

What are the determinants of low exclusive breastfeeding prevalence in China? A cross-sectional study

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Funding information

The Bill & Melinda Gates Foundation to China Development Research Foundation, Grant/Award Number: OPP1152715

Abstract

Exclusive breastfeeding (EBF) status is far from the national target in China. To identify the modifiable factors associated with EBF of infants aged under 6 months in China. A cross-sectional study was conducted in 12 provinces/municipalities across China in 2017–2018. We used multistage stratified cluster sampling and collected data through face-to-face interviews with mothers using an electronic questionnaire. Totally, 5287 pairs of mother–infant aged <6 months were investigated. The EBF prevalence was 29.2% (1544/5287). Mothers with correct knowledge of colostrum (adjusted odds ratio [AOR]: 1.32, 95% confidence interval [CI]: 1.07, 1.62), EBF (AOR: 1.39, 95% CI: 1.06, 1.81) and the highest scores of perceptions for breastfeeding benefits (AOR: 1.36, 95% CI: 1.14, 1.61) were more likely to exclusively breastfeed. However, mothers with more frequent unwillingness of breastfeeding during the first month postpartum were less likely to practice EBF (AOR: 0.68, 95% CI: 0.52, 0.90). Infants having their first breast milk within 24 h of birth increased the odds of EBF (AOR: 2.41, 95% CI: 1.86, 3.13). Infants were less likely to be exclusively breastfed in the families in which the main caregiver was the grandmothers. Mothers without receiving infant formula feeding suggestions via the health facilities, media, or the Internet (AOR: 1.57, 95% CI: 1.33, 1.85) or without the experience of infant formula feeding in public (AOR: 1.45, 95% CI: 1.23, 1.72) might more likely to practice EBF. To acquire comprehensively correct knowledge and keep a positive attitude of breastfeeding for the mothers are crucial for improving the EBF prevalence. Family supports are potential interventions worth focusing on. Infant formula promotion remains a great barrier for EBF in China.

KEYWORDS

China, cross-sectional survey, determinants, exclusive breastfeeding, infants

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1 | INTRODUCTION

Breastfeeding is the optimal feeding method for infants and young children, and the prevalence of exclusive breastfeeding (EBF) during the first 6 months is the most sensitive and ideal core indicator for breastfeeding evaluation (WHO, 2010). According to the 2020 *Global Nutrition Report*, 42.2% of infants aged 0–5 months were exclusively breastfed in 2018 (Global Nutrition Report, 2020). Despite the limited progress in recent years, an increase of 5 percentage points over 6 years, it still to be a challenge to achieve the global goal of increasing the EBF prevalence in the first 6 months up to at least 50% by 2025 (Global Nutrition Report, 2020). The situation is even worse in China. In recent decades, the prevalence of EBF was on a downward tendency with more than one percentage point decrease annually from 2008 to 2013 in China (Duan et al., 2018). Only one-fifth of the infants aged less than 6 months were exclusively breastfed in 2013, which is obviously lower than the global average level (Duan et al., 2018; Victora et al., 2016).

Breastfeeding is not taken for granted and it is a learning process, which are affected by multiple factors (Rollins et al., 2016). In view of the suboptimal status for breastfeeding globally, the Breastfeeding Enabling Environment Conceptual Framework shaped the determinants of breastfeeding into three levels, including the structural, settings and individual levels (Rollins et al., 2016). Around these three aspects, a large number of studies have been carried out to improve breastfeeding practices. Many modifiable factors affecting breastfeeding have been identified. For example, individual attributes include maternal education, employment, breastfeeding knowledge and attitude, psychosocial factors, such as breastfeeding intention and self-efficacy, mode of delivery and parity; and the relationship between mother and child, such as dyad separation and early initiation (Bai et al., 2009; Cascone et al., 2019; Cohen et al., 2018; Ihudiebube-Splendor et al., 2019; Z. Zhang et al., 2018; J. Zhao et al., 2017; Zielińska et al., 2017). Environmental factors include the health service, family support and workplace and societal support for breastfeeding.

