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Feeding behavior in caregivers of 6- to 24-month-old infants and young children: a cross-sectional study from a district in a first-tier city in the southwestern region of China

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Abstract

Background This study aimed to identify the correlation between feeding behavior of caregivers and feeding outcome of 6–24 months old infants and young children in a first-tier city in the southwestern region of China. The influencing factors of feeding behavior were explored in this study.

Methods This cross-sectional study was conducted in 3 community health service centers in Chengdu, China from November 2017 to January 2018. A total of 725 infants and their caregivers participated in this study. Infant and young child feeding index (ICFI) was used to evaluate food preparation behavior. A questionnaire designed based on responsive feeding behavior (RFB) was used to evaluate the interaction behavior in the feeding process. The *Z*-score and the Montreal Children's Hospital Feeding Scale (MCH-FS) were used to evaluate the feeding outcomes.

Results The prevalence of short stature and feeding difficulties was 12.1% and 61.5%, respectively, among infants and young children. The RFB score negatively correlated with feeding difficulties but did not statistically significantly correlate with malnutrition rate. The RFB score was influenced by caregivers' relationship with the child and health belief, including self-efficiency, benefit perception, attention to searching information on websites, and attention to employing professional nurses. ICFI negatively correlated with the rate of underweight but did not statistically significantly correlate with feeding difficulties. ICFI was influenced by the caregivers' age, registered residence, and health belief, including obstacle perception and attention to reading a book on feeding.

Conclusions Searching the information regarding RFB on websites and making a feeding plan with the help of professional nurses may enhance caregivers' RFB. Convenient and attractive reading materials might help caregivers overcome obstacles and adopt better feeding behavior.

Keywords Complementary food, Feeding difficulty, Growth and development, Health beliefs, Infants and young children, Responsive feeding

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Background

The feeding behavior of the caregivers plays an essential role in the intake of appropriate and adequate nutrients among infants and young children, and further affects their growth and development, even the long-term health. The results of Fekadu, et al. [1], Pollitt, et al. [2] and Cui et al. [3] have shown that proper feeding behavior in the early life can improve infants and children's physical, intellectual and motor development. Studies by Pearce, et al. [4], Harding et al. [5] and Black et al. [6] have shown that early nutrition is related to the occurrence of chronic diseases such as obesity, cardiovascular disease and diabetes in adulthood. In addition, psychological development of infants and children is also affected by caregivers' feeding behavior. Carnell et al. [7] found that child appetites can be affected by feeding styles. Feeding difficulties are caused by improper feeding behavior, such as irritability, little interaction and little observation of whether infants and young children accept food. In contrast, the prevalence of feeding difficulties can be reduced by the proper feeding behavior, such as eye contact [8–10].

To improve the feeding behavior of caregivers, the influencing factors need to be explored. A study in the Bolivian Andes showed that mother's education and family economic status were associated with the infant and child feeding index (ICFI) [11]. A cross-sectional study of urban slums of Ahmedabad showed that significantly higher proportions of children with low ICFI scores had illiterate mothers, were older, and belonged to the lower socioeconomic strata [12].

Since the 1950s, the Health Belief Model (HBM) has been one of the most widely used conceptual frameworks in health behavior research, both to explain changes in health-related behaviors and as a guiding framework for interventions. Over the decades, the HBM has been expanded, compared, and contrasted to other frameworks and used to inform interventions to change health behavior [13]. This study was performed to identify the correlation between feeding behaviors and feeding outcomes and find the influencing factors. The goals of this study were to: (1) understand the current situation of feeding behavior of infants and feeding outcomes in the region; (2) explain the formation mechanism of feeding behavior and use the theoretical framework of HBM to explore and analyze the feeding behavior and influencing factors for caregivers of infants aged 6–24 months; and (3) analyze the correlation between feeding behavior of caregivers and feeding outcomes.

Methods

Ethics approval and consent to participate

The study was approved by the Medical Ethics Committee of West China Second University Hospital, Sichuan University [2019 Medical Scientific Research for Ethical Approval No. (081)]. Informed consent was obtained from all participants, and a parent and/or legal guardian of the minors for study participation. In the course of the investigation, the collection of information did not involve privacy issues such as name. In the process of writing a thesis, the names of the respondents were never involved, and all the survey results were only used for research.

