Infant and preschooler feeding behaviors in Chinese families: A systematic review

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ABSTRACT

A systematic review was conducted on the literature on feeding behaviors in Chinese families of children under 6 years old. Forty relevant publications were identified, of which 33 were published in Chinese, 7 in English. All studies were questionnaire-based and used a cross-sectional research design. Approximately half of the studies reported a score for each feeding practice/style, based on a Likert scale; the other half dichotomized these scores into a percentage of the population that reported frequent use of the behaviors. The most commonly reported feeding style of Chinese caregivers was a locally defined “active response” style that somewhat resembled authoritative parenting. The most commonly reported feeding practices were praise, encouraging trying new foods, encouragement of balanced diet and encouragement of healthy eating. Some behaviors showed a great deal of variance in prevalence between studies, which may be at least partially due to differences in methodology and how behaviors were defined. Some feeding behaviors varied in frequency depending on the child’s age, although longitudinal studies are needed to better understand how these evolve over time. Child body composition was also associated with feeding behaviors use, although the direction of the association cannot be determined due to the cross-sectional nature of the research. There is still an important gap in the literature regarding the feeding behaviors of non-maternal caregivers, as grandparents often play an important role in childcare in China.

1. Introduction

The “double burden of malnutrition” in which both overnutrition and undernutrition coexist is a growing health concern for Chinese children (Song et al., 2019). Beyond simply managing energy intake, dietary variety is important to ensure adequate intake of macro- and micronutrients. Early childhood is a sensitive period in which children’s dietary patterns and eating habits are formed. Several factors may influence eating behavior, including genetics, early dietary experience, and the feeding environment.

One modifiable factor that has received considerable attention in the literature is the role of parental feeding styles and feeding practices. Feeding styles refer to the overall approach to parenting in the domain of feeding, such as whether parents exert a lot of control over feeding and the extent to which they are sensitive to the needs of the child (Hughes, Power, OrletFisher, Mueller, & Nicklas, 2005). Feeding practices refer to specific behaviors that caregivers use to manage what, when and how much their children eat (Blissett, 2011; Shloim, Edelson, Martin, & Hetherington, 2015). These practices have been shown to be associated with children’s acceptance or rejection of food (Blissett, Bennett, Fogel,

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Although there is a growing body of literature around feeding practices, their predictors, and related outcomes, the majority of studies have been conducted in North America, Europe, and Australia (Hurley, Cross, & Hughes, 2011; Shloim et al., 2015), and less is known about feeding behaviors in other parts of the world, such as Asia. Cultural factors can influence feeding practices, and previous studies have shown differences in the frequency of use of feeding practices or styles between families of Chinese ancestry and other ethnic groups in countries such as the United States (e.g., Huang et al., 2012; Jambunanthan, Burns, & Pierce, 2000) and Singapore (Fries, Chan, et al., 2019). The relationships between feeding practices and children’s eating behaviors or weight have also been shown to differ between ethnic groups (Billett & Bennett, 2013; Hughes et al., 2011). Therefore, caution must be taken in generalizing previous research findings from predominantly Caucasian populations to Asian countries.

In order to inform local feeding guidelines and interventions for Chinese families, the current review aims to summarize the existing literature on the feeding practices of Chinese caregivers, integrating results published in both English and Chinese language journals.

2. Methods

A search in PubMed was conducted using combinations of terms related to feeding practices (“feeding behavior”, “feeding practice”, “feeding pattern”, “feeding status”, “mealtime interaction”, and “feeding style”), early childhood (“infant”, “baby”, “children”, “preschoolers”, “preschool child”, “child”, “toddlers”, and China (“China”, “Chinese”, “Taiwan”, “Hong Kong”, “Macau”). Chinese translations of these terms were used for searches in Chinese language databases (CNKI, SinoMed, and VPCS). Two authors independently searched the databases (NZ and YL).

Studies were included if they assessed feeding behaviors of Chinese caregivers using quantitative methods. Studies were excluded if the participants were living outside of China (e.g., Chinese immigrants in other countries, Asian Americans); if the children in the study were, on average, over 6 years old; or if the study focused on clinical populations (e.g., children with autism). Studies were also excluded if the only outcomes assessed were breastfeeding rates, variables related to the child’s diet quality (e.g., nutritional supplement use, feeding index score), or the children’s eating habits, rather than a caregiver’s feeding behavior.

Two authors (HZ and HW) independently screened titles and abstracts identified by the search for relevance, followed by a full-text screening of those that initially appeared to meet the inclusion criteria. Any disagreement was resolved by discussion between the reviewers. The reference sections of identified articles were also searched and any additional articles that met inclusion criteria were also included. The following information was extracted from the included articles (by SG and YW): author, publication year, research location, measures used, feeding behaviors assessed, distribution of feeding behavior (including subgroups, if relevant), participant age, and sample size.

For studies that only presented results broken down by subgroups (e.g., by age, weight status), we calculated an overall distribution for each feeding behavior using the subgroup data provided in the article (i.e., the scores/prevalence values for each behavior and the sample sizes of subgroups). Only one study (Guo, Xie, Xiong, & Zhang, 2017) did not provide the size of each subgroup, so total values could not be calculated for this study.

3. Results

After removing duplicate entries, the literature search identified a total of 894 articles (761 in Chinese, 133 in English). After the initial round of title and abstract screening, full texts were retrieved and reviewed for 77 papers (64 Chinese, 13 English). After evaluation of the full texts, 40 (33 Chinese, 7 English) documents met inclusion criteria and were included in the current review (Bao, Chen, & Ni, 2014; Chen et al., 2016; Deng et al., 2012; Guo et al., 2017; D.; Hu, Chen, & Gao, 2014; Z.; Hu & Lu, 2014; C.; Li, He, & Fang, 2020; G.; Li et al., 2015; Yanting; Liang, Liu, Chen, & Jiang, 2017; Youfang; Liang, Zhu, Liang, & Song, 2013; Lin, Yang, Wang, Wu, & Xian, 2018; H.; Liu & Chen, 2014; S.; Liu, Liu, & Cui, 2012; Y.; Liu, 2012; Lo, Cheung, Lee, Keung, & Tam, 2016; Lo, Cheung, Lee, & Tam, & Keung, 2015; J. Ma, Zhou, HU, & Sheng, 2015; L.; Ma & Liu, 2019; Mao et al., 2017; Shi et al., 2017; Tam, Keung, Lee, Lo, & Cheung, 2014; S.; Wang, Huang, Wang, & Jin, 2012; X.; Wang & Zhou, 2018; Wei et al., 2018; J.; Wen, Fan, & Zhao, 2020; B.; Wu, Ban, Liang, & Zh. 2012; Y.; Wu, Wu, Lu, Chen, & Jin, 2014; Xiang, Hu, Zhou, & Huang, 2019; J.; Xie, Yan, & Zeng, 2019; Q.; Xie, Hu, Zh., & Li, 2018; Z.; Xu, Gu, & Peng, 2008; Jing Yuan, Xianjun; Yang et al., 2019; Yuan et al., 2020; Jing Yuan, Yuhai; Zhang et al., 2019; Z.; Zhang et al., 2015; Zhao et al., 2013; L.; Zhou et al., 2010; X.; Zhou et al., 2018b, 2018a; Zhu, Liu, Yue, & Li, 2015). The screening process flowchart is shown in Fig. 1.