Previous studies conducted in China showed that in addition to some demographic and sociological factors, such as the differences between urban and rural area, maternal educational levels and occupations, lack of breastfeeding knowledge, negative breastfeeding intention, caesarean delivery, delayed breastfeeding initiation, minor postnatal depression, inadequate support from hospital professionals and returning to work (Duan et al., 2018; Jiang et al., 2012; Wu et al., 2019; Zhang, Jin, et al., 2018; Z. Zhang et al., 2018; J. Zhao et al., 2017) may decrease the prevalence of EBF in China. However, most research on the determinants of EBF has focused on the association between the EBF prevalence and maternal socio-demographic characteristics, breastfeeding knowledge and attitude, biomedical and lifestyle factors, health care practices, and so on. As mentioned above, there are a broad range of factors that may affect the EBF. Therefore, studying on the determinants at individual, family, community and social levels together may provide a comprehensive picture of the factors affecting the EBF practices in China. Therefore, we conducted a large-scale study collecting the potential

Key messages

- This is the first study with a large sample size that examined determinants at individual, family, community and social levels potentially affecting EBF practice in China.
- In this cross-sectional study, mothers with completely correct knowledge and positive attitude of breastfeeding, infants having their first breast milk within 24 h of birth, and without exposure to infant formula feeding suggestions or experience might more likely to practice EBF.
- Dissemination of comprehensively correct knowledge and operational skills of breastfeeding, initiation of breastfeeding as soon as possible, reducing the influence of infant formula might be effective methods for improving the EBF prevalence in China.

determinants reporting on the Rollins' framework at structural, settings and individual levels, to identify the key modifiable factors associated with the low EBF prevalence in China. The study is conducive to EBF promotion for achieving the EBF target in China and other countries with similar conditions.

2 | METHODS

2.1 | Study design and participants

Data for this study were derived from a population-based cross-sectional survey which was conducted from July 2017 to January 2018. The detailed methods were described previously (J. Li et al., 2020). Briefly, this was a large-scale survey which was undertaken by mothers of infants aged 0–11 months in China to understand the influencing factors of breastfeeding practices. Multistage stratified cluster random sampling was adopted for the selection of the survey sample. In total, 12 districts/counties (four metropolises, four medium and small cities, two general rural areas and two poor rural areas) were chosen from seven regions across China. In each selected county, four townships were systematically sampled. Infants aged 0–11 months were categorised into 12 groups according to their age in months. Finally, 70 infants of each age group were randomly selected in each county. A total number of 10,408 mothers and infants were recruited, of whom 5287 mother–infant pairs less than 6 months were used for analysis. All the mothers in this study provided written informed consent.

2.2 | Exposure data collection

Data were collected through face-to-face interviews by trained staff using an electronic questionnaire based on a mobile phone

application. According to the Rollins et al. (2016) conceptual model, we adapted the conceptual framework and developed the questionnaire for the current study. The content of the questionnaire was designed to include the determinants on breastfeeding practices at structural, settings and individual levels and it could be summarised into two categories of factors affecting breastfeeding, namely, individual factors and environmental factors (Figure 1). The original questionnaire has been translated into English and included in the Supporting Information Appendix for this article.

Demographic and socioeconomic attributes of the mother and child, such as their age, gender, ethnicity, educational level, occupation, migrant status and family income and expenditure were included in this study. We also collected key information about birth, such as preterm, birthweight, mode of delivery, parity and the information about the child's well-being during the neonatal period and at the survey time, including the diagnosis of neonatal jaundice and neonatal hypoglycemia and the incidence of diarrhoea and respiratory system disease during the 2 weeks before the survey. The health status of the mother before and during pregnancy was also included. We have calculated the prepregnancy body mass index with the mother's self-reported height and prepregnancy weight. The diagnosis of gestational diabetes mellitus and gestational hypertension syndrome were collected too. The largest part of this section was the collection of maternal knowledge, attitude and practice information about breastfeeding. Questions related to breastfeeding knowledge included: (1) the beginning time of sucking nipple after birth; (2) the definition and nutritional value of colostrum; (3) the duration a child should be exclusively breastfed; (4) the best method to stimulate breast milk secretion; (5) the frequency of breastfeeding and (6) the benefits of breastfeeding. We designed a multiple-choice question to assess mothers' perception of the benefits, consisting of 11 positive items. For the analysis, we established a score from these 11 items, with 1 point for selecting one and no point for missing one. And three grades were used: 1–3 points, 4–7 points and 8–11 points. The contents of these 11 items include: (6.1) helps uterus and other organs to return to normal, (6.2) helps mothers to regain a desired figure and reduce weight, (6.3) lowers the risk of ovarian and breast cancer, (6.4) helps to delay menstruation, (6.5)

