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Exploring Determinants of Exclusive Breastfeeding among Mothers in Jiangsu, China

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Abstract

Objectives The World Health Organization (WHO) recommends exclusive breastfeeding (EBF) for infants under 6 months, but EBF practices in China face significant challenges. This study aimed to evaluate EBF duration and its determinants among Chinese mothers in Jiangsu Province.

Methods This prospective study recruited 374 mothers from postnatal wards of hospitals. On the day of discharge, a face-to-face survey was conducted, utilizing a demographic record form, the Breastfeeding (BF) Knowledge Questionnaire, the BF Attrition Prediction Tool, the Perception of Insufficient Milk (PIM) Questionnaire, and the Infant Feeding Intention Scale. After discharge, 3 follow-up calls were conducted with an EBF record form. AMOS 23.0 software were employed to perform structural equation modelling.

Results Only 12.30% of the participants sustained EBF until 6 months postpartum. BF intention, maternity leave, and perceived control had direct positive effects on EBF. Subjective norm, perceived control and PIM had indirect positive effects on EBF through BF intention. BF knowledge indirectly influenced EBF through BF attitude, subjective norm, perceived control, and PIM, all in positive directions. Additionally, BF attitude had an indirect positive effect on EBF through subjective norm.

Conclusions Predictors of EBF for the first 6 months were successfully identified in this study, highlighting the importance of a multi-faceted approach. To support EBF, nurses, employers, and governments must collaborate. Providing lactation facilities, time off for milk expression, and comprehensive maternity leave, along with targeted nursing interventions, can extend EBF durations and improve maternal and infant health.

Significance

The WHO recommends EBF for infants under 6 months, but practices in China face challenges. Existing Chinese research often evaluates EBF through 24-h or 7-day recall, leading to overestimations. These studies also frequently overlook psychosocial factors and rarely extend to the crucial 6-month mark. Due to cultural differences, results from foreign studies may not apply to China. Using a predictive model, this study identified direct and indirect predictors of 6-month EBF in China, such as BF intention, maternity leave, and PIM. These insights can guide culturally tailored interventions, improving maternal and infant health outcomes in China.

Keywords Determinants · Exclusive breastfeeding · Mother · Structural equation modelling · China

Introduction

The World Health Organization (WHO) recommends exclusive breastfeeding (EBF) for the first 6 months of an infant's life. (WHO, 2001). The definition of EBF is that infants only receive breast milk, no other liquids or solids except for mineral supplements, medications, and vitamins. EBF during the first 6 months of life can reduce infant mortality by 20% and prevent 800,000 infant deaths annually (Phukan et al., 2018; Tongun et al., 2019). Additionally, longer

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EBF duration reduces the likelihood of infants developing gastrointestinal and acute respiratory infections (Khan & Islam, 2017; Kramer & Kakuma, 2012). For mothers, committing to EBF for the first 6 months has been demonstrated to decrease the likehood of developing type 2 diabetes and ovarian cancer by a minimum of 50% (Schwarz et al., 2010) and 27% (Jordan et al., 2012), respectively, and to decrease the likehood of breast cancer to just 2% (Scoccianti et al., 2015).

Despite the benefits of 6-month EBF, the United Nations Children's Fund (UNICEF) disclosed that 60% of infants worldwide did not meet the recommended EBF standards (UNICEF, 2019). In the United States, only 25% of infants receive 6-month EBF, similar to China's low rates. A study in China reported a 6-month EBF rate of merely 20.7% (Y. Zhang et al., 2020a, 2020b, 2020c), with Nanjing city in Jiangsu Province showing a rate of 29.4% (Chen et al., 2020). The EBF rate in China could decline significantly from 31.3% at 1 month to 12.4% at 6 months (Wang, 2017). Sustaining EBF for 6-month duration appears to be challenging for mothers. Understanding the factors that influence mothers to maintain EBF for up to 6 months is crucial. Based on relevant studies from various countries, a systematic review identified maternity leave, delivery mode, breastfeeding (BF) attitude, subjective norm (perceived BF support from significant others), perceived control, perception of insufficient milk (PIM), BF knowledge and BF intention as crutial predictors of 6-month EBF (Wu et al., 2022).

While many studies have focused on EBF in China, most report outcomes before the 6-month mark. These studies often use 24-h recall methods that may overestimate EBF rates. Unlike foreign studies, Chinese researches have paid less attention to psychological factors, with rare reports on mothers' PIM and BF intention, and no standardized tools for evaluating PIM. China's maternity leave duration (128–158 days) is shorter than that of some Western countries (52 weeks in the UK, 50 weeks in Canada), which forces most employed mothers to return to work within 6 months postpartum. Notably, 63% of women of reproductive age (approximately 208 million) are employed in China (State Council of the People's Republic of China, 2023). Furthermore, China has one of the highest caesarean delivery rates globally. These factors, limited maternity leave and extremely high caesarean delivery rates, may uniquely impact EBF practices in the first 6 months, potentially differing from experiences in other countries. Therefore, it is crucial to explore the determinants of EBF within the context of Chinese culture.

The theory of planned behavior (TPB) offers a robust conceptual framework for understanding EBF practices, positing that attitude, subjective norm, and perceived control influence behavior through intention (Ajzen, 1991). Based on the TPB and previous studies, this study aims to construct and test a hypothetical framework (Fig. 1) to elucidate the complex relationships among BF attitude, subjective norm, perceived control, PIM, BF knowledge,