Of the studies identified, 35 articles contained data on the distribution of feeding behaviors in the population and are summarized in Tables 1 and 2 (Bao et al., 2014; Chen et al., 2016; Deng et al., 2012; Guo et al., 2017; D.; Hu, Lu, & Lu, 2014; C.; Li et al., 2020; G.; Li et al., 2015; Yanting; Liang et al., 2017; Youfang; Liang et al., 2013; Lin et al., 2018; S.; Liu et al., 2012; Lo et al., 2016; Lo et al., 2015; J.; Ma & Li, 2015; L.; Ma & Liu, 2019; Mao et al., 2017; Shi et al., 2017; Tam et al., 2014; S.; Wang et al., 2012; X.; Wang & Zhou, 2018; Wei et al., 2018; J.; Wen et al., 2020; B.; Wu et al., 2012; Y.; Wu et al., 2014; Xiang et al., 2019; J.; Xie et al., 2019; Jing Yuan, Xianjun; Yang et al., 2019; Yuan et al., 2020; Jing Yuan, Yuhai; Zhang et al., 2019; Z.; Zhang et al., 2015; Zhao et al., 2013; L.; Zhou et al., 2010; X.; Zhou et al., 2018b, 2018a; Zhu, Liu, Yue, & Li, 2015). When multiple publications referred to the same data sets, these were combined in the table ((Lo et al., 2016; Lo et al., 2015; Tam et al., 2014), (Jing Yuan, Xianjun; Yang et al., 2019; Jing Yuan, Yuhai; Zhang et al., 2019)). When related publications used different subsets of the population or administered different questionnaires to the same group ((J.; Ma et al., 2015; L.; Zhou et al., 2010; (Yuan et al., 2020; Jing Yuan, Yuhai; Zhang et al., 2019); (X. Zhou et al., 2018a; 2018b)) these were...
listed separately. Thus, the current review covers 32 sets of results on the
distribution of feeding behaviors(Bao et al., 2014; Chen et al., 2016; Deng et al., 2012; Guo et al., 2017; D.; Hu et al., 2014; Z.; Hu & Lu, 2014; C.; Li et al., 2020; G.; Li et al., 2015; Yanting; Liang et al., 2017; Youfang; Liang et al., 2013; Lin et al., 2018; S.; Liu et al., 2012; Lo et al., 2015; J.; Ma et al., 2015; L.; Ma & Liu, 2019; Mao et al., 2017; Shi et al., 2017; S.; Wang et al., 2012; X.; Wang & Zhou, 2018; Wei et al., 2018; J.; Wen et al., 2020; B.; Wu et al., 2012; Y.; Wu et al., 2014; Xiang et al., 2019; J.; Xie et al., 2019; Yuan et al., 2020; Jing Yuan, Yuhai; Zhang et al., 2019; Z.; Zhang et al., 2015; L.; Zhou et al., 2010; X.; Zhou et al., 2018b, 2018a; Zhu et al., 2015). The remaining 5 studies (H. Liu & Chen, 2014; Y. Liu, 2012; Q. Xie et al., 2018; Z. Xu et al., 2008; Zhao et al., 2013) did not report descriptive statistics for individual feeding practices, but included associations with other factors (Table 3).

All 40 included publications used a cross-sectional research design.

Of these, 14 compared participants across different age groups, 5 compared by child weight status, and 5 compared by parents’ weight status. A total of 41,361 subjects were included. The sample population ranged from 70 participants in the smallest study(Deng et al., 2012) to 5302 in the largest(J. Xie et al., 2019). Study sites were located in 21 provinces, municipalities, autonomous regions and special administrative regions in China, including 2 national multi-center studies(S. Wang et al., 2012; Zhao et al., 2013), one study in five provinces(C. Li et al., 2020), and two cross-province studies(Yuan et al., 2020; Jing; Yuan, Yuhai Zhang et al., 2019). Seventeen studies were conducted in the eastern part of China, 6 in the south, 5 in the northwest, 3 in the north, 2 in the northeast, 2 in central China, 2 in the southwest and 1 in Hong Kong.

All included studies measured feeding behaviors through parent-response questionnaires, employing a total of 25 different measures, of

Table 1
Study characteristics and main findings of feeding practices.

| Study | Age Group | Weight Status | Population Characteristics | Prevalence | Main Findings |
|-------|-----------|---------------|----------------------------|------------|--------------|
| Bao et al., 2014 | 
| Chen et al., 2016 | 
| Deng et al., 2012 | n/a | n/a | n/a | n/a | n/a |
| Guo et al., 2017 | n/a | n/a | n/a | n/a | n/a |
| D.; Hu et al., 2014 | n/a | n/a | n/a | n/a | n/a |
| Z.; Hu & Lu, 2014 | n/a | n/a | n/a | n/a | n/a |
| C.; Li et al., 2020 | n/a | n/a | n/a | n/a | n/a |
| G.; Li et al., 2015 | n/a | n/a | n/a | n/a | n/a |
| Yanting; Liang et al., 2017 | n/a | n/a | n/a | n/a | n/a |
| Youfang; Liang et al., 2013 | n/a | n/a | n/a | n/a | n/a |
| Lin et al., 2018 | n/a | n/a | n/a | n/a | n/a |
| S.; Liu et al., 2012 | n/a | n/a | n/a | n/a | n/a |
| Lo et al., 2015 | n/a | n/a | n/a | n/a | n/a |
| J.; Ma et al., 2015 | n/a | n/a | n/a | n/a | n/a |
| L.; Ma & Liu, 2019 | n/a | n/a | n/a | n/a | n/a |
| Mao et al., 2017 | n/a | n/a | n/a | n/a | n/a |
| Shi et al., 2017 | n/a | n/a | n/a | n/a | n/a |
| S.; Wang et al., 2012 | n/a | n/a | n/a | n/a | n/a |
| X.; Wang & Zhou, 2018 | n/a | n/a | n/a | n/a | n/a |
| Wei et al., 2018 | n/a | n/a | n/a | n/a | n/a |
| J.; Wen et al., 2020 | n/a | n/a | n/a | n/a | n/a |
| B.; Wu et al., 2012 | n/a | n/a | n/a | n/a | n/a |
| Y.; Wu et al., 2014 | n/a | n/a | n/a | n/a | n/a |
| Xiang et al., 2019 | n/a | n/a | n/a | n/a | n/a |
| J.; Xie et al., 2019 | n/a | n/a | n/a | n/a | n/a |
| Yuan et al., 2020 | n/a | n/a | n/a | n/a | n/a |
| Jing Yuan, Yuhai; Zhang et al., 2019 | n/a | n/a | n/a | n/a | n/a |
| Z.; Zhang et al., 2015 | n/a | n/a | n/a | n/a | n/a |
| L.; Zhou et al., 2010 | n/a | n/a | n/a | n/a | n/a |
| X.; Zhou et al., 2018b, 2018a | n/a | n/a | n/a | n/a | n/a |
| Zhu et al., 2015 | n/a | n/a | n/a | n/a | n/a |
which 19 were developed by the study authors. The most frequently used questionnaires were the Child Feeding Questionnaire (CFQ(Birch et al., 2001); n = 6 studies) and Children’s Eating Behavior Questionnaire developed by the National Center for Women and Children’s Health of the China CDC(S. Wang et al., 2012) (4 studies). Despite the wide variety of questionnaires used, the majority used a Likert scale response format, in which parents were asked to indicate how often they adopt different behaviors on a 4- (n = 2) (Bao et al., 2014; S. Liu et al., 2012) or 5-point scale (n = 24) from “never” to “often” or “always”. For behaviors that were measured across several questionnaire items, most studies presented an average score across all relevant items. However, two studies (Deng et al., 2012; Z. Zhang et al., 2015) used summed scores rather than means and one study(J. Ma et al., 2015) reported the interquartile range and median scores instead. Therefore, the outcomes of these three studies could not be directly compared to the other studies for assessing the distribution of individual feeding behaviors. Sixteen studies used these “scores” for each behavior as the outcome measure. Another 16 studies reported a prevalence of each feeding behavior, representing the percentage of caregivers who use a particular behavior. Two such prevalence studies used yes/no questions for each behavior(Yanting Liang et al., 2017; Shi et al., 2017). Ten studies converted a 5-point Likert scale by counting scores of 4 or more as representing that a caregiver used a behavior(D. Hu et al., 2014; Z. Hu & Lu, 2014; G. Li et al., 2015; Youfang Liang et al., 2013; Mao et al., 2017; S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Y. Wu et al., 2014; Zhu et al., 2015). The remaining four articles did not describe their criteria (C. Li et al., 2020; L. Ma & Liu, 2019; Wei et al., 2018; J. Xie et al., 2019).