enhances mother–child emotional communication, (6.6) economical and safe, (6.7) can meet the baby's physiological needs in different stages, which is not possible for human milk substitutes, (6.8) helps to build immunity and reduce the incidence of infectious diseases, (6.9) good for children's intellectual and emotional development, (6.10) helps to reduce the risk of being overweight, obese and other chronic diseases as children grow up and (6.11) lowers the likelihood of babies having an allergy. Questions related to breastfeeding attitude included the frequency of unwilling to breastfeed during the first month postpartum and the feeling about breastfeeding publically. Breastfeeding behaviours were collected during the perinatal period, which mainly included information about onset time of lactation, method of breastfeeding, difficulties encountered in breastfeeding and solutions, attendance for antenatal care and breastfeeding class during pregnancy, breastfeeding experience, and so on. The timing of breastfeeding initiation and the infant having his/her first breast milk were collected in our questionnaire too.

The environmental factor section was designed mainly from the perspective of respondents, involving four aspects: health service, family support, workplace and employment and the sociocultural and marketing context. Breastfeeding related services in the health system were collected during pregnancy, at delivery and after discharge, which includes breastfeeding promotion education and counselling services, duration of hospital stay, main maternal caregiver during the hospital stay and support for breastfeeding difficulties in the hospital. In the family setting, we collected sociodemographic profiles of fathers and their attitude toward breast milk and the infant formula via the mothers' report. In addition to the fathers, we also get some related information about the main caregiver for mother and child during the first month of postpartum. Family attitudes towards child weight gain and the choice between breast milk and infant formula have collected too. Work-related factors, such as maternal leave, breastfeeding room, breast milk storage, leadership breastfeeding support and the breastfeeding practices of colleagues, were investigated among the formal employed mothers. The part of social and cultural determinants mainly included the approach of getting breastfeeding

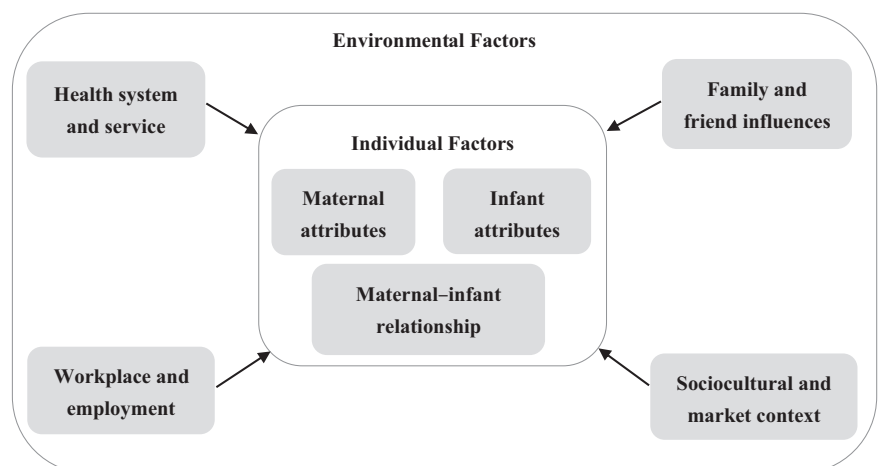


FIGURE 1 Determinants for breastfeeding—an adapted conceptual framework

promotion and the content of breastfeeding information, reception of the infant formula feeding suggestions and free formula sample. Necessity and adequacy of breastfeeding rooms, inconvenience experience of breastfeeding in public were asked to the mothers.

2.3 | Study outcome

A standard questionnaire was adapted from WHO/United Nations Children's Fund indicators for assessing infant feeding practice (WHO, 2010). EBF was defined as the practice in which breast milk is the only food and liquid consumed with the exception of oral rehydration salt, drops, and syrups (vitamins, minerals and medicines) for infants. The EBF prevalence of infants aged <6 months was calculated by dividing the number of infants aged 0–5 months who were exclusively breastfed during the previous day by the total number of living infants aged 0–5 months surveyed.

2.4 | Statistical analysis

All the data were analysed using SAS 9.4 software (SAS Institute Inc.). Descriptive statistics were applied to illustrate the baseline characteristics of participants, including the socioeconomic status of the family consisted of a region of residency, gender of the infant, average age and educational level of the parents, and the household income. The continuous variables were presented as mean standard deviations (SDs) and the categorical variables as percentages (%) to describe the participants.

