Childhood picky eating behaviour and its impact on the growth of young children: A scoping review

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Abstract:

Background: Malnutrition occurs due to inadequate food intake and low daily energy intake, often associated with picky eating behaviour (PEB). Picky eaters have limited food choices and poor dietary diversity, leading to malnutrition. Therefore, this article aims to explore the impact of childhood eating behaviour on a young child's growth. **Method:** Articles were identified through six electronic search engines using 12 keywords. Articles were included if they met the following criteria: (1) sample of study involved

young children (below six years old); (2) study outcome focusing on the impact of eating behaviour on the growth of the children (3) published in English. Studies were excluded if they were review articles, qualitative studies, and involved children with clinical health problems. **Result:** A total of 413 articles were screened, and 8 full-text articles were evaluated. The prevalence rates of selective eaters varied greatly from 25% in India to 77% in Iraq. The screening tools used for identifying PEB varied, with the Children's Eating Behaviour Questionnaire (CEBQ) being the most commonly used tool. Short-term implications of PEB on children include the risk of poor diet intake and limited consumption of a variety of food groups, which can lead to adverse health outcomes. Meanwhile, long-term implications include the development of eating disorders in adulthood. **Conclusion:** Our findings reveal that PEB has had a significant impact on the growth of young children. Despite the increasing concern about the implications of PEB, there is a lack of sufficient research studies on the effects of this behaviour on the nutritional status of young children.

Keywords: eating behaviour; picky eaters; nutritional status; growth; young children

Introduction:

Proper nutrition is essential throughout the different stages of life. In the case of infants, exclusive breastfeeding is recommended for the first six months, followed by the introduction of complementary feeding up to two years of age (World Health Organization (WHO), 2021; National Coordinating Committee on Food and Nutrition, 2010). The age group of 0-5 years is particularly critical for ensuring optimal nutrition to support growth and good health in children. However, global efforts to improve nutrition quality and prevent undernutrition in young children are still challenging. The double burden of malnutrition, encompassing underweight, stunting, wasting, and obesity (WHO, 2016), contributes to nearly half of all deaths in children under 5 worldwide (United Nations Children's Fund (UNICEF), 2022).

Undernutrition often arises due to insufficient food intake and low daily energy intake (WHO, 2016; Norliza et al., 2021; Mok et al., 2022), and picky eating behaviour (PEB) may play a role in this context. Individuals with PEB exhibit restricted food selection and limited dietary variety, which can lead to malnutrition (Hikmah & Nur Islami, 2022; Mok et al., 2022). Food neophobia and picky eating are common behaviours observed during children's growth and development. Food neophobia refers to the rejection of new foods, while PEB involves inadequate consumption of both familiar and unfamiliar foods (Dovey et al., 2008). While picky eating is not a medical term and encompasses a wide range of behaviours, it can negatively impact a child's diet quality and restrict the consumption of diverse food groups, leading to adverse health outcomes. It is crucial to review how researchers define picky eating, determine the prevalence of picky eaters, and identify potential effect modifiers that could impact the association between eating behaviours and weight status. These modifiers include the types of foods offered to the child, parenting styles, breastfeeding, and complementary feeding. Such a review will help shed light on the topic and provide valuable insights. Therefore, this review aims to explore the effects of childhood eating behaviour on a child's growth.

Methodology:

The protocol of this scoping review was chosen due to emerging evidence on childhood PEB and its impact on the growth of young children, whilst still ensuring a rigorous and transparent method for mapping (Arksey & O'Malley, 2005). The reporting adheres to the five-stage framework by Arksey & O'Malley (2005), incorporating the checklist from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for scoping reviews (Tricco et al., 2018).

Stage 1: Identify the Research Questions

The research questions used to guide the search strategy include: 1) What tools or methods have been used to identify young children with picky eating? and 2) What is the impact of eating behaviour towards nutritional status among young children? The studies were then further evaluated by referring to the guided research questions and eligibility criteria.