Study setting

This cross-sectional study was performed in the child healthcare departments of 3 community health service centers in Chengdu, China. The caregivers of 6–24 months old infants and young children were recruited as the study subjects by using the convenience sampling method. After evaluating the physical situation for their child, the caregivers who voluntarily consented to participate in the study were recruited. Premature and infants born with congenital diseases (such as cleft lip, cleft palate, and intestinal malformations) and inherited metabolic diseases were excluded. Those who did not complete the investigation or whose missing information was more than 20% were excluded. Those whose children's age did not meet the inclusion criteria (6–24 months old) were also excluded. The following formula was used to calculate the sample size:

$$n = \left(\frac{Z_{\alpha/2}}{\delta}\right)^2 \cdot \pi(1-\pi)$$

$Z_{\alpha/2}$ is the standard two-tailed Z value of the normal α distribution, δ is the allowable error, and π is the overall rate.

Feeding difficulties were important outcome variables caused by feeding behavior. The overall rate was 21.4%, which was reported as the incidence of feeding difficulties in Chinese literature [14], and the allowable error was 3%. Based on this, the minimum effective sample size (718 people) was calculated. It is estimated that the data is missing, and the final sample size is calculated to be 750.

Study tools

The questionnaire designed based on previous studies included general information on infants and young children and their caregivers, feeding behavior and feeding

belief of caregivers, and feeding outcome. General information on infants and young children included the gender, date of birth, and gestational age at birth of the infant. General information on caregivers included personal characteristics and family structure characteristics, such as age, ethnicity, occupation, family type, key decision makers of baby feeding, annual household income, and parenting experience.

Evaluation of feeding outcomes

Physical development index and feeding difficulty scores were included in the evaluation of feeding outcomes of infants and young children. Considering the "physical measurement indexes of children in 9 cities of China" as a reference standard, the physical development of infants and young children was calculated and compared using the standard deviation score (*Z*-score). The following criteria were used to classify the physical development of the sample population: Height-for-age *Z*-scores (HAZ) < -2, short stature; HAZ ≥ 2, normal; Weight-for-age *Z*-scores (WAZ) < -2, underweight; WAZ ≥ 2, normal; Weight-for-height *Z*-scores (WHZ) < -2, wasting; $2 <$ WHZ < 3, overweight; WHZ ≥ 3, obesity. The frequency and prevalence of nutritional status were used as research indicators. The Montreal Children's Hospital Feeding Scale (MCH-FS) which was developed by Ramsay et al. [15] was used to evaluate feeding difficulties. The Chinese version of the MCH-FS which was translated and revised by Dai et al. [16] was used in this study. It consisted of 14 items, including 7 positive items and 7 reverse items, and adopted the Likert 7-level scoring method. The original score was converted into standardized scores, which were used to determine the severity of feeding difficulties: standardized score ≤ 50, no feeding difficulty; standardized score 51–60, mild feeding difficulty; standardized score 61–70, moderate feeding difficulty; and standardized score > 70, severe feeding difficulty [16]. The principal component variance contribution rate was 70.42%, the retest reliability was 0.87, and the split half reliability was 0.87. The frequency and prevalence of feeding difficulties were used as indicators of research.

Feeding behavior of caregivers

The feeding behavior of caregivers included food preparation behavior and interaction behavior in the feeding process. ICFI was used to evaluate the food preparation behavior. A large number of studies [17–20] showed that ICFI could be used to describe the feeding status of Chinese children aged 6–24 months. A questionnaire regarding the responsive feeding behavior (RFB) was designed by us based on the World Health Organization's Feeding Behavior Framework [21]. It contained 11 items and was used to evaluate the interaction behavior in the feeding process, such as identifying signs of hunger and satiety, responding to hunger and satiety signals, encouraging eating (Supplementary file 1). The 5-point Likert scale was used. The scores ranging from 1 to 5 were assigned to the 5 response options: never (0%), seldom (1–25%), sometimes (26–50%), often (51–75%), and always (76–100%). The definitions of options were verbally explained by the trained investigators during data collection. The full score is 55. The higher the scale score, the better RFB. Scale-level content validity index/average (SCVI/Ave) assessed by experts was 1.