χ^2 Tests were conducted in categorical variable comparison in the freq procedure. The logistic regression was used to assess the relationship between the EBF and the possible predictors (e.g., infant' age, diagnosis of neonatal jaundice, parental educational levels, maternal breastfeeding knowledge, attitude and practices, timing of the infant having his/her first breast milk, father's attitude toward the breast milk and infant formula, main caregivers for the mother and child during the first month postpartum, whether the families worried about the weight gain of the child, mother's experiences of receiving suggestions for infant formula feeding and feeding infant formula due to inconveniency of breastfeeding in public places and etc.).

First, bivariate analysis (the χ^2 tests) was conducted between the EBF and each predictor. If the *p* value was less than 0.20, the variable was viewed as marginally associated with the EBF and selected to be a candidate variable for logistic regression. Then, the multivariate analysis (the logistic regression) was conducted for the EBF with potential determinants. In the final model of the logistic regression, only variables significantly associated with EBF (*p* < 0.05) were included. The adjusted odds ratio (AOR) and 95% confidence intervals (CIs) were reported in the final logistic regression model while retaining all significant variables.

3 | RESULTS

Totally, 5287 pairs of mother–child aged <6 months completed this study. Half of the infants were male, and 67.5% of the participants lived in urban regions. The age of the mothers and fathers were 28.9 years (SD: 5.0) and 30.9 years (SD: 5.4), and the proportion of them with junior high school education were 35.0% and 36.1%, respectively. One-quarter of the participants' annual household income was <15,000 Chinese Yuan (~2346 US Dollars) per capita. Approximately half of the participants refused to report their income or answered with 'unknown'. The EBF prevalence in infants aged <6 months was 29.2% (1544/5287).

3.1 | Individual factors

The EBF prevalence was 32.4% for 0-month-old infants (Table 1). Compared with these infants, infants aged 2 and 3 months were more likely to be exclusively breastfed, and the AOR were 1.28 (1.04, 1.57) and 1.25 (1.01, 1.54), respectively. However, the likelihood of EBF significantly decreased in infants aged ≥ 4 months. The AOR for EBF were 0.71 and 0.42 for 4- and 5-month-old infants, respectively. Infants without neonatal jaundice had a significantly greater likelihood of EBF than those with neonatal jaundice (AOR: 1.20, 95% CI: 1.04, 1.37).

Mothers with college or above education had 1.53 times odds of EBF than those with junior high school level of education. Mothers with the correct knowledge of colostrum and EBF, respectively, had 1.32 and 1.39 times odds of EBF than those without the correct knowledge. Mothers who were aware of the benefits (8–11 points) of breastfeeding had 1.36 times odds of EBF than those with less awareness (1–3 points). Mothers who felt unwilling to breastfeed frequently had 68% less odds of EBF than those who seldom felt unwilling to breastfeed during the first month postpartum. Infants who had their first breast milk within 24 h of birth had 2.41 times odds of EBF than those who had breast milk after 3 days of their lives.

3.2 | Environmental factors

Environmental factors associated with EBF practice, including support from family and friends and the social environment, are listed in Table 1.

Infants whose fathers had college-level education or above had 1.51 times odds of being exclusively breastfed than those whose fathers had junior high school level of education. An infant was likely to be exclusively breastfed if his/her father accepted the concept that breast milk is better than formula milk. A woman was more likely to exclusively breastfeed her child when taken care by her husband (AOR: 1.18, 95% CI: 1.00, 1.40) than by her mother or mother-in-law during the first month postpartum. An infant was