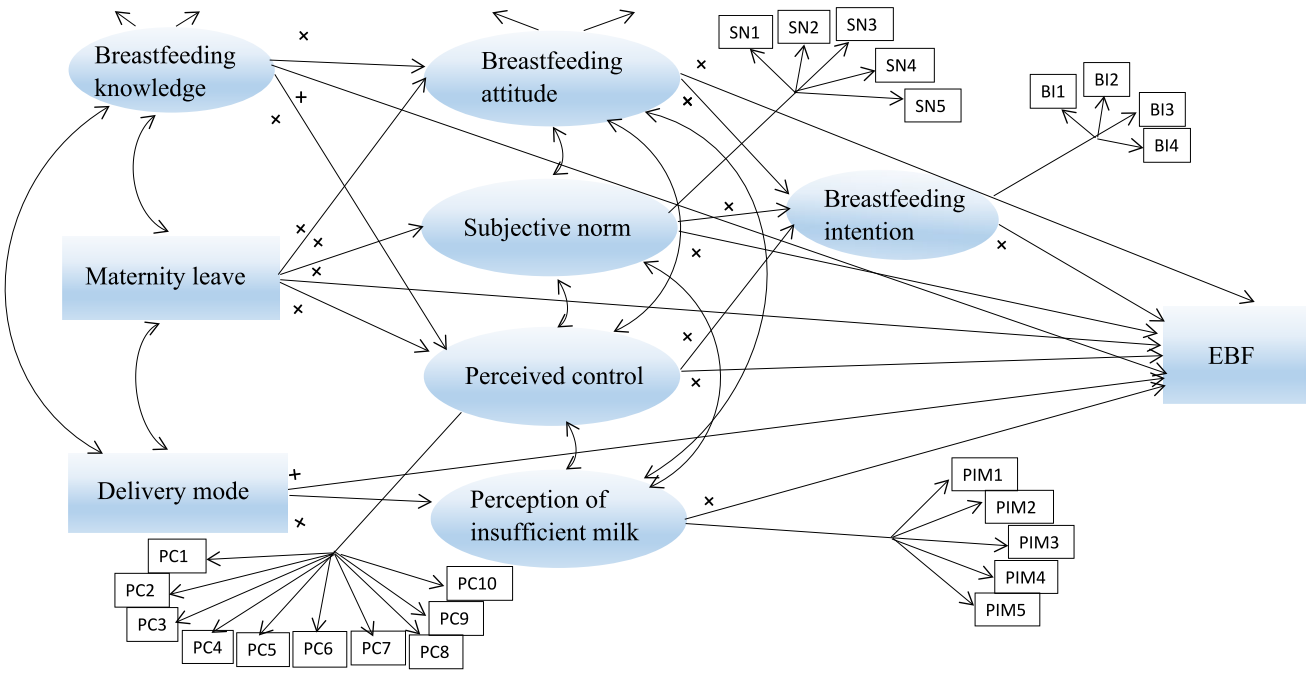

Fig. 1 The hypothesized model of EBF. Reprinted with permission from all the authors of this study

maternity leave, delivery mode, BF intention, and EBF for the first 6 months postpartum.

Methods

Research Participants

A prospective study was conducted from August 2022 to March 2023 in Jiangsu Province, China. Adult mothers were recruited from the postnatal wards of selected hospitals using a multistage random sampling method. The first step of sampling was to randomly select 1 city in Jiangsu Province by the lottery method. Hospitals in China are classified into 3 levels (I to III). In the second step, 1 hospital from each level in the selected city was chosen randomly using the lottery method. Finally, mothers who met the inclusion criteria and volunteered to participate were recruited from these selected hospitals using the same random selection method. Following Hair's (2009) recommendation of 10 participants per parameter (Hair, 2009), the initial sample size was calculated for the 35-parameter model. After accounting for a 10% attrition rate, the final sample size was 385.

Participants in this study were required to meet the following inclusion criteria: aged at least 18 years; had chosen a normal delivery or caesarean section; gave birth to healthy and full-term (≥ 37 weeks) singletons; had common dietary requirements and were healthy; had the ability to communicate in Mandarin; had living partners, mothers-in-law and mothers; had telephones available for follow-up. The exclusion criteria were: had health issues themselves or had infants with health complications, for whom BF was not allowed by doctors; had mental or emotional problems that prevented them from responding to the survey; did not return to work as planned.

Measurements

Demographic Record Form

The demographic record form was designed by the researchers to gather participants' demographic information, including maternity leave duration, delivery mode and other basic information. With this form, participants were asked to specify the length of their maternity leave and their mode of delivery. Mothers who did not intend to return to work in the first 6 months postpartum were assumed to have 180 days of maternity leave, as they were free from workplace obligations, allowing their BF behavior to remain unaffected by work-related pressures or the BF support environment.

Breastfeeding Knowledge Questionnaire

Designed by Zhao (2008), this 17-item questionnaire was used to measure mothers' BF knowledge (Zhao, 2008). Participants rate each item as 0 (no/unsure) or 1 (yes), with total scores ranging from 0 to 17. Higher scores indicate greater BF knowledge. The content validity index is 0.90 (He, 2018), and Cronbach's α ranges from 0.74 to 0.86 (He, 2018; Zhao, 2008).

Breastfeeding Attrition Prediction Tool

This tool was used to assess participants' BF beliefs (attitude, subjective norm, and perceived control). Originally developed by Janke (1994) and translated into Chinese by Zhu et al. (2017), it consists of 3 subscales: attitudinal, subjective norm, and perceived control (Janke, 1994; Zhu et al., 2017). Each item is rated from 1 (strongly disagree) to 5 (strongly agree). Scores range from 29 to 145 for the attitudinal subscale, 5–25 for the subjective norm subscale, and 10–50 for the perceived control subscale. Higher scores indicate stronger BF beliefs. The Cronbach's α for the overall scale is 0.88, with subscale coefficients ranging from 0.81 to 0.92 (Zhu et al., 2017).

Perception of Insufficient Milk Questionnaire

This questionnaire, developed by McCarter-Spaulding and Kearney (2001) and adapted into Chinese by the research team, was used to assess participants' PIM (McCarter-Spaulding & Kearney, 2001). PIM refers to a mother's perception that her breast milk is inadequate in either volume or nutritional quality to meet her infant's needs. This questionnaire includes a global question about milk supply perception (answered as yes or no), followed by 5 items rated on a scale from 1 (strongly disagree) to 5 (strongly agree). The total score ranges from 5 to 25, with higher scores indicating a perception of greater milk supply. The scale has a Cronbach's α of 0.94 and a test–retest reliability ranging from 0.87 to 0.97.

