



Factors associated with feeding behaviors among mothers of obese infants: a cross-sectional study

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Background: Infant obesity is a risk factor for diseases in childhood and even in adulthood. Maternal feeding behaviors are strongly associated with infant obesity, hence factors relevant to mother's perception, socioeconomic status, and social support that influence the feeding behaviors need to be explored. Therefore, this study aimed to examine associated factors of feeding behaviors among mothers with obese infants.

Methods: This cross-sectional study was conducted at the pediatric wards of a tertiary hospital in Wenzhou, Zhejiang Province, China. Participants (n=134) were mothers of infant with obesity aged 6–12 months. Data were collected by structured questionnaires. Maternal feeding characteristics and the relationship between mothers' age, monthly personal income, parental self-efficacy, social support, benefits of maternal feeding behaviors, barriers to maternal feeding behaviors and feeding behaviors were examined. The Data was analyzed by descriptive statistics and multiple regression analysis.

Results: Most of the infants (84.3%) was in the 98th–100th percentile. Nearly half of the mothers were 30–39 years old and unemployed (46.3%). One-third (61.40%) were multiparous mothers and 73.1% cared for their infants for more than 6 hours per day. Monthly personal income, parenting self-efficacy and social support together explained 28% of variance on feeding behaviors ($P<0.05$). Parenting self-efficacy ($\beta=0.309$, $P<0.05$) and social support ($\beta=0.224$, $P<0.05$) had significantly positive influence on feeding behaviors. Maternal personal income ($\beta=-0.196$, $P<0.05$) had a significantly negative influence on feeding behaviors among mothers having infants with obesity.

Conclusions: Nursing interventions should be focused on enhancing parenting self-efficacy and promoting social support for the feeding behaviors of mothers.

Keywords: Infants with obesity; mothers; feeding behaviors; parenting self-efficacy; perceived benefits and barriers

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Introduction

Childhood obesity has become a global public health problem. In 2015, 107.7 million children worldwide were obese, with an overall prevalence rate of 5.5 percent (1). In 2018, the combined prevalence of overweight and obese children under 5 years was 8.3% worldwide (2). Numerous studies have shown that the risk of later obesity has been identified in early infancy (3,4). Rapid weight gain in infancy is one of the most significant risk factors for obesity in later childhood (5). Infanthood is also a critical period for reducing the risk of obesity (6). Childhood obesity is the result of an interaction of genetic and environmental factors, in which the way of food supplementation after 6 months, family eating habits, and socioeconomic conditions play key roles (7). Infant obesity could also be related to the timing of feeding. Children who were introduced complimentary feeding before 4 months of age were likely to be obese (8). However, in breastfed infants the timing was not associated with obesity (9). Regarding the types of feeding sugar sweetened beverages (10), fruit juice intake (11) and low intake of fruits and vegetables influenced the infant weight (12). However, no association was found between the meat intake, fat foods, and cereal consumption with infant obesity (12). The family

environment including parents' weight status, socioeconomic status and physical activity lead to childhood obesity (13). Parental influence plays a vital role in a child's weight status. A study found that authoritarian, neglectful, and permissive parenting styles were associated with the child's higher BMI (14). It has clinical implication about feeding practice. Research in recent years has found that early changes in microbiome composition were associated with obesity (15). The gut microbiome created through breastfeeding may prevent infants from becoming overweight, the microbiome of formula feeding may partly explain the risk of overweight infants (16). In 2021, Chinese research found that the use of antibiotics during pregnancy and first year of life may cause obesity in childhood (17,18). In addition, the feeding practices vary between the primiparous and multiparous mothers. A study found that only fewer primiparas exclusively breastfed their infants and mostly fed the babies with mixed bottle feeding than the multipara mothers (19). Furthermore, primiparas experienced more feeding problems and lower breastfeeding self-efficacy (20). A study from Mexico also confirmed that children are more likely to develop diseases characterized by excess weight after six months (2). Eating stress or food restrictions may adversely affect infants' responses to intrinsic cues such as hunger and satiety, impairing their ability to self-regulate food consumption and putting them at risk of becoming overweight (21).