Feeding health beliefs of caregivers

The health belief questionnaire (Supplementary file 2) was compiled by the researchers based on previous studies [13, 22] on HBM and health belief questionnaires applied in other fields [23–27], including perception to susceptibility (entries C1-C2), perception to seriousness (entries C3-C5), perception to benefit (entries C6-C8), perception to impairment (entries C9-C15), perception to self-efficacy (entries C16-C21), and cues to action (entries C22-C30). A panel of experts, including one health education expert, two child healthcare experts, and two pediatric nursing expert, were invited to evaluate the content validity of the self-designed part of the research tool. After the first round of expert evaluation, Scale-Content Validity Index/Average (SCVI/Ave) reached 0.97 for the health belief questionnaire. Based on the experts' feedback, revisions were made to the health belief questionnaire, including the deletion of five items with lower ratings and the addition of one item as suggested by the experts. Then, a second round of expert evaluation was conducted, resulting in an improved SCVI/Ave of 0.993 for the health belief questionnaire.

To further validate the questionnaire, a pilot study was conducted with 79 participants who answered "yes" to inclusion criteria but answered "no" to exclusion criteria of the official survey. Participants were asked to complete the questionnaire and provide feedback on the clarity, comprehensibility, and relevance of each item. Cognitive interviews were also conducted with a subset of participants to explore their understanding of the questions and response options. The Cronbach's α coefficient of 0.715 was calculated based on the pilot study sample, indicating acceptable internal consistency.

Data collection

Investigators were trained prior to the survey to ensure that they were familiar with the research objectives, content, and questionnaire collection steps and considerations. Qualified investigators were sent to the sampling sites to select subjects who met the inclusion criteria, explain the research purpose, and obtain informed

consent to issue the questionnaire on the spot. The questionnaire required about 8 min to fill in. The respondents could use the waiting time after vaccination (30 min) or wait for the childcare time (5–10 min) to complete the questionnaire. Any participant uncertainties were clarified by the present investigators. In the end, the questionnaire was collected and checked by the investigator on the spot. In case of any vacancies, they were filled in by the respondents in time. Epi Data 3.1 database software was used to enter data, increase the input range control, and jump item selection for each field before entry. One person entered the data independently and one person checked the comparison method. A logic check and missing value cleaning after the end of the entry were performed. In the case of any error, the original information was reviewed in time to be corrected. During data input, in the case of any missing vacancies, the respondents were immediately contacted to confirm the information; if the missing value of the questionnaire was ≥ 20%, it was removed according to the rejection criteria.

Statistical methods

SAS 9.2 and SPSS 21.0 were used for statistical analysis. Significance was set at $P < 0.05$. Frequency and percentage were used to describe the general information for infants and their caregivers. Following a test for normality, it was determined that the ICFI and Z scores obtained from the sample did not confirm to a normal distribution. Two continuous variables, MCH-FS and Z scores, were transformed into categorical variables for statistical description and analysis. The percentage of different kinds of malnutrition and the percentage of feeding difficulties were calculated. Data that followed a normal distribution was analyzed using the t-test, analysis of variance (ANOVA), and Pearson correlation analysis. Data that did not follow a normal distribution was analyzed using the rank sum test and the Spearman's rank correlation analysis. Significant variables were selected for inclusion in multiple regression analysis based on the criterion of $\alpha = 0.05$, and the factors associated with the ICFI and RFB were separately analyzed using the stepwise regression method.

Results

A total of 750 questionnaires were distributed to caregivers; 735 (98%) were recollected, 15 (2%) were not recollected because the caregivers did not complete the investigation; 725 (effective rate 98.63%) completed questionnaires were approved, 10 (1.37%) were excluded because the missing information was more than 20%. The baseline characteristics of the caregivers are summarized in Table 1.