TABLE 1 Associations between the factors and the EBF prevalence

Variables	EBF prevalence % (n/N)	AOR ^a (95% CI)	p Value
Infant attributes			
Age group of the infants (months) ^b			
0~	32.4 (312/963)	1.00	
1~	33.1 (275/832)	1.12 (0.90, 1.38)	0.318
2~	34.3 (305/890)	1.28 (1.04, 1.57)	0.021
3~	34.4 (301/876)	1.25 (1.01, 1.54)	0.036
4~	24.8 (215/868)	0.71 (0.57, 0.89)	0.002
5~	15.9 (136/858)	0.42 (0.33, 0.54)	<0.001
Diagnosis of neonatal jaundice			
Yes	26.3 (502/1912)	1.00	
No	30.9 (1036/3353)	1.20 (1.04, 1.37)	0.011
Maternal attributes			
Maternal education			
Junior high (9–11 years)	24.1 (444/1843)	1.00	
Primary or below (<9 years)	31.0 (117/377)	1.28 (0.95, 1.72)	0.100
Senior high (12–14 years)	27.9 (272/975)	1.27 (1.03, 1.56)	0.027
Junior college (15 years)	27.1 (255/941)	1.08 (0.84, 1.39)	0.572
College or above (>15 years)	39.7 (451/1136)	1.53 (1.14, 2.07)	0.005
Maternal knowledge about the definition of colostrum			
Unknown	25.1 (261/1040)	1.00	
Wrong	28.8 (851/2953)	1.17 (0.98, 1.41)	0.083
Correct	33.6 (431/1282)	1.32 (1.07, 1.62)	0.008
Maternal knowledge about the duration of EBF			
Unknown	23.8 (97/408)	1.00	
0–4 months	20.3 (201/988)	0.74 (0.55, 0.99)	0.043
5 months	23.5 (93/395)	0.84 (0.59, 1.19)	0.320
6 months	33.7 (1033/3068)	1.39 (1.06, 1.81)	0.016
Older than 6 months	29.0 (117/404)	1.25 (0.89, 1.76)	0.196
The scores of maternal perceptions for breastfeeding benefits (points)			
1–3	25.5 (586/2294)	1.00	
4–7	28.4 (483/1704)	1.00 (0.86, 1.17)	0.995
8–11	37.0 (469/1269)	1.36 (1.14, 1.61)	<0.001
Frequency of unwilling to breastfeed during the first month postpartum			
Never/few	30.0 (1460/4868)	1.00	
Sometimes/always	19.3 (79/409)	0.68 (0.52, 0.90)	0.007
Mother–infant relationship			
Time for infants to take their first breast milk after birth			
>3 days	19.0 (138/728)	1.00	
3 days	25.7 (338/1313)	1.48 (1.16, 1.88)	0.002

(Continues)

TABLE 1 (Continued)

Variables	EBF prevalence % (n/N)	AOR ^a (95% CI)	p Value
1–2 days	31.1 (781/2514)	1.73 (1.39, 2.16)	<0.001
0 day	39.6 (285/720)	2.41 (1.86, 3.13)	<0.001
Family supports			
Paternal education			
Junior high (9–11 years)	25.0 (475/1902)	1.00	
Primary or below (<9 years)	29.5 (105/356)	1.14 (0.84, 1.54)	0.398
Senior high (12–14 years)	25.4 (255/1006)	0.97 (0.79, 1.19)	0.771
Junior college (15 years)	29.9 (251/840)	1.29 (0.99, 1.67)	0.058
College or above (>15 years)	39.1 (456/1167)	1.51 (1.13, 2.03)	0.006
Father's attitude toward the breast milk and the infant formula			
Breast milk is better than formula	30.0 (1428/4755)	1.00	
Infants formula is as good as breast milk or better	18.0 (81/449)	0.60 (0.46, 0.78)	<0.001
Unknown	38.5 (25/65)	1.88 (1.06, 3.34)	0.030
The main caregiver for the mother during the first month postpartum			
Mother/mother-in-law	27.7 (1046/3779)	1.00	
Husband	32.8 (364/1110)	1.18 (1.00, 1.40)	0.048
Confinement nanny/staff of the confinement centre	36.2 (117/323)	0.83 (0.51, 1.35)	0.453
Others	18.2 (12/66)	0.48 (0.24, 0.96)	0.039
The main caregiver for the newborn during the first month after birth			
Grandmothers	20.7 (283/1370)	1.00	
Father	31.9 (90/282)	1.68 (1.21, 2.32)	0.002
Mother	32.0 (1041/3254)	1.74 (1.48, 2.05)	<0.001
Confinement nanny/staff of the confinement centre	36.5 (114/312)	1.84 (1.10, 3.09)	0.021
Others	18.2 (10/55)	1.16 (0.53, 2.55)	0.708
Whether the family members have worried about the weight gain of child after birth			
No	31.0 (1276/4111)	1.00	
Yes, worried about growing too fast	28.1 (71/253)	0.89 (0.65, 1.21)	0.446
Yes, worried about growing too slow	21.3 (195/915)	0.64 (0.53, 0.77)	<0.001
Social environment			
Mother had received the suggestions for infant formula feeding			
Yes	21.1 (287/1363)	1.00	
No	32.1 (1255/3916)	1.57 (1.33, 1.85)	<0.001

TABLE 1 (Continued)

Variables	EBF prevalence % (n/N)	AOR ^a (95% CI)	p Value
Experience of feeding infant formula due to inconvenience of breastfeeding in public places			
Yes	23.7 (312/1319)	1.00	
No	31.1 (1225/3943)	1.45 (1.23, 1.72)	<0.001

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; EBF, exclusive breastfeeding.