A previous study found that maternal controlling behavior was associated with infants' energy intake and higher body mass index (22). The mothers' controlling feeding style, which ignored the behaviors suggestive of the baby's satiety (22,23) resulted in excessive feeding, which reduced the child's ability to self-regulate energy intake (24). In Australia, 75% of mothers self-reported cajoling or pressuring their children to eat more, and more mothers were concerned about their child being underweight (22%) than being overweight (9%) (25). These behaviors increase the risk of obesity in infants (26), causing babies to become desensitized to internal signals of satiety and to start using external signals (the smell of preferred food or emotions) as signals of hunger or satiety (27). In China, the older generation's beliefs can affect the child's mother (28), with many young mothers also believing that an obese infant is a healthy infant. As a result, the incidence of simple childhood obesity has gradually increased (29).

Many factors related to maternal feeding behaviors. Previous studies revealed that young mothers lacked experience and information about feeding and got feeding information from their mothers (30), which lead to

Highlight box

Key findings

- Parenting self-efficacy and social support had a significant positively predicted feeding behavior.
- Maternal personal income had significantly negatively influence on feeding behaviors.
- Perceived benefits of maternal feeding behaviors and Perceived barriers to maternal feeding behaviors had no influence on feeding behaviors.

What is known and what is new?

What is known?

- Infant obesity is a risk factor for diseases in childhood and adulthood. Maternal feeding behaviors are strongly associated with infant obesity.

What is known and what is new?

- Parenting self-efficacy and social support had a significant positively predicted feeding behavior, but maternal personal income had significantly negatively influence on feeding behaviors.

What is the implication, and what should change now?

- mHealth application could be initiated as a mobile public health intervention where mothers could easily access and learn to practice appropriate feeding/parenting behaviors.

inappropriate feeding behavior (31). The caregivers with superior economic conditions can invest more manpower and material and enjoy better social resources, their feeding behavior is better (32). Parenting self-efficacy has been shown to affect parents' emotions, motivation, cognition, and responses to infant behavior, and may play a role in the infant feeding practices that parents choose (33). Good social support provided, such as companionship and housework sharing, can increase mothers' feeding confidence and self-efficacy, and lead to better feeding behaviors (34). In addition, parental self-efficacy is associated with baby's growth due to several reasons: if parents have high self-efficacy they will be able to effectively transit to parenthood with better decision-making skills and good psychological adaptation (35,36). In addition, parents adhere to healthy food practices, adaptive parenting behaviors, and positive feeding style that prevent infant obesity (37).

The framework for this study was based on the Pender Health Promotion Model (HPM) (38) and previous research evidence. HPM proposes three constructs: individual characteristics and experiences, behavior-specific cognitions and affect, and health-promoting behaviors. In this study, six possible predictors of feeding behaviors were identified, two of these, mother's age and maternal personal income were taken from the individual characteristics, four of these, perceived barriers to maternal feeding behaviors, perceived benefits of maternal feeding behaviors, self-efficacy, and social support were taken from the behavior-specific cognitions and affect.

In addition to government support, food regulations on food storage and restaurants could be improved. Through traditional mass media, mothers could be educated about the social norms and culture regarding healthy weight (39). A healthy lifestyle campaign or Healthy and Active Parenting Programme for Early Years (HAPPY) intervention programs could be conducted (40). Moreover, periodic health education could be provided in primary health care settings.

Most related studies have focused on toddlers and preschool children. Studies on maternal feeding behaviors of obese infants in China were scarce even the infancy period is very significant for obesity. This study aimed to investigate associated factors on the feeding behaviors among mothers with obese infants. The findings may provide information to evolve intervention for promoting maternal feeding behaviors and contribute to reduce infant obesity in China. We present this article in accordance with the STROBE reporting checklist (available at [https://](https://tp.amegroups.com/article/view/10.21037/tp-23-185/rc)

tp.amegroups.com/article/view/10.21037/tp-23-185/rc).