It is a challenging task to distinguish between feeding styles and feeding practices when combining results from 25 different questionnaires. Individual studies may include a combination of both feeding styles and feeding practices and the original questionnaires were often not published, making it difficult to evaluate exactly what had been measured in each case. Therefore, feeding styles and practices were classified as best as possible, based on the descriptions used in the manuscripts. In the results below, items reflecting an overall approach to food-related parenting or the emotional context of the mealtime setting are classified as feeding styles(Hughes et al., 2011). These include the “traditional” four feeding styles as defined by Hughes and colleagues (Hughes et al., 2005), as well as some items around responsive feeding and the emotional climate during mealtimes. Specific goal-directed behaviors used by caregivers to influence the child’s actions (e.g., to eat something, stop doing something) were classified as feeding practices. These practices were then further subdivided using the conceptual framework proposed by Vaughn and colleagues (A. Vaughn et al., 2016), which divides feeding practices into three main categories: coercive control, structure, and autonomy support.

The majority of studies were about feeding practices. See Table 1 for the distribution of feeding practices in each study. The most commonly measured feeding practices were pressure to eat (22 studies) and unstructured practices (14 studies). See Table 4 for definitions of feeding practices and the number of articles involved. Some feeding behaviors were not formally defined in the publications, such as “allowing children to choose what they want to eat”, potentially because the authors believed that the name was self-explanatory.

Table 2 shows the distribution of feeding styles in each study. Common tools for measuring feeding styles included the Caregiver’s Feeding Style Questionnaire (CSFQ(Hughes et al., 2005)) and Parental Feeding Style Questionnaire (PFSQ(Wardle, Sanderson, Guthrie, Rapport, & Plomin, 2002)), each of which were used in 2 studies(Guo et al., 2017; C. Li et al., 2020; Lo et al., 2015; Wei et al., 2018). There were also some novel questionnaires which included feeding styles (e.g. responsive feeding and active response)(Bao et al., 2014; Mao et al., 2017; Z. Zhang et al., 2015). Some feeding styles were more frequently investigated than others, with several studies (n = 6) focused on the indulgent feeding style, whereas only 3 measured uninvolved feeding. See Table 5 for definitions of feeding styles and number of articles involved.

3.1. The distribution of feeding behaviors

3.1.1. Feeding style

Authoritative feeding style and authoritarian feeding style were both assessed in two studies (C. Li et al., 2020; Wei et al., 2018). These two feeding styles are both characterized by a high level of expectations or rules for children’s eating, but the contrast lies in the degree of sensitivity to the child’s needs. Authoritative caregivers score higher in this responsiveness dimension, which may be reflected explaining rules, enforcing them consistently, and adapting based on the needs of the child; authoritarian caregivers may follow a more scheduled or parent-centric approach, without adjusting for child preferences or needs (Hughes et al., 2005; Wei et al., 2018). Both studies used the same questionnaire and covered a total of 1932 subjects. They reported prevalence rates 13.5%(Wei et al., 2018) and 10.3%(C. Li et al., 2020) for authoritative style, and 39.7%(Wei et al., 2018) and 36.1%(C. Li et al., 2020) for authoritarian.

An indulgent feeding style is characterized by warmth and acceptance in conjunction with making few demands on the child’s eating behavior (Hughes et al., 2005; C. Li et al., 2020). Six studies measured this behavior using three questionnaires, including 2153 subjects in total (Bao et al., 2014; C.; Li et al., 2020; S.; Liu et al., 2012; Mao et al., 2017; Wei et al., 2018; Z.; Zhang et al., 2015). Three studies reported a prevalence of the indulgent style between 34.1% and 47.2%(C. Li et al., 2020; Mao et al., 2017; Wei et al., 2018). The other two studies reported scores of 1.98 and 2.03(C. Li et al., 2020; S. Liu et al., 2012), indicating that caregivers rarely adopt this feeding style. One study provided a sum score (23.8) rather than an average, so it cannot be directly compared with the other studies (Z. Zhang et al., 2015).

The uninvolved feeding style refers to little control and involvement with the child during feeding (Hughes et al., 2005). Three studies assessed the uninvolved style using 2 questionnaires, including 4355 subjects in total(C. Li et al., 2020; Shi et al., 2017; Wei et al., 2018). All studies calculated the prevalence of this feeding style, with results ranging from 12.6% to 30%(C. Li et al., 2020; Shi et al., 2017; Wei et al., 2018).

Responsive feeding refers to caregivers feeding based on the hunger or fullness cue of the child. This style was reported by 4 studies, using 4 questionnaires, and involving 2397 subjects. Three studies reported the prevalence of this feeding behavior, which varied widely among studies, ranging from 24.3% to 79.4%(Z. Hu & Lu, 2014; Yanting Liang et al., 2017; Youfang Liang et al., 2013). Two studies were conducted in the same city (Nanning) and found quite different prevalence rates: 24.3% (Yanting Liang et al., 2017) and 59.1%(Youfang Liang et al., 2013), which may be attributable to differences in the measures used. One study provided median (interquartile range) of the items, 10 (8–10), which could not be compared with the other results (J. Ma et al., 2015).

“Active response” was a feeding style mentioned in four studies(Bao et al., 2014; Yanting Liang et al., 2017; S. Liu et al., 2012; Z. Zhang et al., 2015), referring to caregivers respecting the individuality and independence of children during the feeding process, responding promptly and correctly to the child’s eating behaviors, promoting the child’s eating through positive strategies such as praise and reasoning, explaining the nutritional value of food to children, and encouraging the child to eat independently(Bao et al., 2014; S. Liu et al., 2012). This feeding style is comparable to an authoritative feeding style. It was measured using four study-specific questionnaires. Two articles reported scores of 3.45(S. Liu et al., 2012) and 3.5(Bao et al., 2014), and one article reported the frequency at 65.8%(Yanting Liang et al., 2017). The remaining article used a different scale and could not be compared(Z. Zhang et al., 2015). This shows that parents report using active response relatively frequently. In one study of preschool children (Z. Zhang et al., 2015), active response had a significantly higher score than other feeding behaviors (controlling feeding, instrumental feeding and indulgent feeding), suggesting this is one of the more common feeding approaches in China. One study provided a sum score (32) rather than
an average, so it could not be directly compared with the other studies (Z. Zhang et al., 2015).

Some studies generally assessed emotional interaction between parents and children during feeding, including measures of positive or negative interactions during feeding, as well as lack of emotional interaction. Positive interactions between parents and children include verbal or non-verbal encouragement, praising or hugging the children. Five studies assessed “positive interactions”, using different questionnaires and including 1853 subjects (Deng et al., 2012; Z. Hu & Lu, 2014; G. Li et al., 2015; Youfang Liang et al., 2013; J. Ma et al., 2015). The prevalence across studies ranged between 45 and 86%, and one study presented a median (interquartile range) of the subscale total, 15 (13–15). The incidence of “negative interactions” while feeding, such as arguing with children, was relatively lower, at 22.5%(G. Li et al., 2015), and one study used the total score, 19.5(Deng et al., 2012). Seven studies assessed the “lack of emotional interaction”, involving 5 questionnaires and 7990 participants(D. Hu et al., 2014; Yanting Liang et al., 2017; Mao et al., 2017; S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Y. Wu et al., 2014). Except one study that reported a prevalence of 46% (Mao et al., 2015), all other studies found rates below 17%. One study specified that the lack of emotional communication between caregivers and children before eating was 45.3%(Yanting Liang et al., 2017), while the other studies did not address the timing.

3.1.2. Feeding practices

3.1.2.1. Coercive control. Restriction means that caregivers limit the child’s access to foods or opportunities to consume those foods, typically with a focus on controlling the child’s intake of unhealthy foods. Eight studies measured this behavior using three questionnaires and including 5452 subjects. One study reported prevalence rates at 27.2% (Shi et al., 2017). The other seven studies reported scores, ranging from 3.26 to 4.39(Chen et al., 2016; Lin et al., 2018; Xiang et al., 2019; Yuan et al., 2020; Jing Yuan, Yuhai Zhang et al., 2019; X. Zhou et al., 2018a, 2018b). Scores were mainly between 3.5 and 4.0, indicating that caregivers often adopt this feeding behavior.