^aAdjusted by infants' age group, diagnosis of neonatal jaundice, parental education level, maternal knowledge of the colostrum definition, the duration of EBF, and the benefits of the breastfeeding, frequency of unwilling to breastfeeding during the first-month postpartum, time for infants to take their first breast milk after birth, father's attitude toward breast milk and formula, main caregivers for the mother and child during the first month postpartum, whether the families have worried about the weight gain of the child after birth, whether the mother had received the suggestions for infant formula feeding, the experience of feeding infant formula due to inconvenience of breastfeeding in public places.

^bThe infant age group is indicated at the time of the survey.

more likely to be exclusively breastfed when taken care by his/her father (AOR: 1.68, 95% CI: 1.21, 2.32) or his/her mother (AOR: 1.74, 95% CI: 1.48, 2.05) than his/her grandmothers during the first month after birth. An infant was less likely to be exclusively breastfed in the families that the family members were worried about the slowly weight gain of the infant (AOR: 0.64, 95% CI: 0.53, 0.77) than in which they did not.

Mothers without receiving infant formula feeding suggestions via the health facilities, media, or the Internet (AOR: 1.57, 95% CI: 1.33, 1.85), or without the experience of infant formula feeding in public (AOR: 1.45, 95% CI: 1.23, 1.72) might more likely to practice EBF.

4 | DISCUSSION

The EBF prevalence in 0-5 months aged infants of China was 29.2% according to the current study, which is similar to the prevalence of 28.7% investigated in the central and western China in 2010 (Guo et al., 2013). Although the study is not fully national representative, the result did show a low EBF prevalence and urgent need of improvement in China. We have identified that a higher EBF prevalence may be associated with: (1) mothers with adequate knowledge and positive attitude of breastfeeding; (2) infants who received their first breast milk within 24 hours of birth; (3) fathers' support; (4) no exposure to infant formula feeding suggestion or experience.

Maternal knowledge of breastfeeding has been confirmed to be a crucial and modifiable factor that influences the EBF prevalence (Gewa & Chepkemboi, 2016; Lenja et al., 2016; Muda et al., 2018; Zielińska, Sobczak & Hamułka, 2017). It is worth noting that increasing the EBF-related knowledge comprehensively in mothers increased the EBF prevalence (Gewa & Chepkemboi, 2016). A study showed that the participants with an increase of one unit of the mean total score of knowledge had 1.06 times odds of EBF for their infants at one week after delivery (Muda et al., 2018). In the current study, mothers with the highest scores of perceptions for breastfeeding benefits had 1.36 times odds of EBF than those with the lowest scores. Furthermore, the EBF prevalence was similar for mothers

with intermediate scores of perceptions for breastfeeding benefits as those with the lowest scores. Thus, this result highlights that it may improve the EBF prevalence of China that mothers mastered the knowledge of breastfeeding comprehensively, adequately and correctly. Additionally, psychosocial factors, particularly the breastfeeding attitudes of the mothers, have been confirmed to significantly related to feeding intentions and behavior (Dungy et al., 2008; Scott et al., 2004; Sittlington et al., 2007). Result in our study also indicated that mothers with more frequent unwillingness of breastfeeding during the first month postpartum might decrease the likelihood of EBF. From these mothers' reports, the pain for cracked nipple was the main cause of unwilling to breastfeed, and the lack of sleeping and breast milk were the second and third reasons. Therefore, the result suggested that some operational skills to achieve breastfeeding was urgently needed for the mothers in China, especially for the breastfeeding early initiation period.