Methods

Research design and research setting

A cross-sectional, correlational predictive study was conducted in the Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University. This setting was chosen due to two reasons: firstly, it is one of the biggest public tertiary hospitals and a comprehensive clinical pediatric care institute in the Zhejiang Province. Secondly, this hospital provides health care services exclusively to mothers and children compared to the other regional hospitals that are general hospitals and specialize in cosmetic care, and traditional Chinese medicine.

Participants

Participants were mothers of obese infants receiving health services at the Pediatric Department of the 2nd Affiliated Hospital and Yuying Children's Hospital of WMU. The inclusion criteria were as follows: (I) mothers aged ≥ 18 years; (II) having an infant with obesity (with a weight-to-height ratio $\geq 95^{\text{th}}$ percentile), infants aged 6–12 months with no other chronic health conditions; (III) mothers could communicate, read, and write in Chinese.

The sample size of this study was estimated by using the sample-to-variable ratio, which suggests a minimum observation-to-variable ratio of 5:1, but ratios of 20:1 are preferred. This study consists of six independent variables. This study used simple random sampling to recruit 134 participants. Each day, 8–10 mothers of obese infants who were newly admitted to the pediatric wards were numbered, and at least 5 or 6 mothers were randomly selected from them after the numbers were placed in envelopes.

Research instruments

The infants' demographic data included age, sex, weight, and medical history. The general information of the mothers included age, education level, occupation, residence, economic status, number of children, and health status.

The Perceived Benefits of Maternal Feeding Behaviors Questionnaire (BeFBQ) was used to measure the perceived benefits of feeding behaviors (41). It is 9 items on a 5-point Likert scale from 1 to 5 (strongly disagree to strongly agree). The total score ranges from 9 to 45, which higher

scores indicating higher perceived benefits of maternal feeding behaviors. The scale-level content validity index score (S-CVI) for the BeFBQ was 1.00, and the item-level (I-CVI) score was 0.92.

The Perceived Barriers to Maternal Feeding Behaviors Questionnaire (BaFBQ) was used to measure perceived barriers to feeding behaviors (41). It is 9 items on a 5-point Likert scale from 1 to 5 (strongly disagree to strongly agree). The total score ranges from 11 to 55, which higher scores indicating perceived more barriers to feeding behaviors. The S-CVI score was 1.00 for the BaFBQ, and the I-CVI score was 0.85.

The parenting self-efficacy (PSE) questionnaire was used to measure maternal self-efficacy (42). It contains 48 items with an 11-level response, where 0 represents complete disagreement, and 10 represents complete agreement. It is divided into eight dimensions: emotion, play, empathy, control, self-discipline/rule-making, pressure, self-acceptance, and learning self-efficacy. The higher the score and total score of each dimension, the higher the self-efficacy and overall efficacy of the parent in this dimension. The Cronbach's α of each dimension of PSE was 0.80–0.89, the Cronbach's α of the total table was 0.94, and the retest reliability was 0.58–0.88 (43). The Chinese version of PSE's Cronbach's α of each dimension was 0.59–0.87, the Cronbach's α of the total table was 0.91, and the retest reliability was 0.51–0.71 (44).

The Social Support Rating Scale (SSRS) was used to measure social support (45). It contains 14 items on a 4-point Likert scale and is divided into three dimensions: subjective support, objective support, and utilization of support. The possible total score ranges from 12 to 60, where higher scores show a higher level of social support. The Cronbach's α was 0.833. The scale scoring method is as follows: for items 1–4 and 8–10, only one choice is selected for each item, and items 1, 2, 3, and 4 are scored as 1, 2, 3, and 4 points, respectively; for item 5, A, B, C, D, and E are given a total score, and 1–4 points are given for each item from none to full support; items 6 and 7 are scored 0 if the answer is “without any source” or if the answer is “the following sources”, 1 point is given for each source. Four scores are derived from the scale: total score = the sum of 14 items; objective support score = the sum of items 2, 6, and 7; subjective support score = the sum of items 1, 3, 4, and 5; utilization of support: the sum of items 8, 9, and 10.