Pressure to eat refers to parents’ tendency to pressure their children to eat more food at mealtimes (e.g., “My child should always eat all the food on her plate”), or even physically struggling with them to get them to eat (Birch et al., 2001). This is sometimes referred to in the included articles as “forced feeding”. There were 22 studies, including 24,432 subjects in total, that measured this feeding behavior, using 11 different questionnaires. Twelve studies reported the total prevalence of “pressure to eat”, which varied considerably from study to study, ranging from 4.5% to 55.4%. One study measured an opposite construct, namely “non-pressure feeding”, with a prevalence of 57.9%(Youfang Liang et al., 2013). Another study(Y. Wu et al., 2014) also reported the prevalence of two more specific behaviors that were clustered together within the larger umbrella of pressure to eat: “must eat all their food” (36.5%) and “forced or punished children to eat more” (10%). Eight studies reported scores for this behavior, with results ranging from 2.76 to 3.71. The remaining article reported a median (interquartile range) of the items, 3 (2–5) (J. Ma et al., 2015) or a total score of each subscale (12.3) (Z. Zhang et al., 2015), and could not be directly compared with the other studies.

Threats and bribes, means that caregivers threaten to take away or promise to offer something to children in exchange for desired behaviors, which was also named “instrumental feeding” in several studies (Guo et al., 2017; Wardle et al., 2002). Thirteen studies measured this behavior, using 8 questionnaires, and including 13,089 subjects. The prevalence of the use of threats and bribes ranged from 9.8% to 36.5% in 6 studies(L. Ma & Liu, 2019; Mao et al., 2017; S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Y. Wu et al., 2014). The other 7 studies reported scores ranging from 2.10 to 2.95(Bao et al., 2014; Guo et al., 2017; S. Liu et al., 2012; Lo et al., 2015; Z. Zhang et al., 2015; X. Zhou et al., 2018a, 2018b). One study reported a total score of 11.3, which could not be directly compared (Z. Zhang et al., 2015).

Using food to control negative emotions means that caregivers use food to control or calm the child when he/she is upset, sad, injured, or bored. Six studies, covering 10,504 participants, measured this behavior. Four questionnaires were used, each using different language to assess this construct, including: “using food for emotional management”(X. Zhou et al., 2018a, 2018b), “associating children’s emotions with food”(Zhu et al., 2015), “emotional feeding”(Guo et al., 2017; Lo et al., 2015), and “using food to calm the children”(J. Ma et al., 2015). Five papers presented scores, finding a range between 1.64 and 2.85. One article reported the prevalence of emotional feeding, in which the highest score across different age groups was 8.85%(Zhu et al., 2015).

3.1.2.2. Structure. Monitoring refers to the extent to which parents keep track of child intake, generally with a focus on sufficient intake of healthy foods and avoiding overeating unhealthy foods (e.g., “How much do you keep track of the high fat foods that your child eats?”) (Birch et al., 2001; Jing; Yuan, Yuhai Zhang et al., 2019). Eight studies assessed this behavior using three questionnaires, including 3240 subjects. All studies reported scores, which ranged from 3.5 to 4.3. (Chen et al., 2016; Lin et al., 2018; X. Wang & Zhou, 2018; Xiang et al., 2019; Yuan et al., 2020; Jing Yuan, Yuhai Zhang et al., 2019; X. Zhou et al., 2018a, 2018b).

Meal and snack routines refers to how parents control the location, timing, presence of family members, atmosphere or mood, and presence or absence of distractions during meals and snacks. Regarding the location of meals, “allowing children to move around while eating” means that the child is not required to stay in his/her seat during the meal. Five studies assessed this behavior, involving three questionnaires and 10,495 subjects. The prevalence was relatively low, occurring in 15.7%–27.5% among the different age groups of children. Other studies assessed “distractions” while eating like “allowing children to play around while eating” or “allowing children to play with toys/watch TV while eating”, which was measured in 2 studies, involving 1845 subjects, with the prevalence rates range from 16.67% to 53.4%(Z. Hu & Lu, 2014; Youfang Liang et al., 2013). One study described the distraction factor as “distracting children to encourage them to eat”, finding a prevalence rate of 60.7%(G. Li et al., 2015).

Modeling traditionally means that caregivers demonstrate healthy food choices and eating behaviors for the child (positive modeling) (Musher-Eizenman & Holub, 2007). Other studies assessed the opposite of this construct, that is to say, whether caregivers exhibit unhealthy eating behaviors in front of the child (negative modeling). Eight studies measured modeling, including 6 questionnaires and 7155 subjects (Bao et al., 2014; Deng et al., 2012; S. Liu et al., 2012; Yuan et al., 2020; Jing Yuan, Yuhai Zhang et al., 2019; X. Zhou et al., 2018a, 2018b; Zhu et al., 2015). Four articles about positive modeling found scores between 3.64 and 4.0 (Yuan et al., 2020; Jing Yuan, Yuhai Zhang et al., 2019; X. Zhou et al., 2018a, 2018b; Zhu et al., 2015). Yuan et al.(J. Yuan et al., 2019)’s subscale on “behavioral restraint” explored caregivers’ modeling of healthy mealtime behaviors, with items such as, “when having a meal with my child, I won’t play with my mobile phone or watch TV”. The remaining four articles focused on negative modeling. One article (Zhu et al., 2015) reported a prevalence rate of 25.4%. Two articles presented scores for negative modeling, with both around 2.2 points(Bao et al., 2014; S.; Liu et al., 2012). Taken together, these results suggest that caregivers report more frequent use of positive role modeling to encourage healthy eating in infants and young children. One article presented a total score for negative modeling, 15.5, and could not be compared with other studies (Deng et al., 2012).

Food preparation refers to parents adopting different food preparation and cooking methods to promote healthy food intake. There were three articles that measured feeding behaviors related to food preparation, using three questionnaires with 2200 subjects(Z. Hu & Lu, 2014;
Yanting Liang et al., 2017; Youfang Liang et al., 2013). Two articles measured “preparing separate foods for children rather than the rest of the family”, with the prevalence of 71.5%(Youfang Liang et al., 2013) and 61.7%(Z. Hu & Lu, 2014). “Preparing age-appropriate foods” was reported to be used by 58.5% of caregivers (Youfang Liang et al., 2013).

One study measured “preparing foods in a way to make them more appealing to children”, which could include either the cooking method (e.g., juicing, puree) or the presentation of the food (e.g., cut into fun shapes), at 36.5%(Z. Hu & Lu, 2014). About half of parents (51%) reported “preparing simple or single-ingredient foods for children”, such as serving a plain porridge rather than one mixed with meats or vegetables (Yanting Liang et al., 2017).

Unstructured practices refers to caregivers letting children decide when, where, what, and how much to eat, which was frequently assessed with the items “allowing children to choose what they want to eat” (D. Hu et al., 2014; Z. Hu & Lu, 2014; G. Li et al., 2015; S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Y. Wu et al., 2014; L. Zhou et al., 2010) and “allowing children to snack whenever they want” (D. Hu et al., 2014; G. Li et al., 2015; S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Y. Wu et al., 2014) in Chinese studies. In our review, eight studies measured “allowing children to choose what they want to eat” using six questionnaires and including 7507 subjects. Seven of them calculated the prevalence of this feeding behavior(Z. Hu & Lu, 2014; G. Li et al., 2015; S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Y. Wu et al., 2014). With 56.8% as the highest prevalence(D. Hu et al., 2014) and the others were all below 38.5%. Only one study used score as the outcome (L. Zhou et al., 2010), reporting a result of 2.95 (“sometimes”). Six studies reported on “allowing children to snack whenever they want”, involving 4 questionnaires and 7200 participants. There was a wide range in prevalence rates, with four studies reporting lower rates (between 7.6% and 18.3%) (G. Li et al., 2015; S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012) whereas Wu(Y. Wu et al., 2014) and Hu (D. Hu et al., 2014) reported higher rates, at 27% and 49.1%, respectively.