Infant Feeding Intention Scale

Designed by Nommsen-Rivers and Dewey (2009) and translated into Chinese by Wu et al. (2018), this scale was used to assess participants' BF intentions (Nommsen-Rivers & Dewey, 2009; Wu et al., 2018). It uses a 5-point response scale from 0 (strongly disagree) to 4 (strongly agree). The final score, ranging from 0 to 16, is calculated by summing items 3, 4, and 5, and adding the average score of items 1 and 2. Higher scores indicate stronger intentions to exclusively

breastfeed. The scale has a content validity index of 0.92, a Cronbach's alpha of 0.77, and a construct validity of 0.997 (Wu et al., 2018).

Exclusive Breastfeeding Record Form

The researchers of this study designed the EBF record form for participants to log daily EBF. EBF duration for the first 6 months was estimated from the total number of EBF days recorded.

Data Collection

Participants were invited to complete all questionnaires (except for the EBF record form) during a 20-min, face-to-face (interviewer-administered) survey conducted on the day of discharge.The EBF record form was distributed to each participant after the interview, with instructions on its use. After discharge, researchers conducted telephone interviews at 2, 4, and 6 months postpartum to track the duration of EBF using the EBF record form and to verify maternity leave data. Data were considered missing if mothers could not be reached within 2 weeks of each follow-up.

Statistical Analysis

SPSS 20.0 and AMOS 23.0 were used for statistical analysis. Continuous variables with a normal distribution were reported as the mean and standard deviation, while non-normal variables were summarized as medians and interquartile ranges. Categorical variables were presented as frequency counts and percentages. Structural equation modelling (SEM) was utilized to examine the predictive relationships between independent and dependent variables. SEM assumptions (outliers, normality, linearity, and multicollinearity) were tested. Goodness-of-fit indices for the predictive model included: a discrepancy divided by degree of freedom (CMIN/*df*) < 2.0, root mean square error of approximation (RMSEA) between 0.05 and 0.08, goodness-of-fit index (GFI) > 0.90, comparative fit index (CFI) > 0.90 and normed fit index (NFI) > 0.90. The significance level was set at $p < 0.05$.

Results

Characteristics of Participants

This study recruited 180 mothers from Pizhou People's Hospital, 180 from Xinan Hospital, and 25 from Fuyou Hospital in Xuzhou city. A total of 11 mothers dropped out of the study, resulting in an attrition rate of 2.86%. Reasons for dropout included incorrect contact details (2), infant health issues (2), illness preventing return to work as planned (3), failure to answer calls (3), and relocation to the United Kingdom for studies (1). The demographic characteristics of the non-participants did not differ significantly from those of the participants ($p > 0.05$). Participants had a mean age of 30.29 years with a standard deviation (SD) of 4.53 years, and 66.84% were employed. Employed mothers took an average maternity leave of 140.47 days (SD = 41.99), with 43.6% taking less than the statutory leave and 33.6% receiving no paid maternity leave. Details are presented in Table 1.

Descriptive Statistics of the Study Variables

The mean duration of EBF was 62.29 days (SD = 72.06) (Table 2). Further details on the rates of maintaining EBF to different durations are presented in Fig. 2. The rate of sustaining EBF for 2 months was 43.58%, and for 6 months, it declined to 12.30%. The mean scores of the other study variables, as described in Table 2, were all near the midpoint of the range. 63.90% of the participants believed their breast milk supply was inadequate for their infants.

Assumption Testing

Univariate outliers were identified using z-scores greater than + 3.29 or less than − 3.29 (Mowbray et al., 2019). No univariate outliers were found in this study. Multivariate normality was assessed using Skewness (SK) and Kurtosis (KU). Data with SK between − 2 and + 2 and KU between − 7 and + 7 are considered normal (Hair et al., 2009). The SK and KU values of all variables in this study indicated normal distribution (Table 2). Multicollinearity is typically identified by absolute correlations exceeding 0.90 (Senthilnathan, 2019). It was further assessed via Variance Inflation Factor (VIF) and tolerance values, where VIF > 4 and tolerance < 0.20 signal multicollinearity (Duxbury, 2021; Senaviratna & Cooray, 2019). In this study, correlations ranged from − 0.12 to 0.62, with all tolerance values above 0.20 and VIF values below 0.40, confirming the absence of multicollinearity.

Model Testing and Results

The fit indices of the hypothesized model indicated that the data did not fit the hypothesized model well (CMIN = 1511.89, *df* = 417, $p < 0.001$, CMIN/ *df* = 3.63, RMSEA = 0.08, GFI = 0.77, CFI = 0.85, and NFI = 0.80). According to the modification indices in the output, the hypothesized model was modified. The paths from BF knowledge, delivery mode, BF attitude, subjective norm and PIM to EBF; from maternity leave to BF attitude, subjective norm and perceived control; from delivery mode to PIM; and from BF attitude to BF intention were deleted

Table 1 Demographic characteristics of the participants (n = 374)

Characteristics	n	%
Age (years) (Range = 19–47 years, Mean = 30.29, SD = 4.53)		
≤ 20	2	0.53
21–30	196	52.41
31–40	168	44.92
≥ 41	8	2.14
Gestational age (weeks) (Range = 37–41 weeks, Mean = 38.74, SD = 0.94)		
37–38	35	9.36
38^{+1}–39	112	29.95
39^{+1}–40	154	41.18
> 40	73	19.52
Residence		
Urban	260	69.52
Rural	114	30.48
Average monthly household income (RMB)		
< 3000	3	0.8
3000–6000	47	12.57
6000–10000	104	27.81
> 10,000	220	58.82
Education		
Junior college or below	284	75.94
Bachelor degree or above	90	24.06
Quantity of child (Range = 1–3, Mean = 1.51, SD = 0.57)		
1	197	52.67
2	164	43.85
≥ 3	13	3.48
Having BF experience		
Yes	147	39.30
No	227	60.70
Having received BF education		
Yes	195	52.14
No	179	47.86
Delivery mode		
Vaginal delivery	145	38.77
Caesarean section	229	61.23
Employment status		
Employed	250	66.84
Unemployed	124	33.16
Maternity leave of employed mothers (days) (n = 250, Range = 30–180 days, Mean = 140.47, SD = 41.99)		
< 90	25	10
90–120	45	18
121–150	38	15.2
151–180	142	56.8

since these paths were not significant. The paths from BF knowledge to subjective norm and PIM, from BF attitude to subjective norm, and from PIM to BF intention were added to the model due to the significant parameter estimations. After modification, the fit indices indicated that the fit of the modified model was acceptable (CMIN = 951.14, $df = 656$, $p < 0.001$, CMIN/ $df = 1.45$, RMSEA = 0.06, GFI = 0.91, CFI = 0.91, and NFI = 0.91). The modified model (Fig. 3) explained 30.0% of the variance in EBF.