The Parental Feeding Behaviors Questionnaire (PFBQ) was used to measure feeding behaviors (46). It was modified for maternal feeding behaviors in regard to infants and

translated into Chinese. It contains 38 items on a 5-point Likert scale, ranging from 1 (never) to 5 (always). It is divided into three dimensions: providing healthy food, enhancing toddlers' eating behaviors, and providing a pleasant eating environment. The possible total score ranges from 38 to 190. The higher the score, the more appropriate the parent's feeding behaviors. The I-CVI score of the PFBQ was 0.83–1.00, and the S-CVI was 0.98. Most of the items had acceptable inter-item correlation values (>0.30). The value of Cronbach's α was 0.94.

Ethical statement

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This research is a part of the study at Burapha University. It was approved by the Institutional Review Board (IRB) of Burapha University (No. MHESI 8137/1235) and the Second Affiliated Hospital and Yuying Children's Hospital of WMU (No. 2021-K-64-02). The requirement for informed consent guarantees respect for the principle of bioethical autonomy. Voluntary consent was obtained from all participants before participating in the research process. The confidentiality and privacy of the data obtained were guaranteed, and participants were given the opportunity, either verbally or in writing, to refuse to participate in the study or to leave the study at any time. The respondents' information was kept confidential at all times.

Data collection

The mothers of the infants were recruited at the inpatient ward of the Children's Hospital of the Second Affiliated Hospital of WMU. The researchers explained the purpose of the study to mothers of obese infants and invited them to participate. Considering the coronavirus situation in 2019 (COVID-19), the researchers and participants were required to wear masks at all times. Mothers were required to undergo temperature screening and show a health QR code (an official way to declare residents' health status) daily. Patients who displayed a green code and temperature below 37.3 °C were allowed entry into the inpatient department. All participants guaranteed the truthfulness of their responses and were required to read and sign the corresponding questionnaires. The researcher instructed the participants in filling out the questionnaires and the matters needing attention to avoid survey bias. The questionnaires were filled out by the mothers themselves. After completing

Table 1 Infant demographic characteristics (n=134)

Infant characteristics	Value
Age, months	8.57±1.66; [6–12]
6–9 months	91 (67.90)
10–12 months	43 (33.10)
Gender	
Male	32 (23.90)
Female	102 (76.10)
Weight/height	99.21±1.17; [95–100]
95–97 th percentile	21 (15.70)
98–100 th percentile	113 (84.30)
Birth order ranking	
1 st	53 (39.60)
2 nd	67 (50.00)
3 rd	14 (10.40)
Past medical history	
No	112 (83.58)
Yes	22 (16.42)
Type of disease	
Pneumonia	66 (49.30)
Gastroenteritis	42 (31.30)
Urinary infection	20 (14.90)
Others	6 (4.50)

Data are presented as n (%) or mean ± standard deviation; [min–max].

the questionnaires, participants were reminded to take any belongings away. Any public items, including pens, were disinfected with alcohol swabs after use.

The researcher checked if the questionnaires had been completed after the participants submitted them. Out of the 134 mothers recruited for the study, six dropped out. Two mothers said there were too many questions and it took too long to fill out the questionnaires. A further four mothers did not think their infants were obese, so they refused to fill in the questionnaire.

Statistical analysis

A total of 140 questionnaires were issued, excluding data to fill in write questionnaires with 4.3% attrition rate, and

collected them effectively 134 with effective response-rate of 95.7%. SPSS software 18 was used for the statistical analysis. A significance level of 0.05 was set for the correlation and multivariate analyses. The data analysis was conducted after double-checking the data entry. Descriptive statistics were used to analyze the demographic characteristics of the participants, and tests for the normal distribution of each variable were performed. Pearson's correlational analysis was conducted, regression residuals, procentile-procentile (P-P) plots, and scatter plots were used to demonstrate that the data were normally distributed, followed by a multiple regression analysis to predict the relationship between the independent and dependent variables.