Table 1 Personal characteristics and family status of caregivers

Variable	Number	Percentage (%)
Age (year)		
< 30	351	48.4
30–39	271	37.4
≥ 40	103	14.2
Sex		
Male	148	20.4
Female	577	79.6
Ethnic groups		
Han	687	94.8
Minorities	38	5.2
Education attainments		
High school or below	268	37.0
Junior college	196	27.0
Undergraduate or above	261	36.0
Income of the family (CNY/year)		
< 30,000	59	8.1
30,000–80,000	231	31.9
80,000–300,000	369	50.9
≥ 300,000	66	9.1
Relationship with baby		
Parents	639	88.1
Grandparents	84	11.6
Others	2	0.3
Family type		
Nuclear family	224	30.9
Main family	495	68.3
Single-parent family	6	0.8
Key decision maker of baby feeding		
Parents	615	84.8
Grandparents	105	14.5
Others	5	0.7
Registered residence		
Chengdu	417	57.5
Others	308	42.5
Total	725	100

The prevalence of malnutrition and feeding difficulties

Among the samples, the prevalence of short stature, underweight, wasting, overweight, and obesity was 12.1%, 3%, 2.5%, 4.4%, and 2.5%, respectively. According to the MCH-FS score, the prevalence of feeding difficulties was as high as 61.5%, among which, 31.9% were mild feeding difficulties, 25.9% were moderate feeding difficulties, and 3.7% were severe feeding difficulties.

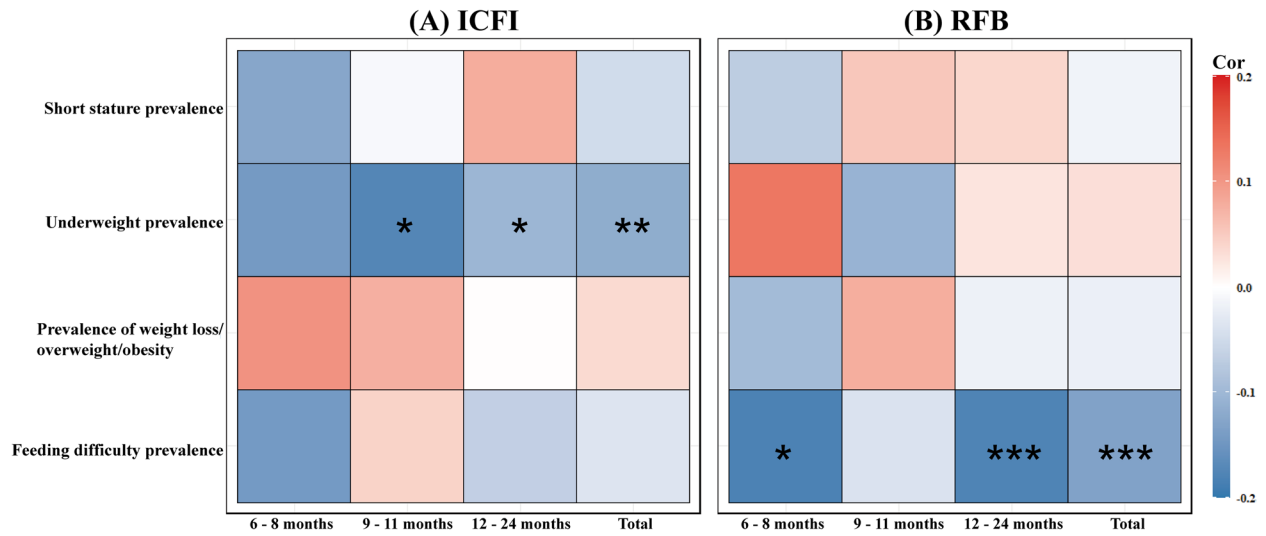

Fig. 1 Correlations between feeding behaviors and feeding outcomes

Table 2 Multiple regression analysis of factors associated with ICFI

	β	Se	*B*	*t*	*P*
Constant	8.333	1.177	-	7.078	< 0.001
Obstacle perception	-0.077	0.028	-0.101	-2.758	0.006
Attention to reading a book	0.771	0.22	0.128	3.5	< 0.001
Age of caregivers	0.578	0.194	0.109	2.972	0.003
Registered residence	0.743	0.282	0.097	2.635	0.009
Family type	0.710	0.296	0.087	2.399	0.017

Relationship between feeding behavior and feeding outcome

In our study, a statistically significant negative correlation was observed between the ICFI and the prevalence of underweight, primarily among the 9–11 month age group and the 12–24 month age group. Additionally, a statistically significant negative correlation was found between the RFB and the prevalence of feeding difficulties, predominantly in the 6–8 month and the 12–24 month age groups. The correlation between the ICFI and feeding difficulties, as well as the that between the RFB and malnutrition, were not detected, as shown in Fig. 1.