Stage 2: Identifying Relevant Studies

Various databases such as PubMed, Science Direct, EBSCO (Medline), Scopus, Google Scholars, and ProQuest were searched to select studies from 2017 to February 2023. There were no restrictions imposed on the study design and publication status. In total, 8

articles were critically reviewed. The search terms used were "Picky" (picky, fuss*, choosy, selective) AND "Growth" (body weight, nutrition*, nutritional status) AND "Child" (child*, young child*, paediat*, pediat*, todd*).

Stage 3: Study Selection

Research articles were evaluated using the PICOS (Population, Intervention, Comparators, Outcome, and Study Design) model (Table 1) (Liberati et al., 2009). The following studies were included if they met the following criteria: (1) sample of study involved young children (below six years old); (2) study outcome focusing on the impact of eating behaviour on the growth of the children (3) published in English. Studies were excluded if they were review articles, qualitative studies and involved children with clinical health problems such as autism, down syndrome, dyslexia, global development delay (GDD) or health problem interfering with eating habits.

Figure 1 shows the modified PRISMA flow diagram that provides an overview of the process for selecting articles. Initially, 413 records were screened and 131 duplicates were removed. Out of the remaining 282 articles, only ten were relevant to the study topic. Two reports lacked full articles and were excluded. Therefore, eight publications were included that focused on the association between eating behaviour and nutritional status in young children.

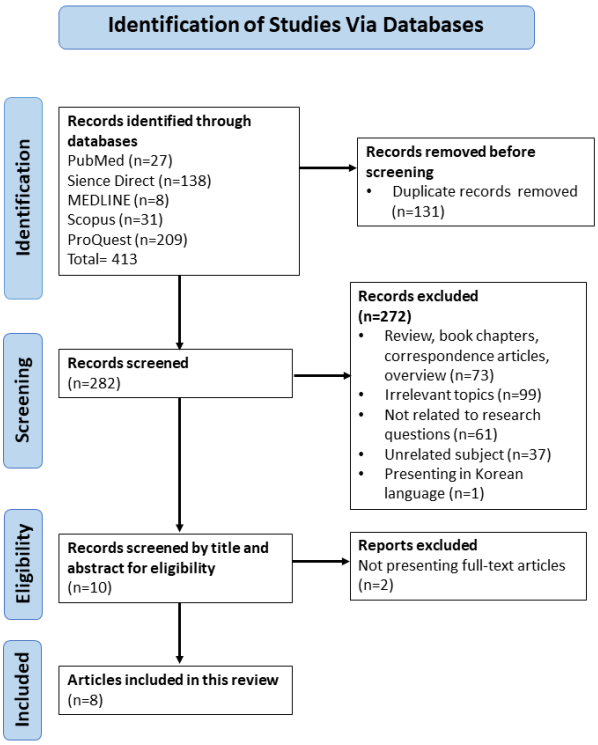

Figure 1: PRISMA Flow Diagram

Table 1: PICOS criteria for inclusion and exclusion of studies

Category	Inclusion	Exclusion
Participants	Children aged 0–6 years old.	Children with chronic illnesses or special nutritional needs that will impact their dietary diversity.
Intervention	None	None
Comparator	Prevalence of PEB. Screening tools. Association between PEB and young children's nutritional status.	None
Outcomes	Determination of PEB. Nutrition-related outcomes such as anthropometric measurements (body mass index, waist circumference), dietary intakes, or dietary diversity score.	None
Study design	Cross-sectionals, mixed-method, randomized controlled trials, pre-post design quasi-experimental studies.	Review articles. Qualitative studies.

Stage 4: Charting the Data

The main author conducted a thorough search, screening the articles for both quality and relevance based on the established criteria and research question. Meanwhile, the other reviewers independently analyzed each paper and recorded key

details such as the author, year of publication, location of the study, study design, study population, study size, screening tools used to identify picky eating, and the outcomes/findings of child behaviours associated with picky eating.