Interventions to support establishing breastfeeding immediately after birth increase the likelihood of EBF up to 3-6 months of life (WHO, 2017a). A recently published study corroborated that early breastfeeding practices were associated with EBF, and the path through early initiation breastfeeding and non-pretactal feeding explained 13%-18% of the effect of the interventions on EBF (Nguyen et al., 2020). Nowadays, delayed initiation of breastfeeding is a global problem and pretactal feeding is common. More than half of newborns did not initiate breastfeeding in the first hour of life globally (UNICEF, 2018). The situation was even worse in China. We found that only 15% of the infants had been put to the breast within an hour of birth reported by their mothers. Moreover, 34% of the infants were fed foods or liquids other than breast milk within 24 hours of birth, and this proportion increased to 45% during the first 3 days after birth. Result in this study showed a downward trend with the EBF prevalence and the extension of time for infants to take their first breast milk, which suggested that the initiation of breastfeeding within 24 hours is critical for exclusive breastfeeding. As mentioned above, early initiation of breastfeeding was suboptimal in China. Our findings suggested that increasing the proportion of the infants who can have their first breast milk within 24 hours might be more practical for improving the early initiate of breastfeeding in

China. At present, almost all the pregnant women in China give birth in hospitals or maternity facilities. By 2015, 7036 hospitals had passed the reassessment of baby-friendly hospital, accounting for about two-thirds of births in China (National Health and Family Planning Commission of the People's Republic of China, 2015). In health system, health-care providers influence and support feeding decisions at key moments before and after birth and later (WHO, 2017b). One of the key strategies in this regard is to strengthen implementation of the Ten Steps to Successful Breastfeeding and the Baby-friendly Hospital Initiative.

Extended family support and intergenerational parenting are popular in China. In the current study, 71.6% of the lactation mothers were taken care by their mother or mother-in-law during the first month postpartum. Similarly, grandmothers were more likely to take care of the newborns than their fathers. However, the prevalence of EBF was lower in families in which main caregiver was grandmother during the first month postpartum. Another study indicated that the risk of mixed or formula feeding might increase during the first 3 months of life if grandmothers were the main child caregivers (Li et al., 1999). Grandmothers, based on their knowledge and experiences, may interfere breastfeeding positively or negatively (Jiang et al., 2012; Zhang, Jin, et al., 2018). Their negative opinion could decrease breastfeeding likelihood by up to 70% (Negin et al., 2016). In addition to grandmothers, the influence of fathers on exclusive breastfeeding cannot be ignored either. In the current study, the infants, whose father thought that breastmilk was better than formula, were more likely to be exclusively breastfed. The father's beliefs have contributed significantly to the mother's final decision of feeding, and the support from father was associated with the early initiation and long duration of breastfeeding (Bich et al., 2014; Rempel et al., 2017; Su & Ouyang, 2016). However, only 21 percent of fathers were the primary caregiver for the mothers in the first month postpartum, and this proportion was even lower for the newborns in our study. At present, although national laws and regulations such as labor laws do not explicitly stipulate paternity leave, most provincial family planning regulations have provided about 15 days of leave for the new fathers in China. In the context of policy guarantees, Chinese fathers need to be educated to involve and understand their role in breastfeeding and how to support it.

There is no denying that the advent of infant formula does provide an alternative option for some exceptional circumstances. However, challenges in promotion, protection and support of breastfeeding follows too. In order to regulate Breast Milk Substitute (BMS) marketing, the International Code of Marketing of Breast Milk Substitutes (the "Code") was adopted by the World Health Assembly in 1981. Although China enacted Code legislation in 1995, it has not been updated to take into account new marketing tactics, and implementation and enforcement were weak (Rollins et al., 2016). As the end of 2017, the regulation was abolished without replacement, BMS marketing regulation weakened in China (National Health and Family Planning Commission of the People's Republic of China, 2017). Previous studies suggest that the hospital is the primary site of inappropriate BMS marketing

and one of the major approaches of formula sales was through the influence and recommendations of health workers (Sobel et al., 2011; Zhang et al., 2013). Besides marketing at hospitals, BMS companies marketed their products across the entire society through various methods such as television and magazine advertisement, promotion pamphlets at supermarkets, shopping Web sites, and parenting Web sites in China (Liu et al., 2014). In the current study, a quarter of mothers with infants under 6 months of age had reported to receive advice on infant formula feeding, and the primary sources were the health facilities and the Internet, of which the online shopping malls and the social media were the major web sources. Result in our study indicated that without the exposure of infant formula feeding suggestion was associated with a high EBF prevalence. Thus, policy support remains the core means to regulate the BMS marketing in China.