3.1.2.3. Autonomy support. Child involvement refers to caregivers actively involve children in food purchases, preparation, and mealtime. Only two articles, using the same questionnaire and measuring the same population (1157 subjects), measured “involving children in food preparation”, with the score of 2.9(X. Zhou et al., 2018a; 2018b). There was no difference in distribution between mothers of different weights (X. Zhou et al., 2018b).

Encouragement refers to parents’ prompts for children to consume specific foods, without any negative consequence for refusal to comply. Two studies assessed prompting and encouraging to eat (Guo et al., 2017; Lo et al., 2015), covering 4761 participants and using the same questionnaire. Both studies reported similar scores around 3.7. Another study (768 subjects) found an average score of 3.8 for the related behavior, “encouragement of healthy eating” (Yuan et al., 2020; Jing Yuan, Yuhai Zhang et al., 2019). And two articles. using the same questionnaire and measuring the same population (1157 subjects), measured “encouragement of balanced diet”, with the score of 4.13 (Guo et al., 2017; X.; Zhou et al., 2018a). “Prompting and encouraging to eat”, “encouragement of balanced diet”, and “encouragement of healthy eating” were all about getting children to eat adequate and varied nutrition, and all the scores were around 4 between studies, meaning that Chinese caregivers report paying great attention to their children’s diet quality.

Two studies focused on “encouraging trying new foods”, with prevalence rates of 47.8%(G. Li et al., 2015) and 85.9%(J. Xie et al., 2019). The ages of the children included in the two studies were 1-4 years and 3-6 years, respectively, suggesting that this behavior may become more common as children grow older. Five papers assessed this construct using a negative wording (“rarely encouraging children to taste new foods”), using five questionnaires, and including 6564 participants. Four studies found an incidence between 8.5% and 19.6% (S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Y. Wu et al., 2014) with one study reporting a higher prevalence (54.59%)(D. Hu et al., 2014).

Praise refers to caregivers providing positive verbal reinforcement for eating specific foods or trying new foods. Two studies measured this feeding behavior using 2 questionnaires and including 609 subjects, and found scores of around 3.7 (G. Li et al., 2015; J. Ma et al., 2015). One study measured a behavior described as “hug and praise while eating” with a prevalence of 71.1%(G. Li et al., 2015). And Ma et al. used median (interquartile range) of total score, 9(7–10), to measure “verbal communication while feeding” (e.g. Praising the child’s good eating behaviors)(J. Ma et al., 2015).

Although not included in the original framework from Vaughn and colleagues, we have also categorized a new behavior, encouraging children to eat independently, under “autonomy support”. Two studies reported the distribution of this behavior, involving two questionnaires and 950 subjects. The incidence of this feeding behavior differed between the two studies at 63.6%(Z. Hu & Lu, 2014) and 29.4% (Youfang Liang et al., 2013). Another study worded this construct in the opposite way, unwilling to encourage children to eat independently, with an incidence of 18.5%(J. Wen et al., 2020). The large differences between the three studies may be related to differences in local eating habits and the use of different questionnaires.

3.2. Summary

Figs. 2 and 3 have been created to visually represent the distribution of each feeding behavior in China. Only one set of data from Yuan Jing and colleagues was included(Yuan et al., 2020; Jing Yuan, Yuhai Zhang et al., 2019), as one paper only presented subgroup analyses of the same data set presented in the other paper. One study (Guo et al., 2017)did not give the size of each subgroup, so total values could not be calculated for each feeding behavior and this study was not included in Fig. 2.

3.3. Predictors of feeding behavior

The distribution of feeding behaviors may also be associated with demographic or health factors such as socioeconomic status, ethnicity, and parent- or child body composition.

3.3.1. Demographic factors

Family income, parents’ educational level, and differences in the main caregivers may be related to the caregivers’ feeding attitudes and methods. In families with higher income, parents were more likely to adopt an indulgent feeding style (Z. Zhang et al., 2015) and to prepare balanced meals for their children (J. Xie et al., 2019). One study found that income was negatively correlated with monitoring and using pressure to eat, but found no association with use of restriction (Xiang et al., 2019). One study showed that family income was not associated with the use of monitoring, pressure to eat, or using food to control negative emotions (H. Liu & Chen, 2014).

A higher educational level was positively associated with the active response feeding style (H. Liu & Chen, 2014; Tong, Mi, Cheng, Hou, & Zhao, 2013; Z. Zhang et al., 2015), and negatively associated with an uninvolved style (Tong et al., 2013; Z.; Zhang et al., 2015). One study found that highly educated fathers were more likely than other types of caregivers to adopt authoritarian and indulgent feeding styles(C. Li et al., 2020). One study found that more educated parents were less likely to use pressure to eat (Xiang et al., 2019). Two studies found that parents with higher education levels were more likely to adopt monitoring behaviors (H. Liu & Chen, 2014; Tong et al., 2013), but another found a negative association between these variables(Xiang et al., 2019).

One study found that when the child’s main caregivers were parents, they tended to adopt active response feeding styles, while grandparent primary caregivers were more likely to pressure to eat (Z. Zhang et al., 2015).
This is consistent with findings that grandparents more often reported pressuring children to eat a certain amount of food at each meal, regardless of the children’s hunger and fullness signals (J. Ma et al., 2015). However, another study found that when mothers were the main caregivers, they were more likely to adopt authoritarian feeding methods than were grandparents (C. Li et al., 2020). The same study found that grandparents used more indulgent feeding styles than did fathers (C. Li et al., 2020).

### 3.3.2. Ethnic differences

Different customs, cultural backgrounds, religious beliefs and eating habits may influence parents’ feeding behavior. Studies in China have shown that parents of Han ethnicity were more likely to use restriction and pressure to eat than were Uyghurs (Lin et al., 2018). Other ethnic differences have not yet been explored.

### 3.3.3. Child age

Some feeding practices may be more suitable for younger children, whereas others may be more common as children get older. Three studies (S. Wang et al., 2012; B. Wu et al., 2012; Y. Wu et al., 2014) found that threats and bribes were less common in families of older children.

For all other feeding behaviors, the results were mixed. Three studies (S. Wang et al., 2012; Y. Wu et al., 2014; Zhu et al., 2015) with large samples (total 9558) found that parents of older children used pressure to eat more frequently while two studies with smaller sample sizes (1, 303) found no significant differences among age groups (D. Hu et al., 2014; B. Wu et al., 2012). In one of these studies without statistically significant differences (B. Wu et al., 2012), the distribution of pressure to eat tended to increase with age, consistent with the other studies. The other study (D. Hu et al., 2014) that found no significant age trends covered a wider age range (1–7 years) than the other studies focused on 0-4 year-olds, and the observed pattern suggested that the distribution of pressure to eat peaked at age three and then declined again.

One article (Zhu et al., 2015) reported significant differences in using food to control negative emotions among different age groups of children, which showed an inverted U-shaped distribution in the prevalence of this feeding practice, reaching the highest level at the age of 2–3 (8.85%).

Regarding “meal and snack routines”, three studies found that parents of older children were less likely to allow children to move around while eating (S. Wang et al., 2012; B. Wu et al., 2012; Zhu et al., 2015) than parents of younger children, but one study (Y. Wu et al., 2014) found no significant age differences. Two studies found that parents of older children were more likely to allow children to choose what to eat (S. Wang et al., 2012; B. Wu et al., 2012), but one study found no differences between age groups (D. Hu et al., 2014). Wu and colleagues found an inverted U-shaped distribution in the prevalence of this feeding practice, peaking at around 3 years (Y. Wu et al., 2014).

Three studies found that parents of older children were more likely to report the unstructured practice of allowing children to snack whenever they want (S. Wang et al., 2012; B. Wu et al., 2012; Y. Wu et al., 2014). While one study found no significant age differences, they found a non-linear pattern for this feeding behavior, first increasing until a peak at age three (54%), followed by a decrease after 4 years of age, and another increase at 6 years of age (55%) (D. Hu et al., 2014).