Results

Infant demographic characteristics

Table 1 shows that more than half of the infants were 6–9 months old (67.9%), and the majority were female (76.1%). The weight/height ratio of most of the infants was at the 98th–100th percentile (84.3%). More infants were second children (50.0%) than first children (39.6%). Almost all infants had no past medical history (83.58%), with the majority diagnosed with pneumonia (49.3%).

Maternal demographic characteristics

Table 2 indicates that most mothers were 30–39 years old (49.3%), and the majority were married (99.3%). Most of the participants were multiparous mothers (61.40%).

Almost half had completed college-level education or higher (41.1%). The majority of participants earned a monthly personal income less than 3,000 RMB (37.3%), and almost half were unemployed (46.3%), 50% the fathers of infants were the main source of household income. The majority reported good family relationships (93%), and 73.1% cared for their infants for more than 6 hours per day. None of the mothers had a family history of psychiatric problems.

Maternal feeding behaviors

As presented in Table 3, the overall score of feeding behaviors ranged from 83 to 178, and the mean score was 145.19 (SD =21.78). Providing healthy food had the highest mean score of 64.54 (SD =9.81), and enhancing toddlers' eating behavior had a mean score of 61.5 (SD =10.25). Providing a pleasant eating environment had the lowest

Table 2 Maternal demographic characteristics (n=134)

Maternal characteristics	Value
Age, years	30.03±4.81; [19–42]
19–29 years	61 (45.50)
30–39 years	66 (49.30)
40–45 years	7 (5.20)
Marital status	
Single	1 (0.70)
Married	133 (99.30)
Pregnancy	
Primipara	53 (39.60)
Multiparous	81 (61.40)
Education	
Primary school	13 (9.70)
Secondary school	31 (23.10)
High school	35 (26.10)
College and higher	55 (41.10)
Current employment situation	
No employment	62 (46.30)
Part-time employment	13 (9.70)
Full-time employment	59 (44.00)
Monthly income	
<3,000 RMB	50 (37.30)
3,001–5,000 RMB	22 (16.40)
5,001–8,000 RMB	22 (16.40)
8,001–10,000 RMB	19 (14.20)
>10,000 RMB	21 (15.70)
Main source of household income	
Father	67 (50.0)
Mother	2 (1.50)
Joint income	65 (48.50)

Data are presented as n (%) or mean ± standard deviation; [min–max].

mean score of 19.15 (SD =3.82).

Description of maternal factors, including PSE, perceived benefits of maternal feeding behaviors, perceived barriers to maternal feeding behaviors, and social support

Table 4 illustrates that PSE scores ranged from 206 to 440, with a mean of 356.04 (SD =48.77). Perceived benefits of maternal feeding behaviors (BeFB) ranged from 31 to 45, with a mean score of 40.71 (SD =4.19). Perceived barriers to maternal feeding behaviors (BaFB) ranged from 10 to 44, with a mean score of 24.10 (SD =6.71). The social support (SSRS) scores ranged from 28 to 52, with a mean score of 39.93 (SD =5.78), indicating high social support.

Relationship between factors and feeding behaviors among mothers with obese infants

Pearson's correlation was performed to explore the relationship between mothers' age, monthly income, PSE, BeFB, BaFB, SSRS, and feeding behaviors (PFBQ). Table 5 illustrates the correlation among the variables studied.

Factors influencing feeding behaviors of mothers with obese infants

The study used a multivariate regression approach to examine the effect of mothers' age, monthly income, PSE, BeFB, BaFB, and SSRS on feeding behaviors. The variance inflation factors of the mothers' age (VIF =1.082), monthly income (VIF =1.076), PSE (VIF =1.495), BeFB (VIF =1.248), BaFB (VIF =1.038), and SSRS (VIF =1.189) were all around 1.500 without severe multicollinearity or outliers, and the homoscedasticity test was significant (P=0.00). The Durbin–Watson statistic was 1.619, which was in the acceptable range. The Std. Residual max was 2.395, meaning the residuals were uncorrelated.