The modified model showed that maternity leave, BF intention and perceived control had positively direct effects on EBF ($\beta = 0.07$, $p < 0.05$, $\beta = 0.29$, $p < 0.001$, $\beta = 0.29$, $p < 0.001$, respectively).These findings suggest that for each one-unit increase in maternity leave, BF intention, or perceived control, EBF increased by 0.07, 0.29, and 0.29 units, respectively. Subjective norm, perceived control and PIM had positively direct effects on BF intention ($\beta = 0.10$, $p < 0.05$, $\beta = 0.61$, $p < 0.001$, and $\beta = 0.20$, $p < 0.001$, respectively), indicating that each one-unit increase in these variables led to increases of 0.10, 0.61, and 0.20 units in BF intention, respectively. BF knowledge had positively direct effects on BF attitude, perceived control, subjective norm and PIM ($\beta = 0.94$, $p < 0.001$, $\beta = 0.78$, $p < 0.001$, $\beta = 0.43$, $p < 0.001$, $\beta = 0.18$, $p < 0.01$, respectively).This meant that for every one-unit increase in BF knowledge, BF attitude increased by 0.94 units, perceived control by 0.78 units, subjective norm by 0.43 units, and PIM by 0.18 units. In addition, BF attitude had a positively direct effect on subjective norm ($\beta = 0.05$, $p < 0.05$), indicating that for every one-unit increase in BF attitude, subjective norm increased by 0.05 units. The direct, indirect, and total effects in the modified model are presented in Table 3.

Discussion

Despite the suboptimal EBF practices in China, there is a notable lack of research investigating the predictive relationships among various factors such as PIM, BF intention, BF attitude, subjective norms, perceived control, BF knowledge, maternity leave, delivery mode, and EBF for the first 6 months using SEM approaches in the Chinese context.

The results of the present study found that maternity leave, perceived control and BF intention were important factors predicting EBF for the first 6 months. These findings indicated that mothers with longer maternity leave, greater perceived control and stronger BF intention were more inclined to sustain EBF for a prolonged duration. This was consistent with the findings of Abou-ElWafa and El-Gilany (2019), who also reported that maternity leave positively impacted on EBF (Abou-ElWafa & El-Gilany, 2019). The present study found that a significant proportion of participants had a maternity leave shorter than the statutory duration and did not receive paid maternity leave. Under economic constraints, certain participants, lacking paid maternity leave, had to resume work merely 1 month after childbirth. However, few workplaces in China offer a

Table 2 Descriptive and distributional characteristics of study variables (n = 374)

Variables	Possible Range	Actual Range	*M*	*SD*	*SK*	*KU*
BF knowledge	0–17	1–17	11.01	3.25	− .22	− .54
BF attitude	29–174	30–180	99.78	13.67	.13	.18
Subjective norm	12–72	15–25	21.06	3.89	− .63	.14
Perceived control	10–60	11–50	34.90	9.57	− .10	− .97
PIM	5–25	7–25	16.72	5.03	.02	− .96
BF intention	0–16	0–16	10.23	4.22	− .24	− .85
Maternity leave	0–180	30–180	153.57	39.04	− 1.49	1.17
Delivery mode	/	/	/	/	− .43	− 1.83
EBF duration	0–180	0–179	69.29	72.06	.26	− 1.7

BF knowledge Breastfeeding knowledge, *BA* Breastfeeding attitude, *PIM* Perception of insufficient milk, *BF intention* Breastfeeding intention, *EBF duration* Exclusive breastfeeding duration

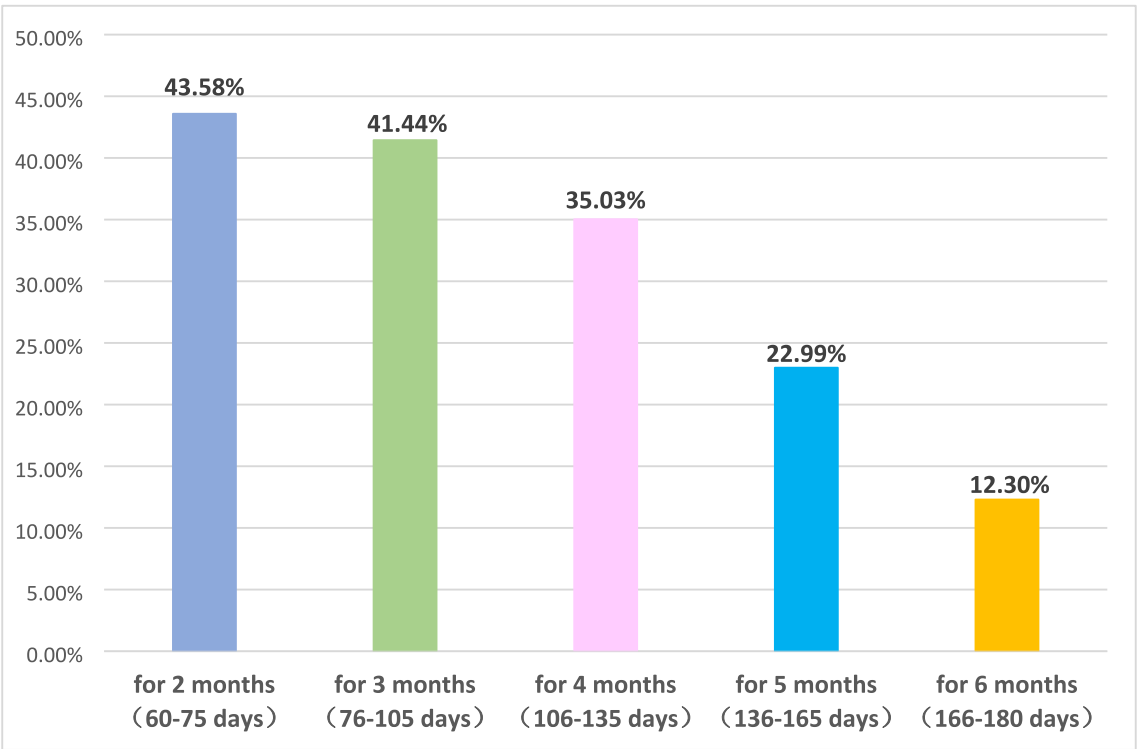

Fig. 2 The rates of maintaining EBF to different durations. Reprinted with permission from all the authors of this study