Factors associated with ICFI

The factors correlated with the ICFI was summarized in Table 2. The higher the score of attention to reading a book, the higher the ICFI score. The caregivers whose registered residence was in the city investigated got higher feeding index score compared with those in other cities. The family structure of caregivers for the core family had a higher feeding index score than the family structure for other families. The higher the age of caregivers, the higher the ICFI score. The lower the score of the perceived obstacle, the higher the ICFI score.

Factors associated with RFB

The factors correlated with the RFB was summarized in Table 3. Parents had higher RFB scores compared with grandparents and other caregivers. The higher the scores of attention to searching information on websites,

Table 3 Multiple regression analysis of factors associated with RFB

	β	Se	*B*	*t*	*P*
Constant	21.259	2.098	-	10.133	< 0.001
Self-efficiency	0.328	0.077	0.164	4.28	< 0.001
Benefit perception	0.512	0.136	0.142	3.764	< 0.001
Attention to searching information online	1.126	0.393	0.118	2.864	0.004
Attention to employing child care professional	0.645	0.253	0.096	2.545	0.011
Relationship of caregivers with the child (parents/grandparents)	-1.561	0.69	-0.079	-2.261	0.024

attention to employing professional nurses, perceived benefit and self-efficacy, the higher the RFB scores.

Feeding behavior model

Based on the aforementioned results, the standard regression coefficient or correlation coefficient between the factors was listed, and the feeding behavior model of caregivers of infants aged 6–24 months was constructed, as shown in Fig. 2.

Discussion

Previous studies have confirmed the correlation between caregiver feeding behaviors and feeding difficulties, as well as the correlation between food preparation behavior (ICFI) and malnutrition. However, these studies have not provided systematic guidance for professionals aiming to devise strategies and policies to improve feeding outcomes. This shortfall is attributed to the need for a more refined understanding of the definition of feeding behaviors, the framework surrounding these behaviors, and the underlying mechanisms that link feeding behaviors to feeding outcomes.

To address these gaps, our study built a theoretical model of feeding behavior based on the Health Belief Model (HBM). This model posits that correction factors, such as caregiver's age, family type and health beliefs, directly affect feeding behaviors, which in turn influence feeding outcomes. The correction factors, as independent variables, are expected to shape the health beliefs and feeding behaviors of caregivers. The mediators, ICFI and RFB, are crucial as they represent the mechanisms through which the independent variables affect the dependent variables.This provides a comprehensive framework that could guide the development of targeted interventions and policies to improve feeding practices and outcomes.

Promoting and fostering responsive feeding behaviors (RFB) among caregivers is a crucial and effective health promotion strategy. Previous studies [9, 14, 28, 29] have shown that feeding behaviors of caregivers can reduce the incidence of feeding difficulties. In our study, we integrated the framework of the RFB and verified that better implementation of the RFB was associated with a lower prevalence of feeding difficulties. Health belief factors for caregivers were the most important positive influencing factors of the RFB. Similar findings have been reported in other studies of health beliefs [30–33]. Therefore, assessing and advising on the RFB should be a standard part of