Statistically significant differences between age groups in the behavior “encouragement: rarely encouraging children to taste new foods” were found in two studies (D. Hu et al., 2014; S. Wang et al., 2012), but the researchers did not present pairwise comparisons between particular subgroups. Looking at the general trajectory of means between age groups, one study (S. Wang et al., 2012) showed no clear developmental pattern, whereas the other showed (D. Hu et al., 2014) an increase in the use of this practice from age 1–4 years, after which it was relatively stable (57–61%). Two other studies (B. Wu et al., 2012; Y. Wu et al., 2014) found no significant age differences.

### 3.3.4. Body composition

#### 3.3.4.1. The child’s body composition

Both the actual child’s weight status and their perceived weight can affect the way parents feed. The evidence regarding the relationships between pressure to eat and child weight status was mixed. Two studies reported more frequent use of pressure to eat in families of overweight/obese children than in families of normal weight children (Lin et al., 2018; Mao et al., 2017). This is consistent with the finding that of the four studies that measured pressure to eat using the Children’s Eating Behavior Questionnaire (S. Wang et al., 2012; J. Wen et al., 2020; B. Wu et al., 2012; Zhu et al., 2015), the only study reporting a prevalence above 10% (at 34.8%) (J. Wen et al., 2020) was specifically focused on overweight/obese children. These findings could support hypotheses about “pressure to eat” as a risk factor for childhood obesity (C. Zhang et al., 2013). However, other studies found a negative correlation between children’s BMI and pressure to eat (X. Wang & Zhou, 2018; Q. Xie et al., 2018), which could reflect a parent adapting feeding practices in response to the child’s weight status (P. W. Jansen et al., 2014). A final study found no difference between weight groups (J. Ma et al., 2015). Parents of overweight/obese children were less likely to report using monitoring than parents of normal-weight children (Lin et al., 2018). Another study found significant differences in prevalence of monitoring among children of different weight groups (X. Wang & Zhou, 2018), but did not specify the direction of the difference.

Studies found no significant differences between child weight status groups for indulgent style (Mao et al., 2017), lack of emotional communication (Mao et al., 2017), restriction (X. Wang & Zhou, 2018; Yuan et al., 2020), or threats and bribes (Mao et al., 2017).

#### 3.3.4.2. Parents’ perceptions of their child’s weight

Among overweight children, mothers who underestimate their children’s weight were more likely to adopt pressure to eat and less likely to monitor their children’s diet than parents who correctly perceived their children’s weight (Chen et al., 2016; X.; Wen & Hui, 2011).

#### 3.3.4.3. The caregiver’s body composition

The weight status of the caregiver can also affect their feeding behaviors. One study found that overweight/obese mothers used more restriction and threats and bribes, but were less likely to encourage their children to diversify their diets or to model healthy eating (X. Zhou et al., 2018b). A second study also found mothers with higher BMI used more restriction (Xiang et al., 2019). Guo et al. found no significant differences in encouraging healthy eating between different parent BMI groups (Guo et al., 2017).

### 4. Discussion

The current review summarizes the distribution of feeding behaviors in China and related predictors. In terms of prevalence, the most commonly reported feeding styles of Chinese caregivers were the active response feeding style (65.8% on average), with the least common being authoritative (11.9% on average). The most common feeding practice was praise (71%), followed by encouraging children to taste new foods (66.9% on average), and the least common was being unwilling to encourage children to eat independently (18.5% on average). Based on scores, the most common style was active response (3.5) and the least common was indulgent (2.0). For feeding practices, encouragement of balanced diet was the most commonly reported by parents (4.2), followed by encouragement of healthy eating (4.1) and monitoring (3.8); with the least common being using food to control negative emotions (2).

#### 4.1. Unstandardized tools

In addition to validated questionnaires commonly used in other
| First author, year | City | Sample size/Age range (mean ± SD) | Questionnaire | Assessment method | Authoritative | Authoritarian | Indulgent | Uninvolved | Responsive feeding | Active response | Positive interactions | Negative interactions | Lack of emotional interaction |
|-------------------|------|----------------------------------|---------------|------------------|---------------|---------------|-----------|------------|-------------------|----------------|---------------------|---------------------|-----------------------------|
| Bao et al. (2014) | Nantong, Jiangsu Province | 412/6-36M | Study-specific questionnaire | Scoring<sup>bd</sup> | 1.98 | 3.51 | | | | | | | |
| Deng et al. (2012) | Guangdong Province | 70/1-5Y | Study-specific questionnaire | Scoring<sup>ae</sup> | | | | | | | | | |
| Guo et al. (2017) | Wuhan, Hubei Province | 208/1-2y | Parental Feeding Style Questionnaire (PFSQ) | Scoring<sup>bd</sup> | | | | | | | | | |
| D. Hu et al., 2014 | Tongling, Anhui Province | 1002/1-6Y | Study-specific questionnaire | Prevalence<sup>ad</sup> | | | | | | | | 9.90% | |
| Z. Hu & Lu, 2014 | Ningbo, Zhejiang Province | 107/6-24M | Study-specific questionnaire | Prevalence<sup>ad</sup> | | | | | | | 79.40% | 86% |
| Lo et al. (2016) | Hong Kong | 4553/2-8Y | Parental Feeding Style Questionnaire (PFSQ) | Scoring<sup>bd</sup> | | | | | | | | | |
| C. Li et al., 2020 | Liaoning Province; Shanghai; the Nei Monggel Autonomous Region; Guangdong Province; Sichuan Province | 1057/3-5Y | Caregiver’s Feeding Style Questionnaire (CFSQ) | Prevalence<sup>a</sup> | 10.30% | 36.10% | 35.80% | 17.80% | | | | | |
| G. Li et al., 2015 | Fuzhou, Fujian Province | 636/1-4Y | Study-specific questionnaire | Prevalence<sup>ad</sup> | | | | | | | | | 22.50% |
| Yanting Liang et al., 2017 | Nanning, Guangxi Zhuang Autonomous Region | 1250/6-36M | Study-specific questionnaire | Prevalence<sup>c</sup> | | | | | | | 24.32% | 65.76% | | Lack of emotional communication before meal: 45.28% |
| Young Liang et al., 2013 | Nanning, Guangxi Zhuang Autonomous Region | 843/6-18M | Study-specific questionnaire | Prevalence<sup>ad</sup> | | | | | | | 59.08% | | | Give verbal encouragement during feeding: 45.08% Give nonverbal encouragement during feeding: 45.90% |
| S. Liu et al., 2012 | Beijing | 359/2-3Y | Study-specific questionnaire | Scoring<sup>bd</sup> | | | | | | | 2.03 | 3.45 | | Interaction with the child during | |
| Shanghai | 197/6-18M | Study-specific questionnaire | Scoring<sup>ae</sup> | | | | | | | 10(8-10) | | | |

(continued on next page)
Table 2 (continued)

| First author, year | City | Sample size/Age range (mean ± SD) | Questionnaire | Assessment method | Authoritative | Authoritarian | Indulgent | Uninvolved | Responsive feeding | Active response | Positive interactions | Negative interactions | Lack of emotional interaction |
|---------------------|------|----------------------------------|---------------|-----------------|---------------|---------------|-----------|-------------|---------------------|----------------|---------------------|------------------------|-----------------------------|
| J. Ma et al., 2015  | Beijing | 176/0-3Y | Study-specific questionnaire | Prevalencead | 47.20% | | | | | | | | 46.00% |
| Mao et al. (2017)  | Nanjing, Jiangsu Province | 2423/1-6Y | Child Feeding Questionnaire, CFQ | Prevalencef | | | | | | | | | 30.00% |
| Shi et al. (2017)  | Nanjing, Jiangsu Province | 2423/1-6Y | Child Feeding Questionnaire, CFQ | Prevalencead | | | | | | | | | 8.10% |
| S. Wang et al., 2012 | National survey | 4969/0-3Y | Children’s Eating Behavior Questionnaire | Prevalencead | | | | | | | | | 13.50% |
| Wei et al. (2018)  | Shenyang, Liaoning Province | 875/3-5Y | Caregiver’s Feeding Style Questionnaire (CFSQ) | Prevalence | | | | | | | | | 13.50% |
| J. Wen et al., 2020 | Chongqing | 92/6-24M | Children’s Eating Behavior Questionnaire | Prevalencead | | | | | | | | | 4.30% |
| B. Wu et al., 2012 | Nanning, Guangxi Zhuang Autonomous Region | 301/1-4Y | Children’s Eating Behavior Questionnaire | Prevalencead | | | | | | | | | 14.60% |
| Y. Wu et al., 2014 | Suzhou, Jiangsu Province | 200/7M-4Y | study-specific questionnaire | Prevalencead | | | | | | | | | 6.50% |
| Z. Zhang et al., 2015 | Fuzhou, Jiangxi Province | 405/2-6Y | study-specific questionnaire | Scoringae | | | | | | | | | 23.8 |