In this context, improving the acceptance of breastfeeding in public is another important path to create breastfeeding-friendly environment. A web-based survey showed that there were still 35% of Chinese adults considered that it was not acceptable for mothers to breastfeed in public places (Zhao, Ouyang, et al., 2017). Literature suggested that negative cultural perceptions of breastfeeding in public deter initiation and duration of breastfeeding (Yngve & Sjostrom, 2001). In our study, mothers with experience of infant formula feeding in public places because of the inconvenience of breastfeeding were less likely to practice EBF compared with their counterpart. A society that is perceived by women to disapprove of breastfeeding in public is not conducive to prolonged breastfeeding. Attitudes against breastfeeding in public can serve as a barrier for those attempting EBF and might contribute to a low EBF prevalence (Scott et al., 2015). Increasing the acceptance of breastfeeding in public could be contributed to improve the EBF prevalence of China. Meanwhile, to promote public breastfeeding rooms could be helpful too. Result in our study showed that 88% of the mothers believed that public breastfeeding rooms was needed, while 90% of the mothers thought that the breastfeeding rooms in public was insufficient in their living area. According to the official data reporting, more than 24,000 breastfeeding rooms had been built in the public places by the end of 2018 in China (National Health and Family Planning Commission of the People's Republic of China, 2021). However, there are 880 million women and children, which accounts for the biggest proportion of the population in China, these efforts remain far from enough.

To the best of our knowledge, this is the first study with a large sample size that collected comprehensive factors including individual and environmental affect breastfeeding practices in China. Our findings have identified several modifiable determinants of non-EBF with practical implications which could be applied to the target population for improving EBF practice, and call for implementation of new policies to improve on breastfeeding-friendly environments. Dissemination of comprehensively correct knowledge and operational skills of breastfeeding, initiation of breastfeeding as soon as possible, reducing the influence of infant formula might be effective methods for improving the EBF prevalence in China.

There were undeniably some limitations in the present study. Firstly, causal inference between EBF and these identified factors is limited due to the nature of the study being cross-sectional. A longitudinal study might provide more insights to establish causal relations. Secondly, to collect exact information on breastfeeding, only infants' mothers were recruited as participants and most questions were designed from the mother's point of view. Therefore, infants not living with their mothers could not be included in our study, which might cause some selection bias, thus overestimating the EBF prevalence. Those infants are unlikely to be exclusively breastfed and are certainly with a higher risk for further interventions. Because mother was interviewed, mother's perception on father's attitude may not fully reflect father's own opinion. Further researches are required to investigate the other people who is closely related to breastfeeding, such as the fathers, grandmothers, staff of Baby-friendly hospitals and so on, in order to explore possible ways to improve exclusive breastfeeding from different perspectives.

5 | CONCLUSIONS

The EBF prevalence of infants aged <6 months in China was far below the international target. Completely correct knowledge and a positive attitude of breastfeeding for mothers are crucial in improving the EBF prevalence. Support from grandmothers and fathers of infants and delivery environment are other potential ways to intervene. Infant formula promotion remains a great barrier for EBF practice in China. Policy support remains the core means to regulate the BMS marketing in China. Additionally, further intervention studies are warranted, especially for the health systems, family and community interventions.

ACKNOWLEDGEMENTS

This study was sponsored by the Bill & Melinda Gates Foundation to China Development Research Foundation (Grant number OPP1152715). The authors thank all the participants in this study and all the staff working for this study.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

ETHICS STATEMENT

The study has received ethical approval from the Medical Ethics Review Board of the National Institute for Nutrition and Health, Chinese Centre for Disease Control and Prevention (Approval number: 2017-015) (Trial Registration: ChiCTR-ROC-17014148. Registered 26 December 2017).

AUTHOR CONTRIBUTIONS

YD, ZY and JL designed the study; YD and ZY drafted the manuscript; YB, JW, XP, SJ, LX and HZ supervised the field survey; and YD and ZY conducted the statistical analysis. All authors have seen and approved the final version of the manuscript for publication.

DATA AVAILABILITY STATEMENT

Data of this study are currently available.

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How to cite this article: Duan, Y., Yang, Z., Bi, Y., Wang, J., Pang, X., Jiang, S., Zhang, H., Xu, L., & Lai, J. (2022). What are the determinants of low exclusive breastfeeding prevalence in China? A cross-sectional study. *Maternal & Child Nutrition*, 18, e13324. <https://doi.org/10.1111/mcn.13324>