supportive setting for mothers to breastfeed (Zhang et al., 2020a, 2020b, 2020c). It was observed that after returning to work, mothers did not have time to breastfeed their infants or places to express milk. In addition to the lack of BF-friendly workplaces, a knowledge gap about how to express and store breast milk was also found to be a barrier for working mothers to exclusively breastfeed their infants (Uwamariya, 2021). For sanitation and safety reasons, mothers and their families preferred to use formula rather than breastmilk stored in the refrigerator. Consequently, it was challenging for mothers with short maternity leave to maintain EBF for 6 months.

Furthermore, previous studies have demonstrated that perceived control plays a key role in determining EBF (Alfianrisa et al., 2017; Sulaeman et al., 2018). In accordance with the TPB, perceived control denotes an individual's belief in their capability to influence their behaviour (Ajzen, 1991). Increased perceived control can empower mothers to develop a sense of efficacy in achieving EBF. When mothers have effective control over the EBF behaviour, they believe in their capability to perform EBF and are more likely to take actions to exclusively breastfeed their infants. However, some participants in this study expressed that BF was beyond their control due to a lack of BF skills.

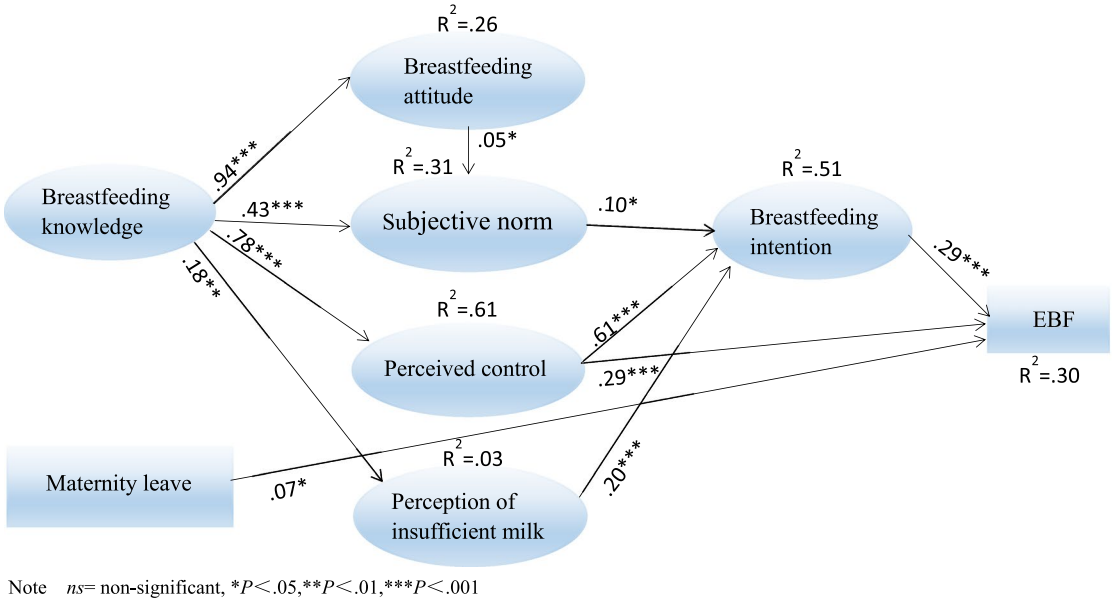

Fig. 3 The modified model of EBF. Reprinted with permission from all the authors of this study. *ns* non-significant, $^{*}p < .05, ^{**}p < .01, ^{***}p < .001$

This limitation may hinder mothers' efforts to exclusively breastfeed their infants. BF intention was also found to be a crucial predictor of EBF (Al-Barwani, 2017; De Roza et al., 2019), aligning with the findings of the present study. Behavioural intention reflects an individuals' willingness to attempt a behaviour and the level of effort they plan to invest to achieve it (Ajzen, 1991). Consequently, mothers with stronger BF intentions would be more likely to breastfeed their infants for longer durations and with greater exclusivity (Al-Barwani, 2017). To enhance EBF practices, future studies should further explore policies on extended maternity leave and nursing interventions aimed at improving perceived control and BF intentions.

The present study also found that subjective norm, perceived control and PIM had positive indirect effects on EBF through BF intention. This indicated that mothers with higher scores for subjective norm, perceived control and PIM had stronger intentions to perform EBF, predicting a longer EBF duration. This finding aligns the TPB, which posits that a proximal predictor of individual behaviours is behavioural intention, affected by subjective norm and perceived control (Ajzen, 1991). Previous studies also supported that subjective norm (Al-Barwani, 2017; Ritta et al., 2020) and perceived control (Ritta et al., 2020) were predictors of BF intention. When mothers perceive more BF support from important others and greater control over BF, they are more encouraged and motivated to provide EBF for their infants. In addition, PIM was identified as an essential factor influencing BF intention, a finding that has been rarely reported in other studies. When participants believed their milk was sufficient in both quantity and quality, they had more confidence in achieving EBF, which strengthened their intention to exclusively breastfeed their infants. Given the positively predictive relationship between BF intention and EBF, mothers with stronger behavioural intention are more likely to perform EBF for extended periods. However, in China, BF intention and PIM have not been given due attention. Further researches are needed on how to improve BF intention by enhancing PIM, subjective norm, and perceived control, thus promoting EBF in the first 6 months.