As presented in Table 6, linear regression analysis showed that monthly personal income, PSE, and social support together explained 28% of the variance in feeding behaviors

Table 3 Range, means, and standard deviations of maternal feeding behaviors (n=134)

Variables	Range of scores		M	SD
	Possible core	Actual score		
Feeding behaviors	38–190	83–178	145.19	21.78
Providing healthy food	17–85	38–84	64.54	9.81
Enhancing toddlers' eating behavior	16–80	36–80	61.50	10.25
Providing a pleasant eating environment	5–25	9–25	19.15	3.82

M, mean; SD, standard deviation.

Table 4 Range, means, and standard deviations of PSE, BeFB, BaFB, and SSRS among the mothers (n=134)

Factors	Range of scores		M	SD
	Possible score	Actual score		
PSE	0–480	206–440	356.04	48.77
BeFB	9–45	31–45	40.71	4.19
BaFB	10–50	10–44	24.10	6.71
SSRS	14–64	28–52	39.93	5.78

PSE, parenting self-efficacy; BeFB, Benefits of Maternal Feeding Behaviors Questionnaire; BaFB, Barriers to Maternal Feeding Behaviors Questionnaire; SSRS, Social Support Rating Scale; M, mean; SD, standard deviation.

Table 5 The relationship between mothers' age, monthly personal income, PSE, BeFB, BaFB, SSRS, and feeding behaviors (n=134)

Variables	Age	Income	PSE	BeFB	BaFB	SSRS	PFBQ
Age	1.00	0.004	–0.094	0.047	–0.034	0.187*	0.156
Income		1.00	–0.217*	–0.075	–0.053	0.074	–0.254**
PSE			1.00	0.423**	–0.170	0.281**	0.437**
BeFB				1.00	–0.037	0.046	0.206**
BaFB					1.00	–0.115	–0.205*
SSRS						1.00	0.337**
PFBQ							1.00

*, $P < 0.05$; **, $P < 0.01$. PSE, parenting self-efficacy; BeFB, Benefits of Maternal Feeding Behaviors Questionnaire; BaFB, Barriers to Maternal Feeding Behaviors Questionnaire; SSRS, Social Support Rating Scale; PFBQ, Parental Feeding Behaviors Questionnaire.

Table 6 Predictive factors of feeding behaviors among mothers of obese infants (n=134)

Predictive variables	Unstandardized coefficients		Standardized coefficients		T	P value	VIF
	B	Std. error	β				
Age	–0.624	0.346	0.138		1.803	0.074	1.082
Income	–2.850	1.112	–0.196		–2.562	0.012	1.076
PSE	0.138	0.040	0.309		3.430	0.001	1.495
BeFB	0.205	0.427	0.039		0.480	0.632	1.248
BaFB	–0.358	0.243	–0.110		–1.471	0.144	1.038
SSRS	0.846	0.302	0.224		2.798	0.006	1.189

$R^2=0.312$, adjusted $R^2=0.280$, $F_{(6, 127)}=9.613$, P value < 0.001 , Constant =48.24. VIF, variance inflation factor; PSE, parenting self-efficacy; BeFB, Benefits of Maternal Feeding Behaviors Questionnaire; BaFB, Barriers to Maternal Feeding Behaviors Questionnaire; SSRS, Social Support Rating Scale.

[$F_{(6, 127)} = 9.613, P < 0.001$]. PSE ($\beta = 0.309, P < 0.05$) and social support ($\beta = 0.224, P < 0.05$) had significantly positive influences on feeding behaviors. The monthly personal income of mothers ($\beta = -0.196, P < 0.05$) had a significantly negative influence on feeding behaviors among mothers with obese infants. The perceived benefits of maternal feeding behaviors ($\beta = 0.039, P > 0.05$), perceived barriers to maternal feeding behaviors ($\beta = -0.110, P > 0.05$), and age of mothers ($\beta = 0.138, P > 0.05$) had no significant influence on feeding behaviors among mothers with obese infants.