a The feeding behaviors were scored on a 5-point Likert-type scale (responses were recorded using the following scale: 1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always).
b The feeding behaviors were scored on a 4-point type scale (responses were recorded using the following scale: 1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often).
c Measurement data were presented as mean of the items.
d Measurement data were presented as total score of the items.
e The prevalence of feeding behaviors assessed based on a “yes” or “no” question.
f The prevalence of feeding behavior was defined based percentage of participants giving a score of 4 or more on a 5-point Likert scale (“often” or “always”).
g The authors did not explain how the prevalence was calculated.
Table 3
Characteristics of articles that did not present descriptive statistics on feeding practices/styles used.

| First author, year | City       | Sample size/ Age range (mean ± SD) | Questionnaire                                                                 |
|--------------------|------------|------------------------------------|-------------------------------------------------------------------------------|
| Q. Xie et al., 2018| Shanghai   | 872/5.23 ± 0.87                    | CFQ                                                                          |
| H. Liu & Chen, 2014| Shanghai   | 2324/12-36m                        | not described                                                                |
| Y. Liu, 2012       | Lanzhou, Gansu Province | 202/6-24m | Study-specific questionnaire                                                      |
| Zhao et al., 2013  | National   | 4017/6-24m                        | Study-specific questionnaire                                                   |
| Z. Wu et al., 2008 | Shanghai   | 423/0-6y                           | Study-specific questionnaire                                                   |

countries, such as the CFQ or CFSQ, the Chinese studies also used several novel questionnaires. Some of these local questionnaires were designed based on foreign feeding behavior questionnaires, whereas others added new concepts relevant to Chinese caregivers, such as allowing children to move around while eating or snack whenever they want. This diversity of measures provides learnings on a wider range of feeding behaviors than have been studied in other countries where a handful of questionnaires are used by most researchers.

Although the challenges around the heterogeneity of measures used to assess feeding behaviors are common around the world, international reviews of the literature show that most commonly used feeding practice measures have had at least preliminary assessments of reliability, but this is often limited to measures of internal consistency, and thorough validation or reliability assessments are often lacking (Heller & Mobley, 2019; A. E.; Vaughan, Tabak, Bryant, & Ward, 2013). This lack of questionnaire validation is even more evident in the Chinese literature identified in the current review, where few of the novel questionnaires were supported by any reliability or validity data.

The biggest challenge in the current review was the lack of consensus around the definitions of the feeding behaviors, making it difficult to consolidate findings across studies on related variables. The definition of each feeding behavior should be clear, as well as the criteria for judging whether the caregiver has used a certain feeding behavior, in order to obtain meaningful results. However, many Chinese articles did not provide a precise definition of each feeding behavior, and most of the novel local questionnaires were not published or publicly available.

Overall, feeding styles were less commonly studied than feeding practices. Four studies included in the current review used common international feeding style questionnaires (CFSQ and PFSQ) to classify parents into feeding styles (Guo et al., 2017; C. Li et al., 2020; Lo et al., 2015; Wei et al., 2018), and one study used a locally-developed questionnaire which also classified caregivers along similar feeding style dimensions (Z. Zhang et al., 2015). Other studies addressed novel feeding style descriptions, such as “lack of emotional communication during feeding”. Some studies also mixed feeding styles and feeding practices in their measures (Bao et al., 2014; Mao et al., 2017) and/or confuse these concepts in their translations (Bao et al., 2014; S.; Liu et al., 2012), making it difficult to fully dissociate these constructs in a review. For example, Mao et al. (Mao et al., 2017) classified “using tools to encourage children to eat” as instrumental feeding (practice), but in Wu Ying’s research, this behavior was classified as indulgent feeding (style) (Y. Wu et al., 2014). As this item describes an observable feeding behavior, rather than an overall approach to feeding, we considered the results for this behavior from both studies under the threats and bribes feeding practice in the current framework (A. Vaughan et al., 2016). There are also some practices which cannot be classified easily. For example, “verbal communication while feeding” included two items, “talked or sang to child while feeding” and “praising the child’s good eating behaviors”. According to our classification scheme, the former item should be related to “positive interactions”, while the latter related to “praise”, so an arbitrary decision had to be made to classify it as “praise”.

The distribution of feeding practices and styles look quite different, depending on whether studies reported scores or prevalence outcomes. Although the majority of studies included in this review measured feeding behaviors using 5-point Likert scales, many of the studies reporting prevalence rates have artificially dichotomized the resulting scores, generally using a cutoff of scores of 4 or more to represent a caregiver that uses the feeding behavior. Studies using a ‘4 or more’ cut off would be expected to generate a lower prevalence than a study using ‘yes/no’ data, because some caregivers may choose ‘yes’ even if they occasionally practice certain feeding behaviors, which would result in higher prevalence rates. In either case, this kind of scoring method loses important information about the frequency of caregivers’ feeding behaviors. Studies have shown that using dichotomous variables for research may obscure individual differences can complicate estimation and interpretation of relationships among variables (MacCallum, Zhang, Preacher, & Rucker, 2002). Therefore, when studying the distribution of feeding behaviors/styles, the method of scoring provides richer data than reporting prevalence.

4.2. Family factors

There were four articles that illustrated the relationship between feeding behaviors and family income (H. Liu & Chen, 2014; Xiang et al., 2019; J. Xie et al., 2019; Z. Zhang et al., 2015). Each study used different questionnaires, with diverse measuring methods (scoring/prevalence, mean/total score, see Tables 1 and 2), and findings were inconsistent across studies. For example, one study of 3-6 year-olds in Hangzhou found that income was negatively correlated with pressure to eat (Xiang et al., 2019), while another focused on younger children (0-3 years) in Shanghai found no significant associations (H. Liu & Chen, 2014). The different results may be due to the age of the participants, the differences in measures used, or other confounding factors.

One of the studies in our review found that there was a positive correlation between indulgent feeding style and family income (Z. Zhang et al., 2015). This pattern is consistent with findings from a study of Chinese-American families in the United States, but may differ from other populations (Pai & Contento, 2014). There are many potential explanations for this pattern, including the rapid increase in incomes in China in the past generation, differences between countries in the relative cost of healthy vs. “treat” foods, or cross-cultural differences in ideal body composition. Unlike studies in other countries which tend to find positive associations between indulgent feeding and child weight, e.g., (Hughes et al., 2021; Hughes, Swewchuk, Baskin, Nicklas, & Qu, 2008; Olvera & Power, 2010), the one study (Mao et al., 2017) that explored this relationship in Chinese families did not find any significant correlations. More research is needed to better understand both the predictors of indulgent feeding in Chinese families and its impact on child health outcomes.

One study found that parents with more nutritional knowledge used more responsive feeding and less indulgent feeding (Z. Zhang et al., 2015), however, other studies found weak correlations between feeding knowledge and feeding behavior (Tong et al., 2013), which suggests that there may be a gap between parents’ knowledge and their behavior (Z. Xu et al., 2008). One study found that parents generally advocate that children’s eating environment should be “easy and happy” (98.3%), with lots of encouragement (96.8%) and with few reprimands (88.3%) or interference (95.6%), but still found that 43.5% of the surveyed children ate only what was served to them. This is consistent with global research, showing that it is difficult for caregivers to translate the knowledge they have acquired into actual feeding behavior.
The findings related to the role of child weight status on feeding practices are quite mixed. For example, for pressure to eat, some studies...