BF knowledge has a direct positive impact on BF attitude, perceived control, subjective norm, and PIM. In other words, mothers who are more knowledgeable about BF tend to develop more positive attitudes towards BF, feel more in control of BF, perceive more support from important others, and believe they have sufficient milk supply. Consistent with the present study, evidence from different countries also indicates that BF attitude (Al-Barwani, 2017), perceived control (Titaley et al., 2021), subjective norm (Al-Barwani, 2017), and PIM (Huang et al., 2022) can be predicted by BF knowledge. Behavioural attitude describes feelings of approval or disapproval towards a behaviour. When mothers are equipped with adequate BF knowledge, they better understand the benefits of BF and how to prevent and address BF problems, resulting in a positive attitude towards BF (Hamze et al., 2018). Perceived control indicates one's confidence in performing a behaviour (Esquerra-Zwiers et al., 2022). Mothers who possess good knowledge about BF are more prepared and confident in BF their infants. They perceive BF to be manageable since it is within their control.

Table 3 Direct, indirect, and total effects of independent variables on the dependent variable in the modified model (n = 374)

Independent variables	BA			SN			PC			PIM			BI			EBF		
	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE	DE	IE	TE
BF knowledge	.94***	–	.94***	.43***	.04*	.47***	.78***	–	.78***	.18**	–	.18**	–	.55***	.55**	–	.25***	.25***
Maternity leave	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	.07*	–	.07*
BA	–	–	–	.05*	–	.05*	–	–	–	–	–	–	–	–	–	–	–	–
SN	–	–	–	–	–	–	–	–	–	–	–	–	.10*	–	.10*	–	.03*	.03*
PC	–	–	–	–	–	–	–	–	–	–	–	–	.61***	–	.61***	.29***	.18*	.46***
PIM	–	–	–	–	–	–	–	–	–	–	–	–	.20***	–	.20***	–	.06*	.06*
BI	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	.29***	–	.29***
Structure equation fit	$R^2 = .26$			$R^2 = .31$			$R^2 = .61$			$R^2 = .03$			$R^2 = .51$			$R^2 = .30$		

*$P < .05$, **$P < .01$, ***$P < .001$

DE Direct effect, *IE* Indirect effect, *TE* Total effect, *BF knowledge* Breastfeeding knowledge, *BA* Breastfeeding attitude, *SN* subjective norm, *PC* perceived control, *PIM* Perception of insufficient milk, *BI* Breastfeeding intention, *EBF* Exclusive breastfeeding

The present study also found a predictive relationship between BF knowledge and subjective norm. Important others are key sources of mothers' BF knowledge. Mothers who gain more knowledge from healthcare providers, partners, and friends are exposed to more supportive attitudes towards BF from these important others. PIM was also a common reason for mothers to terminate EBF early (Huang et al., 2022), aligning with the conclusions of the current study. Most mothers experience engorgement between 2 and 5 days postpartum, often occurring earlier in multiparous women (Demirci et al., 2018). In the target hospitals, mothers are typically discharged within 4–7 days postpartum, and since nearly half of the participants in this study were multiparous, milk supply is generally sufficient on the day of discharge, especially considering that the newborn's milk demand is not high at this stage. However, some mothers with sufficient milk, lacking BF knowledge, misinterpreted normal infant behaviors as signs of insatiability and perceived their milk to be too thin, which led to PIM. In future nursing interventions, a comprehensive approach to BF education is essential, targeting both mothers and their significant others. This education should include information on understanding milk supply, helping mothers accurately assess their actual milk supply.

The present study also identified a relationship between BF attitude and subjective norm, a finding consistent with previous studies (Han et al., 2023; Mitchell-Box et al., 2013). It indicated that participants with more negative attitudes towards BF perceived less support from important others. This might be because the choice to breastfeed is ultimately at the discretion of the mother. With a negative BF attitude, the support from important others may be diminished. This finding suggests that interventions aimed at improving maternal BF attitudes could enhance perceived social support and, consequently, EBF outcomes.

Limitations and Strengths

This study, conducted only in Jiangsu Province, limits the generalizability of the findings. China has 34 regions and 56 ethnic groups, creating diverse social, economic, and cultural backgrounds. Jiangsu, predominantly Han (99.6%), is advanced in finance and education. Women in less developed provinces may have lower education levels, prefer vaginal delivery, and ethnic minorities might receive less support from the important others (Zhang et al., 2020a, 2020b, 2020c), all of which can affect this study's applicability. Additionally, this study used self-reported data. To strengthen its reliability, the EBF record form was beneficial. Due to the increasing emphasis on infant feeding by parents in China and the multiple follow-up calls conducted, the EBF record form proved effective in providing more

accurate and consistent data. Despite the limitations, this study (1) is the first model test addressing Chinese mothers' EBF duration with a 6-month postpartum follow-up; (2) quantifies the impact of psychosocial factors, such as BF intention and PIM, on EBF in China; (3) collects data from various hospital levels, allowing findings to be generalized across populations with different healthcare services.

Conclusions and Implications

The status of EBF for 6 months in China was suboptimal. Direct positive effects on EBF were observed for BF intention, maternity leave, and perceived control. Higher scores in subjective norm, perceived control, and PIM indirectly predicted longer EBF through strengthened BF intention. Increased BF knowledge, mediated by better BF attitude, subjective norm, perceived control, and PIM, also predicted longer EBF.

Addressing these challenges is essential for aligning with WHO's EBF recommendations. Nursing managers should help nurses update their knowledge on EBF determinants and organize practical sessions for applying relevant instruments in clinical settings.This will enable nurses to identify mothers at risk of early EBF cessation and take proactive measures to prevent premature discontinuation of EBF.

Employers bear significant responsibility in supporting BF mothers. They should provide dedicated pumping rooms and paid lactation breaks, which not only enable mothers to continue BF but also improve EBF rates. The implementation of such policies would emphasize society's role in creating an environment that supports BF mothers.

Government policies should ensure comprehensive maternity leave and workplace support for BF mothers. Additionally, strengthening public health campaigns and enforcing stricter regulations are essential for overcoming socio-cultural and economic barriers, thereby facilitating the broader adoption of EBF. These measures are expected to not only extend the duration of EBF but also improve overall maternal and infant health outcomes.

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Declarations

Conflicts of interest The authors declare no potential conflicts.