Discussion

Feeding behaviors

The questionnaire in this study is based on the questionnaire of Lusmilasari (47), and was truncated and modified according to the feeding characteristics of infants in China. The general principle is that higher scores indicate better feeding behavior, the results showed that mothers' feeding behavior was at a high level. It may be because most of the participants were multiparous mothers, they already had some parenting experience. The results showed that 70–74% of mothers did not often attend hospitals or professional institutions for consultation on infant feeding unless it was for other illnesses, in which case they took the opportunity to ask the doctor about feeding. There have also been relevant studies on obese infants that indicate Chinese parents lack scientific knowledge about feeding and that training advocates for infant feeding is necessary (48,49).

Our results also showed that 26.9% of mothers did not control how much their infants ate, and 28% did not pay attention to whether their children showed satiety cues, instead expecting their infants to eat a fixed amount each time. These behaviors that do not respond to or listen to a child's hunger and satiety cues may increase the risk of infant weight gain (22). A study about feeding behavior of caregivers from Kunming Province, China, the results also showed that the risk of improper feeding was reflected in the caregiver's overemphasis on feeding (50). Many mothers worried about their infant's hunger and fed them regularly rather than according to their infant's hunger signals. Although there is no evidence in the literature that this behavior is detrimental to infants' self-regulating ability, it can increase their likelihood of obesity (51).

In the era of mobile phones, the most convenient way to receive information is through electronic media. Half of the mothers in our study were willing to learn how to

provide a good feeding environment for their infants from mobile phones and electronic media. A previous study had shown that familiar eating places and feeding utensils can reduce resistance to feeding and increase the chances of successful feeding (52). Fixed cutlery can help the caregiver understand the exact amount of food the child eats and help regulate and replenish the amount (52).

Factors influencing feeding behaviors of mothers with obese infants

Maternal personal income

In our study, maternal personal income was significantly correlated with feeding behavior and had a significant negative influence on feeding behaviors. This result contradicts previous research showing that family income and maternal feeding behavior were positively correlated and statistically significant (53). However, other studies have concluded that family income is not associated with feeding behavior, possibly because the income gap between participants in the study was small (54,55). The participants in our study also had similar economic levels and minor regional differences. More importantly, the vast majority of family income comes from joint income and the father of the infants, the mother's income did not represent the family income or affect the access to and quality of food for her children.

PSE

The results indicated that PSE was not only significantly and positively correlated with feeding behavior but was also a predictor of feeding behavior. This result is consistent with a previous study where maternal self-efficacy was positively correlated with feeding behavior and the frequency of offering food (56). It also suggests that self-efficacy may help mothers make decisions about feeding their infants, which are essential for establishing healthy eating habits and growth (56). An American study also found a significant correlation between maternal self-efficacy and infant feeding styles, including control of home food access ($r = 0.110, P < 0.01$) (30). Maternal self-efficacy can increase infant intake of healthy foods, especially vegetables ($r = 0.31, P < 0.005$), and interventions for mothers with higher self-efficacy can further improve their feeding behavior (57). Mothers with higher self-efficacy were more likely to follow professional recommendations regarding infant feeding behaviors (58). They are more aware of their child's eating patterns, the involvement and structural behavior in their

children's eating environment will increase (59). As children get older, they become more autonomous and develop a greater ability to communicate with their mothers about dietary choices (60).

Perceived benefits of maternal feeding behaviors

The results indicated that maternal perceived benefits of feeding behaviors were significantly and positively correlated with feeding behavior but were not a predictor of the feeding behavior of mothers with obese infants. Many studies have shown that perceived benefits play a significant role in promoting healthy behaviors. On the contrary, the lack of perceived behavioral benefits would be an obstacle to promoting healthy behaviors (61). In this study, maternal perceived benefits were significantly associated with, but could not predict, feeding behavior. A previous study showed that mothers' perceived benefits score was significantly correlated with feeding behavior ($r=0.542$, $P<0.01$) and was the best predictor of feeding behavior compared to other factors. When combined with other variables in the regression model, perceived benefits still had a significantly positive influence on feeding behavior ($\beta=0.366$, $P<0.01$) (41).