4.3. Child age

The results for age-related changes in feeding behaviors were quite mixed, with several studies finding no significant associations with age. This may be due, in part, to differences in the age ranges covered between studies. In studies with relatively narrow age ranges, caregiver behaviors may not change much. In studies covering a wider age range (such as 0–6 years old), the results suggest that there may be non-linear patterns of feeding practice use, such as an inverted U with peaks at a certain age. This is important to note, as some studies may have failed to detect associations with age if they assumed a linear relationship with age or used the wrong cutoffs between age groups. In order to determine the relationship between the distribution of feeding behaviors at different ages, studies with longer age spans and larger sample sizes are needed, as well as appropriate statistical methodologies to explore non-linear relationships.

4.4. Child body composition

The majority of studies included in the current review focused exclusively on the feeding practices of mothers, even though grandparents are common caregivers in China (Jiang et al., 2007; Yue et al., 2018), and fathers are getting more engaged in childcare (X. Li, 2020). This may be due, in part, to differences in the age ranges covered between studies. In studies with relatively narrow age ranges, caregiver behaviors may not change much. In studies covering a wider age range (such as 0–6 years old), the results suggest that there may be non-linear patterns of feeding practice use, such as an inverted U with peaks at a certain age. This is important to note, as some studies may have failed to detect associations with age if they assumed a linear relationship with age or used the wrong cutoffs between age groups. In order to determine the relationship between the distribution of feeding behaviors at different ages, studies with longer age spans and larger sample sizes are needed, as well as appropriate statistical methodologies to explore non-linear relationships.
show greater use in parents of normal weight children (X. Wang & Zhou, 2018), others find higher use in parents of overweight/obese children (Lin et al., 2018; Mao et al., 2017), and yet other studies find no difference between these groups (J. Ma et al., 2015). These studies differed along several variables, such as location, sample size, and questionnaires used, thus it is difficult to hypothesize on the reasons for the discrepancies between the results. In contrast to the current findings, a recent meta-analysis of 42 global studies showed that pressure to eat tends to be associated with lower child weight (Ruzicka, Darling, & Sató, 2021). This discrepancy between cultures may be due to a variety of factors, including differences in ideal body composition. One study found that Chinese children whose parents preferred a larger ideal body shape gained more weight over the course of a longitudinal study (Gao et al., 2020). Due to the rapid recent development of China, Chinese parents may still consider a chubby baby to look healthier and to be a symbol of a well-off family (Gao et al., 2020). Thus, culture may indirectly affect caregivers’ choice of feeding behaviors. Additional research is needed in order to better understand this association.

Beyond the actual weight of the child, it is possible that perceptions of the child’s weight status might also influence feeding practices. Compared to parents who correctly perceive their child’s weight, mothers who underestimate their children’s weight are more likely to adopt pressure to eat and less likely to use monitoring (Chen et al., 2016; X. Wen & Hui, 2011). Yilmaz et al. have shown that parents in Turkey who underestimate their children’s weight are more likely to use emotional feeding practices, and are less likely to adopt restriction (Yilmaz, Erkorkmaz, Ozçetin, & Karaaslan, 2013). Studies in Ireland found that about half of the parents of preschoolers underestimated the weight of their children (Queally et al., 2018), and that underestimation was more likely if the child was overweight (J. Wang & Zhu, 2019). They also found that parents of five-year-old children were less likely to misclassify child weight than parents of three-year-olds (Queally et al., 2018). Two Chinese studies also found that parents commonly misclassified the weight status of their infants and toddlers (6–36 months), with the most common error being underestimation (Z. Y. Li et al., 2017; M. Xu, Cui, & Zhou, 2020).

### 4.5. Caregiver body composition

Chinese studies show that the higher BMI of mothers, the more likely it is to adopt restriction (Xiang et al., 2019; X. Zhou et al., 2018b). Warkentin also found that overweight mothers in Brazil were more inclined to adopt restrictive feeding methods (Warkentin, Mais, Latorre, Carnell, & de Aguiar CarracedoTaddei, 2018). Haycraft et al. shows that compared with overweight/obese mothers, healthy weight British mothers scored higher on providing food as a reward, but there was no statistical difference (Haycraft, Karasouli, & Meyer, 2017).

### 4.6. Strengths & limitations

Among the strengths of the current review are the large sample sizes of the included studies and the wide geographic distribution of the study locations, covering 62% of the provincial administrative regions in China. The wide range of questionnaires implemented also provided insight into a variety of different feeding behaviors.

The limitations of the current review largely relate to methodological limitations of the included studies. All studies used cross-sectional research designs, so it was not possible to draw any causal conclusions nor to determine the directionality of relationships between variables. This will need to be verified by future intervention or prospective studies. Further, all outcomes were assessed through study-specific questionnaires, which are highly subjective. Parents may not be aware of whether they use certain feeding behaviors, may have different understandings of the meanings or definitions of behaviors, and may have difficulty estimating the frequency with which they use such behaviors during feeding (Fries, van der Horst, Modling, Hughes, & Johnson, 2019; Schwarz, 1999). Previous studies in other populations have found substantial differences between parent-reported feeding practices and those observed by researchers (Bergmeier, Skouteris, & Hetherington, 2015; Fries, van der Horst, et al., 2019). Even among-study-specific questionnaire, different question wordings and response options may influence caregiver responses and estimates of behavior frequency (Schwarz, 1999). This may explain some of the variability between studies using different measures, even if conducted in similar populations. These challenges in interpreting such subjective measures highlights the potential value of observational research to compare feeding behaviors across different groups of individuals.

For several feeding practices or feeding styles, there were large differences in the distribution between studies (e.g. the scores ranging from 2.57 to 3.71), but we could not find the specific reasons for the differences. It is possible that these results reflect true differences between study populations (e.g., based on geographic location, age, or socioeconomic factors), or in other cases, this could be due to methodological differences such as the wide variety of questionnaires used across studies.

Finally, it is possible that our search strategy missed some relevant publications, especially newer ones that may not have yet been indexed in the databases. We tried to mitigate this possibility by hand-searching the reference sections of the included studies (which revealed an additional 5 references which met our inclusion criteria), but it is possible that there were additional papers that were overlooked.

### 5. Conclusions and future research directions

The Chinese literature includes a wide range of feeding behaviors, including some that seem to be unique to Chinese questionnaires. This introduces the unique research ideas of Chinese scholars studying...
feeding behaviors and provides new directions for developing and revising feeding practice questionnaires for Chinese populations.

The most commonly reported feeding style of Chinese caregivers was the active response feeding style. The most commonly reported feeding practices were praise, encouraging children to taste new foods. It is important to note the amount of variability in findings between studies, which can likely be largely attributed to differences in methodology, including inconsistencies in the questionnaires used, how feeding behaviors were defined, and how the data was analyzed (e.g., scores vs. prevalence). There is a need for well-designed feeding practice questionnaires that have been validated in Chinese populations and that provide clear definitions of behaviors. Of course, it would be impossible to create a single measure that could address all research questions in all population segments and age groups, but there is room for improvement in the creation of well developed, described, and validated instruments in China. If such questionnaires became widely used, this would facilitate comparisons between studies and populations. National surveys would also make it possible to explore regional differences.

Finally, the studies identified in the current review used two ways to evaluate the distribution of feeding behaviors: scores and prevalence rates. The scoring method provides more information on the frequency of feeding behavior use, and therefore is a more valuable tool for future research.

Ethical statement

Ethics approval was not required for this research, as it is a review of existing literature, therefore original studies would have to have sought ethical approval.

Author contributions

LS and LRF contributed to the conceptualization of this review. NZ and YL defined the search terms and conducted the literature search. HZ and HW screened the articles identified by the search. SG and YW extracted and analyzed the data from the identified articles and drafted the manuscript. LRF, LS, and XJ critically revised the paper. All authors reviewed and approved the final version of the review.

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Declaration of competing interest

At the time of writing, LF and YL were employees of Nestle Research. All other authors have nothing to disclose. The authors declare no conflict of interest based on the outcome of this review.

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