Ethical Approval Ethical approval was obtained from the Institutional Review Board of X University and X Hospital. For the other 2 participating hospitals that did not maintain independent ethics committees due to their smaller size, official administrative authorization for data collection was obtained from the hospital authorities. Mothers were informed about the purpose, methods, and data collection procedures of this study, as well as their right to withdraw at any time. Each mother signed an informed consent form before participating in this study.

Informed Consent All participants signed informed consent forms before taking part in the study.

References

Abou-ElWafa, H. S., & El-Gilany, A.-H. (2019). Maternal work and exclusive breastfeeding in Mansoura, Egypt. *Family Practice, 36*(5), 568–572. https://doi.org/10.1093/fampra/cmy120

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Al-Barwani, S. (2017). Employing the Theory of Planned Behavior to Predict Breastfeeding Intention and Intensity in Oman [Master's thesis, University of North Carolina at Chapel Hill Graduate School]. Carolina Digital Repository. https://cdr.lib.unc.edu/concern/dissertations/xw42n 850j.

Alfianrisa, A., Salimo, H., & Poncorini, E. (2017). Factors associated with exclusive breastfeeeding: application of PRECEDE-PROCEED model and theory of planned behavior. *Journal of Maternal and Child Health, 2*(1), 42–53. https://doi.org/10.26911/thejmch.2017.02.01.05

Chen, L., Zhang, L., Xu, Q., Dong, J., Liu, L. X., Chen, M., . . . Qian, J. (2020). The Rate and Influencing Factors of Exclusive Breastfeeding for the First 6 Months in Nanjing, China. https://doi.org/10.21203/rs.3.rs-50603/v1.

De Roza, J. G., Fong, M. K., Ang, B. L., Sadon, R. B., Koh, E. Y. L., & Teo, S. S. H. (2019). Exclusive breastfeeding, breastfeeding self-efficacy and perception of milk supply among mothers in Singapore: A longitudinal study. *Midwifery, 79*, 102532.

Demirci, J., Caplan, E., Murray, N., & Cohen, S. (2018). "I just want to do everything right:" Primiparous women's accounts of early breastfeeding via an app-based diary. *Journal of Pediatric Health Care, 32*(2), 163–172.

Duxbury, S. W. (2021). Diagnosing multicollinearity in exponential random graph models. *Sociological Methods & Research, 50*(2), 491–530.

Esquerra-Zwiers, A., Goris, E. D., & Franzen, A. (2022). Explaining variance in breastfeeding intentions and behaviors among a cohort of Midwest mothers using a theory of planned behavior-based structural model. *BMC Pregnancy and Childbirth, 22*(1), 1–10. https://doi.org/10.1186/s12884-022-04628-9

Hair, J. F. (2009). Multivariate data analysis. Kennesaw State University. Retrieved from https://digitalcommons.kennesaw.edu/facpubs/2925/.

Hamze, L., Carrick-Sen, D., Zhang, Z., Liu, Y., & Mao, J. (2018). Maternal attitude towards breastfeeding: A concept analysis. *British Journal of Midwifery, 26*(7), 462–469. https://doi.org/10.12968/bjom.2018.26.7.462

Han, F. L., Ho, Y. J., & McGrath, J. M. (2023). The influence of breastfeeding attitudes on breastfeeding behavior of postpartum women and their spouses. *Heliyon*. https://doi.org/10.1016/j.heliyon.2023.e13987

He, J. X. (2018). Application of health education based on transtheoretical model and stages of change in breastfeeding for primiparas [Master's thesis, Shanxi Medical University]. Retrieved from https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C475KOm_zrgu4lQARvep2SAkZIGkvqfmUZglMdu7fCR482i9MwELdHazjdy-OeCPaKY6AFSqw4u2PZmzMRrn9Z1&uniplatform=NZKPT.

Huang, Y., Liu, Y., Yu, X. Y., & Zeng, T. Y. (2022). The rates and factors of perceived insufficient milk supply: A systematic review. *Maternal & Child Nutrition, 18*(1), e13255. https://doi.org/10.1111/mcn.13255

Janke, J. R. (1994). Development of the breast-feeding attrition prediction tool. *Nursing Research, 43*(2), 100–104. https://doi.org/10.1097/00006199-199403000-00008

Jordan, S., Cushing-Haugen, K., Wicklund, K., Doherty, J., & Rossing, M. (2012). Breast-feeding and risk of epithelial ovarian cancer. *Cancer Causes & Control, 23*, 919–927. https://doi.org/10.1007/s10552-012-9963-4

Khan, M. N., & Islam, M. M. (2017). Effect of exclusive breastfeeding on selected adverse health and nutritional outcomes: A nationally representative study. *BMC Public Health, 17*(1), 889–895. https://doi.org/10.1186/s12889-017-4913-4

Kramer, M. S., & Kakuma, R. (2012). Optimal duration of exclusive breastfeeding. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.CD003517.pub2

McCarter-Spaulding, D. E., & Kearney, M. H. (2001). Parenting self-efficacy and perception of insufficient breast milk. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 30*(5), 515–522. https://doi.org/10.1111/j.1552-6909.2001.tb01571.x

Mitchell-Box, K., Braun, K. L., Hurwitz, E. L., & Hayes, D. K. (2013). Breastfeeding attitudes: Association between maternal and male partner attitudes and breastfeeding intent. *Breastfeeding Medicine, 8*(4), 368–373.

Mowbray, F. I., Fox-Wasylyshyn, S. M., & El-Masri, M. M. (2019). Univariate outliers: A conceptual overview for the nurse researcher. *Canadian Journal of Nursing Research, 51*(1), 31–37.

Nommsen-Rivers, L. A., & Dewey, K. G. (2009). Development and validation of the infant feeding intentions scale. *Maternal and Child Health Journal, 13*(3), 334–342. https://doi.org/10.1007/s10995-008-0356-y

Phukan, D., Ranjan, M., & Dwivedi, L. (2018). Impact of timing of breastfeeding initiation on neonatal mortality in India. *International Breastfeeding Journal, 13*(1), 27–36. https://doi.org/10.1186/s13006-018-0162-0

Ritta, W., Tachasuksri, T., & Suppasri, P. (2020). Factors Predicting Exclusive Breastfeeding Intention for 6 Months among Working Mothers in the Industry. The Journal of Faculty of Nursing Burapha University, 28(3), 66–78. Retrieved from https://he02.tci-thaijo.org/index.php/ Nubuu/article/ view/246075.

