② 否 ③ 不清楚
39. 您曾经看到过某位母亲母乳喂养吗? ① 是 ② 否 ③ 不清楚
40. 您在高中的时候学习过母乳喂养的知识吗? ① 是 ② 否 ③ 不清楚
41. 您在初中的时候学习过母乳喂养的知识吗? ① 是 ② 否 ③ 不清楚
42. 您觉得应该在学校介绍母乳喂养的信息吗?
① 是 ② 否 (请跳至 44 题) ③ 不清楚 (请跳至 44 题)
43. 如果“是”, 您觉得什么时候介绍母乳喂养的相关信息最合适? (单选)
① 小学 ② 初中 ③ 高中
④ 本科/大专 ⑤ 研究生 ⑥ 其它
44. 您认为什么时候接触母乳喂养的信息最重要? (单选)
① 我或者我的伴侣怀孕前 ② 我或者我的伴侣怀孕期间
③ 我或者我的伴侣生完孩子后 ④ 不清楚
⑤ 我不想要母乳喂养的教育
45. 您认为母乳喂养方式应该由谁来决定? (单选)
① 完全由婴儿母亲决定 ② 主要由婴儿母亲决定
③ 婴儿母亲和父亲共同决定 ④ 主要由婴儿父亲决定
⑤ 整个大家庭决定, 包括祖父母 ⑥ 其它
46. 您将来会母乳喂养 (或者支持您的伴侣母乳喂养) 您的孩子吗?
① 是 ② 否 ③ 不清楚

感谢您的参与!

Appendix D. Questionnaire for Chinese Mothers (Chinese version)

妈妈母乳喂养问卷调查表

1. 宝宝性别： ①男 ②女
2. 宝宝出生体重： _____（斤）
3. 宝宝出生日期： _____年_____月_____日（阳历）
4. 母亲年龄： _____（周岁）
5. 母亲文化程度：
①初中及以下 ②高中/中专 ③大专 ④大学本科 ⑤硕士及以上
6. 母亲民族： ①汉族 ②少数民族
7. 您的工作情况是？
①现在不工作，以后也不打算工作 ②现在不工作，但打算以后做全职工作
③现在不工作，但打算以后做兼职工作 ④现在全职工作 ⑤现在兼职工作
8. 如果您打算以后工作，您计划在产后第_____个月开始工作
9. 通常家庭人口数： _____人
10. 家庭月收入：
①<1000元 ②1000元~ ③3000元~ ④6000元~ ⑤≥10000元
11. 母亲产次： _____次
12. 宝宝的生产方式： ①顺产 ②剖宫产
13. 宝宝出生时的孕周： ①<37周 ②≥37周
14. 宝宝出生后开奶时间是：
①≤1小时 ②1-2个小时 ③1天内 ④2天内 ⑤2天后 ⑥不清楚 ⑦
没吃过
15. 宝宝目前饮食包括：（可多选）
①母乳 ②白开水 ③婴儿配方奶 ④辅食等其他食物
16. 添加白开水的时间是（较规律的添加）：
①出生时 ②宝宝第_____个月
17. 添加婴儿配方奶粉的时间是（较规律的添加）：
①出生时 ②宝宝第_____个月
18. 宝宝现在断母乳了吗？
①是 ②否（跳至 21 题） ③没有母乳喂养过（跳至 24 题）

19. 如果“是”，断母乳时间：宝宝第_____个月

20. 请选择断母乳的原因：（可多选）

- | | |
|----------------|------------------------|
| ①母乳喂养太累了 | ⑧产假结束，要上班了 |
| ②我觉得我母乳不足 | ⑨乳房、乳头原因（乳房胀痛，涨奶，乳头皲裂） |
| ③宝宝吸吮困难或含接乳头困难 | ⑩妈妈生病 |
| ④宝宝不愿意吃母乳了 | ⑪宝宝生病 |
| ⑤宝宝咬乳头 | ⑫我觉得我的母乳营养不足 |
| ⑥想恢复到怀孕前的饮食 | ⑬家人/朋友建议 |
| ⑦想恢复到怀孕前的体型 | ⑭其它_____ |

21. 若有母乳不足，您何时觉得自己母乳不足？ 宝宝第_____月

22. 您判断母乳不足是依据：（可多选）

- | | |
|----------------|---------------|
| ①我觉得宝宝身长体重不达标 | ⑧宝宝吃完母乳后较烦躁 |
| ②医生觉得宝宝身长体重不达标 | ⑨宝宝看上去不喜欢母乳喂养 |
| ③宝宝排便排尿少 | ⑩乳房没有胀感 |
| ④宝宝每次吃母乳时间过长 | ⑪我就是没有母乳 |
| ⑤哺乳后宝宝看上去还饿 | ⑫喂母乳次数太频繁 |
| ⑥吃完母乳后喂奶粉，宝宝还吃 | ⑬其它_____ |
| ⑦宝宝吃完母乳后会哭 | |

23. 您觉得您母乳不足的原因是：（可多选）

- | | |
|---------------|----------------------|
| ①母乳喂养让我太紧张了 | ⑨母乳喂养方法不当 |
| ②我太累了 | ⑩母乳喂养次数少 |
| ③我心情不好 | ⑪我中间停止母乳喂养一段时间，母乳量少了 |
| ④要返回工作岗位，压力太大 | ⑫我生病了 |
| ⑤家庭氛围不好 | ⑬对我来说，学习做一位母亲太难了 |
| ⑥我喝的汤、水不够 | ⑭对我来讲，母乳喂养不是件顺其自然的事 |
| ⑦我胃口不好 | ⑮不清楚/找不到原因 |
| ⑧产后情绪抑郁 | ⑯其它_____ |