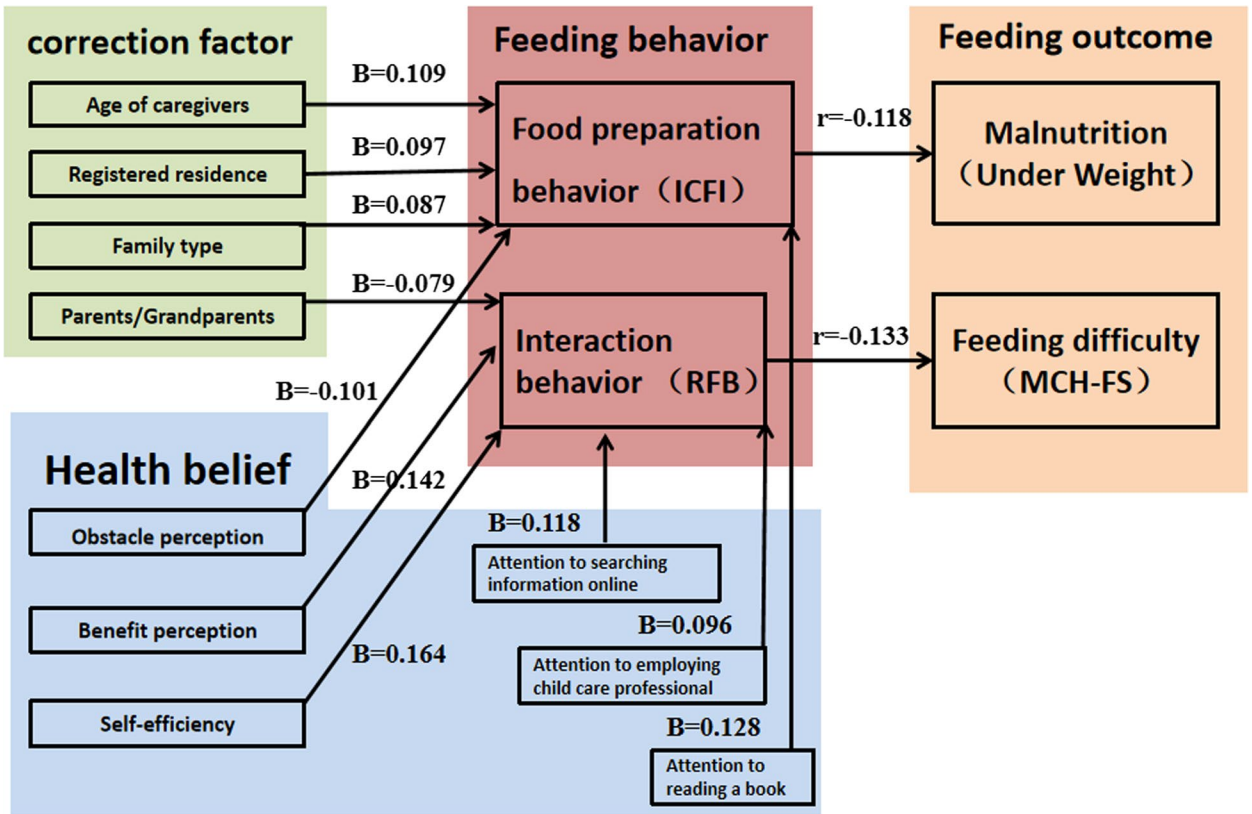

Fig. 2 Feeding behavior model

pediatric care, particularly for children at risk of feeding difficulties.

Policies that support caregiver education and the implementation of the RFB in early childhood settings will be valuable for public health. To promote benefit perception and self-efficacy of caregivers, educational programs should focus on responsive feeding techniques and emphasizing the importance of early intervention to establish healthy feeding patterns. The attention to searching for information online indicates that caregivers are actively seeking knowledge to improve their feeding practices [34], but child care professional support may provide caregivers with the necessary skills and confidence to practice RFB more effectively. Training programs on the RFB for child care professionals are necessary to organize. Grandparents have different parenting styles compared to parents [35, 36], which may result in poorer RFB. This underscores the importance of parental involvement in the feeding process. In most Chinese families, parents and grandparents take care of children together. The unique contributions of different family members [37, 38] to children's feeding need to be assessed, and targeted interventions for different family should be designed to improve the RFB, family communication, and mutual understanding.

In our study, we observed a negative correlation between the prevalence of underweight and food preparation behavior (ICFI), particularly among infants aged 9–11 months and 12–24 months. This suggests that the timely introduction of complementary foods is crucial for feeding improvement. Compared to interaction behavior (RFB), a greater number of correction factors reflecting the personal characteristics of caregivers were associated with the ICFI, including registered residence, family structure, and age.

Our findings are supported by several studies that provide insights into this phenomenon. For example, Xin [39] noted a significant reduction in the frequency of eating out among individuals aged 31 and above, coupled with an increase in nutritional awareness with age. Similarly, Zheng [40] identified age as a determinant of regular meal patterns, with middle-aged individuals exhibiting healthier dietary habits. Caregivers registered in other cities, those under 30 years of age, and those living in main families may face additional obstacles such as complex food preparation processes, time constraints, financial limitations, and family disagreements, which could impede healthy feeding practices [31, 32]. To mitigate these challenges, the development and dissemination of cost-effective and user-friendly food preparation tools, along with educational initiatives on infant food preparation, could be instrumental. Additionally, the creation of fresh and convenient baby food products could further alleviate the difficulties associated with infant food preparation.