Schwarz, E. B., Brown, J. S., Creasman, J. M., Stuebe, A., McClure, C. K., Van Den Eeden, S. K., & Thom, D. (2010). Lactation and maternal risk of type 2 diabetes: a population-based study. *The American Journal of Medicine, 123*(9), 863.e861.

Scoccianti, C., Key, T. J., Anderson, A. S., Armaroli, P., Berrino, F., Cecchini, M., & Powers, H. (2015). European code against cancer 4th edition: breastfeeding and cancer. *Cancer Epidemiology, 39*, S101–S106. https://doi.org/10.1016/j.canep.2014.12.007

Senaviratna, N., & Cooray, T. (2019). Diagnosing multicollinearity of logistic regression model. *Asian Journal of Probability and Statistics, 5*(2), 1–9.

Senthilnathan, S. (2019). Usefulness of correlation analysis. Available at SSRN 3416918.

State Council of the People's Republic of China. (2023). Statistical Monitoring Report on the Outline for the Development of Chinese Women (2021–2030). https://www.stats.gov.cn/xxgk/sjfb/zxfb2020/202501/t20250124_1958439.html.

Sulaeman, E. S., Murti, B., Setyawan, H., & Rinawati, S. (2018). Exclusive breastfeeding behavior model in rural Central Java, Indonesia: The application of theory of planned behavior. *Global Journal of Health Science, 10*(10), 35–49. https://doi.org/10.5539/gjhs.v10n10p35

Titaley, C. R., Dibley, M. J., Ariawan, I., & Mu'asyaroh, A., Alam, A., Damayanti, R., Li, M. (2021). Determinants of low breastfeeding self-efficacy amongst mothers of children aged less than six months: results from the BADUTA study in East Java, Indonesia. *International Breastfeeding Journal, 16*(1), 12–26. https://doi.org/10.1186/s13006-021-00357-5

Tongun, J. B., Tumwine, J. K., Ndeezi, G., Sebit, M. B., Mukunya, D., Nankunda, J., & Tylleskar, T. (2019). The effect of health worker training on early initiation of breastfeeding in south Sudan: A hospital-based before and after study. *International Journal of Environmental Research and Public Health, 16*(20), 3917–3925. https://doi.org/10.3390/ijerph16203917

UNICEF. (2019). Why family-friendly policies are critical to increasing breastfeeding rates worldwide. Press Release. New York, 1. Retrieved from https://www.unicef.org/press-releases/ why-family-friendly-policies-are-critical-increasing-breastfeeding-rates-worldwide.

UWAMARIYA, M. C. (2021). Practice and barriers of breast milk expression among health care mothers of infants less than 6 months at CHUK, Rwanda. a qualitative study. [Doctoral dissertation, UR-College of Medicine and Health Sciences].http://dr.ur.ac.rw/handle/123456789/1726.

Wang, Y. (2017). Feeding practice and related factors in infants during 0~6 months in Wuhan [Master's thesis, Huazhong University of Science and Technology]. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C475KOm_zrgu4lQARvep2SAkWfZcByc-RON98J6vxPv10Wucn0fj 6qF_0aopPuq1q6XHCi5LXJ9tracd53YF3de&uniplatform=NZKPT.

WHO. (2001). Report of the expert consultation of the optimal duration of exclusive breastfeeding, Geneva, Switzerland, 28–30 March 2001.Retrieved from https://apps.who.int/iris/ bitstream/handle/ 10665/ 67219/WHO_NHD_01. 09. pdf.

Wu, Q., Tang, N., & Wacharasin, C. (2022). Factors influencing exclusive breastfeeding for 6 months postpartum: A systematic review. *International Journal of Nursing Knowledge, 33*(4), 290–303. https://doi.org/10.1111/2047-3095.12360

Wu, Y. H., Ho, Y. J., Han, J. P., & Chen, S. Y. (2018). The influence of breastfeeding self-efficacy and breastfeeding intention on breastfeeding behavior in postpartum women. *The Journal of Nursing, 65*(1), 42–50. https://doi.org/10.6224/jn.201802_65(1).07

Zhang, X., Wu, D., Zhang, X., Yang, X., Gao, J., & Chen, S. (2020). Progress in researches on assessment of breastfeeding support in the workplace and related tools. Chin J Public Health, 36(7), 1090–1093.Retrieved from https://kns.cnki. net/kns8/AdvSearch?Dbprefix=CFLS&&crossDbcodes=CJFQ%2CCDMD%2CCIPD%2CCCND%2CCISD%2CSNAD%2CBDZK%2CCCJD%2CCCVD%2CCJFN.

Zhang, Y., Wang, H., Wang, Y., & Tang, K. (2020b). Breastfeeding practices of ethnic minorities in China: A population-based cross-sectional study of 10,408 mothers. *Journal of Immigrant and Minority Health, 22*, 545–553. https://doi.org/10.1007/s10903-019-00918-1

Zhang, Y., Yang, J., Li, W., Wang, N., Ye, Y., Yan, S., & Zhang, F. (2020). Effects of baby-friendly practices on breastfeeding duration in China: a case-control study. *International Breastfeeding Journal, 15*(1), 92–101. https://doi.org/10.1186/s13006-020-00334-4

Zhao, M. (2008). Factors associated with breastfeeding self-efficacy among Beijing new mothers [Master's thesis, Chinese Academy of Medical Science and Peking Union Medical College]. https://kns.cnki.net/kns8/AdvSearch?dbprefix= CFLS&&crossDbcodes=CJFQ%2CCDMD%2CCIPD%2CCCND%2CCISD%2CSNAD%2CBDZK%2CCCJD%2CCCVD%2CCJFN.

Zhu, Y., Zhang, Z., Ling, Y., & Wan, H. (2017). Impact of intervention on breastfeeding outcomes and determinants based on

theory of planned behavior. *Women and Birth, 30*(2), 146–152. https://doi.org/10.1016/j.wombi.2016.09.01

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