24. 您做出母乳喂养宝宝的决定是在？

- ①怀孕前 ②怀孕期间 ③产后 ④不打算母乳喂养

25. 当您决定要母乳喂养时，您计划喂多长时间？

- ①<3个月 ②3个月~ ③4个月~ ④6个月~ ⑤9个月~ ⑥1年~
⑦喂到没有母乳 ⑧直到上班 ⑨能喂多长时间就喂多长时间
⑩无计划 ⑪不打算母乳喂养 ⑫其它_____

26. 生孩子前，您了解过以下哪些母乳喂养的知识：（可多选）

- ①正确的母乳喂养姿势 ②母乳喂养常见问题的解决方法
③哺乳期乳汁的变化，如颜色和泌乳量 ④促进泌乳的合理饮食
⑤母乳喂养的好处 ⑥促进乳汁分泌的方法
⑦无 ⑧其它_____

27. 您何时开始了解母乳喂养的相关知识的？

- ①怀孕之前 ②怀孕前3个月 ③怀孕中间3个月
④怀孕后3个月 ⑤宝宝出生后 ⑥从未关注过

28. 您觉得**最重要**的了解母乳喂养知识的途径是：（单选）

- ①网络 ②书籍 ③医务人员 ④电视 ⑤杂志
⑥朋友 ⑦家人 ⑧从未关注过 ⑨其它_____

29. 您小时候吃过母乳吗？

- ①是 ②否 ③不清楚

30. 家人支持您母乳喂养吗？

- ①都支持 ②多数人支持 ③少数人支持 ④不支持 ⑤无母乳喂养

31. 对您母乳喂养影响**最大**的亲戚/朋友是：（单选）

- ①丈夫 ②父母等长辈 ③朋友 ④亲戚
⑤没人影响，自己说着算 ⑥无母乳喂养 ⑦其它_____

32. 母乳喂养遇到困难的时候，您的家人/朋友的做法是：（可多选）

- ①帮助我克服困难 ②建议添加婴儿配方奶粉 ③建议添加其他食物
④建议断母乳 ⑤他们不关心 ⑥没有遇到过困难
⑦没有母乳喂养过 ⑧其它_____

33. 在您产后，医院有实施24小时母婴同室吗？ ①是 ②否

34. 在您产后，医护人员指导过您如何哺乳吗？ ①是 ②否

35. 在您产后，医护人员帮助过您在产后 1 小时内开始母乳喂养吗？ ①是 ②否
36. 在您产后，医护人员鼓励过您按需哺乳吗？ ①是 ②否
37. 您在产前买过婴儿配方奶粉吗？ ①是 ②否
38. 您得到过免费婴儿配方奶粉赠品吗？ ①是 ②否
39. 若“是”，免费赠品来源是：（可多选）
- ①医院推销人员 ②婴儿喂养讲座/培训
- ③产前购买妈妈奶粉时得到 ④其它_____

请在您认可的选项上打“✓”

	同意	不同意
40.母乳喂养应在宝宝出生后 1 小时内开始。		
41.新生儿的第一口食物应该是母乳。		
42.母乳喂养能够给 0-6 个月的婴儿提供足够的营养。		
43.母乳喂养有助于预防婴儿患呼吸系统疾病。		
44.母乳喂养对孩子的好处可延续至断奶以后。		
45.母乳喂养的母亲患乳腺癌的风险较低。		
46.母乳喂养的母亲不易恢复到怀孕前的体重。		
47.乳房小的女性常常母乳不足。		
48.产后前几天母乳量少是正常的。		
49.生产后母乳量会逐渐增多。		
50.增加哺乳次数是促进乳汁分泌的有效方法。		
51.树立母乳喂养的自信心可以帮助克服母乳不足。		

请在您认可的选项上打“✓”

	非常不同意	不同意	一般	同意	非常同意
52.与母乳喂养婴儿相比，配方奶粉喂养的婴儿容易吃的更多。					
53.给宝宝喂奶粉可以让我比较自由。					
54.母乳喂养会导致乳房下垂。					
55.在返回工作岗位（或学校）之前最好给宝宝断奶。					
56.在家里，有家人在场时，我也能自然的给宝宝哺乳。					
57.如果我在公共场所母乳喂养，我会觉得尴尬。					
58.看到别人母乳喂养我会觉得不舒服。					
59.在电视上看到母乳喂养的场面，我会觉得不舒服。					
60.在杂志上看到母乳喂养的图片，我会觉得不舒服。					
61.生宝宝前，我相信我会有足够的母乳。					
62.宝宝出生后，我很快适应了母亲的角色。					
63.给宝宝哺乳时我常常担心宝宝吃不饱。					
64.母乳喂养时，我能看出宝宝是否吸吮困难。					
65.母乳喂养时，我能看出宝宝是否吃饱了。					
66.我能做到按需哺乳。					
67.我能根据宝宝的排尿和排便情况判断母乳是否充足。					
68.我觉得我母乳喂养比较成功。					

Vita

Zixin Lou was born in Qixia, Shandong Province, China. She is the only child in the family. She attended First Elementary School, Middle School, and High School in the small town. In 2003, she went to Wuhan University in Hubei Province for undergraduate study. After graduation, she continued for a Master's Degree in the School of Public Health, advised by Prof. Qiong Luo. In 2009, she was accepted into the PhD program, in the Department of Nutrition at the University of Tennessee, Knoxville (UTK), to be mentored by Dr. Katherine F. Kavanagh. That August, she flew across half of the earth and started the journey at UTK. During her study at UTK, she went to Sichuan University in China, for her collaborative dissertation project. She was married to Bin Wang in 2012. Zixin graduated with a Doctor of Philosophy in Nutritional Science in August 2013. She will complete a 5-month postdoctoral training at UTK after graduation, and pursue an academic position for her future career.