The correlation between caregivers' ICFI and their health beliefs, concerns obstacle perception and attention to reading a book on feeding. The act of seeking information from books on feeding emerged as a positive influencing factor. According to Hochbaum's [22] theory, perceived susceptibility and benefits become actionable when triggered by cues. In this context, when caregivers recognize the benefits and obstacles and are motivated to overcome them, their attention to reading about feeding serves as a cue to instigate positive action. This suggests that the provision of accessible and engaging educational materials could encourage the adoption of improved feeding behaviors in future studies [41].

Strength and limitations

This study pioneers the application of the Health Belief Model to the research on feeding behaviors of infant and young children caregivers, constructing a model of factors influencing feeding behavior and conducting a systematic and comprehensive study of their feeding practices. The research content extends from traditional complementary feeding behaviors to include responsive feeding behaviors of infant and young children caregivers, an area that requires further investigation both domestically and internationally. This study is of a cross-sectional survey design, with the sample size restricted to 3 community health service centers in Wuhou District, Chengdu City. The study population is limited to the caregivers of infants and toddlers aged between 6 to 24 months. Due to the study population, the correlation between the RFB and the prevalence of malnutrition was not verified in this study. Future research could extend to a broader geographical area with a larger sample size, and could further conduct cohort studies to explore the relationships between early feeding practices and health outcomes during infancy, preschool age, school age, adolescence, and adulthood. There were potential bias due to self-reporting in the cross-sectional survey. First, the subjective interpretation of questions and options might vary among participants, potentially affecting response accuracy. Second, self-reporting inherently carries the risk of recall bias and social desirability bias, which might influence the results. To minimize potential bias in self-reporting, we implemented several measures. First, we conducted a pilot study to ensure the clarity and comprehensibility of the scale. Second, trained investigators were present during data collection to clarify any participant uncertainties. Finally, we emphasized the importance of honest responses and assured participants of the confidentiality of their answers. Future studies could consider

incorporating objective measures or more granular scales to complement self-reported data.

Conclusions

The prevalence of feeding difficulties among infants and young children aged 6 to 24 months in this region was high. The higher the score of RFB by caregivers, the lower the prevalence of feeding difficulties in infants and young children. Health beliefs, including self-efficiency, benefit perception, attention to searching information on websites, and attention to employing professional nurses, were influencing factors of RFB. This suggests employ professional nurses and creating websites may be effective measures to improve caregivers' RFB.

The prevalence of short stature in this area was high. The correlation between ICFI and Z-score was only found between ICFI and WAZ in the 9–11 month age group and the 12–24 month age group. The reason of the high prevalence of short stature in this region need to be explored in the future research. The caregivers' ICFI was associated with their health beliefs, including obstacle perception and attention to reading a book on feeding. The health education to improve food preparation behavior need to focus on reduce the difficulty in baby food preparation.

Abbreviations

HAZ	Height-for-Age *Z*-scores
HBM	Health Belief Model
ICFI	Infant and Young Child Feeding Index
MCH-FS	Montreal Children's Hospital Feeding Scale
RFB	Responsive Feeding Behavior
SCVI/Ave	Scale-Level Content Validity Index/Average
WAZ	Weight-for-Age *Z*-scores
WHZ	Weight-for-Height *Z*-scores

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12887-025-05622-8.

Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

BL and XZ contributed to the study design. YG and XG carried out the data collection. YT conducted the data analysis. YG drafted the manuscript. WP, LZ and XL revised the manuscript. All the authors read and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study are not publicly available because the participants' personal information was included in this study, but the data that were not involved the participants' personal information are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. All research methods were carried out in accordance with the relevant guidelines and regulations. This study was approved by the Medical Ethics Committee of West China Second University Hospital, Sichuan University [2019 Medical Scientific Research for Ethical Approval No. (081)]. Informed consent was obtained from all participants, and a parent and/or legal guardian of the minors for study participation.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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