Social support

The results indicated that social support was significantly and positively associated with feeding behaviors and was also a predictor of feeding behaviors of mothers with obese infants. Social support is one of the most important functions of social networks, and social stratification reflects family life, differential family values, family tastes, and media (62). In a study of early feeding behavior, social support was also found to be a significant and positive influence on feeding behavior ($\beta=1.325$, $P<0.001$) (53). A study in Portugal showed that strong social support encourages mothers to do what they think is right and leads to better feeding behavior (63). Social support also plays an important role in exclusive breastfeeding, with support from partners, family, and peers leading to prolonged breastfeeding (64).

Mother's age

The results indicated that the mother's age had no significant relationship with, and was not predictive of, feeding behaviors in mothers with obese infants. This result differed from previous studies, especially for adolescent and adult mothers, in aspects of feeding experience and access to feeding information, which directly affects the development

of infants and can easily lead to malnutrition or obesity (65). Shiraishi *et al.* (66) found that the age of primipara mothers had a statistically significant impact on feeding behavior ($P<0.05$). However, the age of multiparous mothers had no significant effect on feeding behavior ($P=0.597$). In a survey of early breastfeeding, the authors also confirmed that socioeconomic variables, such as the mothers' age, did not predict feeding behavior ($P=0.820$) (53).

Perceived barriers to maternal feeding behaviors

The results indicated that perceived barriers had a significant negative correlation with, but did not predict, feeding behaviors of mothers with obese infants. This result is contrary to a previous study that found perceived barriers had a negative correlation to feeding behavior ($r=-2.13$, $P<0.05$) and also had a significant negative influence on feeding behaviors ($\beta=-0.155$, $P<0.05$) (41). The perceived barriers to feeding scores in our study were low, with most scores under 3 points. In other words, the problems described in the questionnaire were not perceived as barriers to the mothers in our study. The mothers made substantial efforts to provide the best food and feeding environments for their children.

Limitations

This study was limited to collecting information about the mother's personal income rather than the family's household income. Since, 46.10% mothers stayed at home for the first year after giving birth, and relied on their husbands for their financial support, using the mother's personal income as an indicator may affect the associations between socioeconomic status and feeding behaviors. Participants were mothers with obese infants who attended the Pediatric Department of the 2nd Affiliated Hospital and Yuying Children's Hospital of WMU. Most were from downtown Wenzhou or nearby, with similar economic status and minor regional differences. Future studies should recruit participants from wider geographical area to ensure a more representative sample. Finally, this study did not separately analyze the feeding behaviors of the primiparous and multiparous mothers, which might affect maternal feeding behaviors.

Conclusions

This study showed that PSE and social support positively predicted feeding behaviors, and monthly personal

income negatively predicted feeding behaviors. The feeding behavior of the mothers in this study was above average, but it was mainly reflected in improving a good eating environment for infants, and there was a relative lack of knowledge about correct feeding. This is due to China's current national conditions, where most of the professionals who can be consulted are in hospitals rather than communities. Therefore, this kind of consultation can only be received as part of medical treatment, and most parents would find this procedure too complicated to pursue. A community project is required in the future so that parents can consult locally rather than gather fragmented information about infant feeding on the internet, which often lacks a scientific basis. Mobile apps (mHealth application) could be initiated as a mobile public health intervention where mothers could easily access these applications and learn to practice appropriate feeding/parenting behaviors without going to the hospital setting. In addition, the online consultation platforms of major hospitals in China have also seen rapid development during the COVID-19 pandemic. Through the platform, parents can meet doctors face-to-face and solve problems in the fastest and most professional way. Infant obesity is a widespread problem, and it is essential that the beliefs and attitudes of parents and elders should be modified to reduce the incidence of infant obesity in China.

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Footnote

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://tp.amegroups.com/article/view/10.21037/tp-23-185/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the Institutional Review Board (IRB) of Burapha University (No. MHESI 8137/1235) and the Second Affiliated Hospital and Yuying Children's Hospital of WMU (No. 2021-K-64-02). Voluntary consent was obtained from all participants before participating in the research process.

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