Stage 5: Collating, Summarising and Reporting Results

After screening several studies, eight of them were deemed relevant and selected for further analysis. The authors reviewed these eight publications and extracted the data into a spreadsheet (Table 2). The findings were then independently analyzed by all authors, who identified the factors associated with PEB and its impact on nutritional status. These factors were characterized to help develop successful interventions, and the results were presented in a supplementary table. Finally, the authors discussed the findings, and a consensus was reached.

Results:

Study Characteristics

The selected studies had various characteristics, as shown in the Supplementary table. This review includes seven cross-sectional studies (mentioned in the seven citations) and one cohort research (Derks et al., 2018). The participants' ages ranged from 12 months (Kwon et al., 2017; Shettiwar & Wade, 2019; Kumar et al., 2018) to 6 years old (Kumar et al., 2018; Hikmah & Nur Islami, 2022; Derks et al., 2018), and the sample sizes ranged from 192 (Hikmah & Nur Islami, 2022) to 3,331 children (Derks et al., 2018). In total, these eight articles had 7,196 participants.

Most studies on eating behaviour (87.5%; n=7) were found in Asia, specifically Malaysia, Iraq, India, Taiwan, Vietnam, and Singapore. While only a small portion of the study (12.5%, n=1) was completed in the Netherlands.

Prevalence of Picky Eating Behaviour

The prevalence of picky eaters varied across different studies, as presented in Table 1. Reported prevalence rates ranged from 25% in India (Shettiwar & Wade, 2019) to 77% in Iraq (Yaqob Qazaryan & Kazim Karim, 2019). Additionally, Kumar et al. (2018) reported age-specific prevalence, revealing an increase in PEB from 32% to 69% as age increased. However, two articles (Derks et al., 2018; Tan et al., 2022) did not provide data on the prevalence of picky eaters. Instead, they focused on examining the association between picky eating behaviour and nutritional status outcomes in their respective study populations.

Screening tools for PEB

The identification of picky eaters in the studies involved the use of various screening tools. In total, nine studies employed four different tools and utilized a total of 14 scales, as summarized in Table 2. The CEBQ by Wardle et al. (2001) was the most used tool, accounting for 75% (n=6) of the studies (Hikmah & Nur Islami, 2022; Yaqob Qazaryan & Kazim Karim, 2019; Chao, 2018; Tan et al., 2022; Derks et al., 2018; Shettiwar & Wade, 2019).

The remaining 25% (n=2) of the studies employed different screening tools, including self-administered surveys (Kwon et al., 2017), a modified version of the United Kingdom Department of Health Survey of the Diets of British School Children (UKSQ) (Chao, 2018), and Stanford Feeding Questionnaire (SFQ) on Child-Parent Feeding Behavior (Kumar et al., 2018). Despite the variation in tools used, all eight studies relied on parental reports regarding their children's picky eating behaviour.

Association of Eating Behaviour and Nutritional Status Among Young Children

As shown in the Supplementary Table, all eight articles indicated a significant association ($p<0.05$) between PEB and the nutritional status of young children. These associations were observed in various parameters, including weight-for-age (WAZ), height-for-age (HAZ), and body mass index (BMI)-for-age (BAZ). Specifically, the studies consistently demonstrated that picky eaters had significantly lower z-scores in WAZ, HAZ, and BAZ compared to non-picky eaters ($p<0.05$) (Hikmah & Nur Islami, 2022; Tan et al., 2022; Yaqob Qazaryan & Kazim Karim, 2019; Derks et al., 2018; Shettiwar & Wade, 2019; Chao, 2018; Kumar et al., 2018; Kwon et al., 2017). Overall, the studies revealed that the picky eater group had lower z-score values below the median (z-score 0) for WAZ, HAZ, and BAZ compared to the WHO Child Growth Standards (2016).

Discussion:

Prevalence of Picky Eating Behaviour

The key findings of this scoping review pertain to the prevalence of picky eating, the diverse screening tools employed to identify picky eaters, and the association between eating behaviour and nutritional status in

Table 2: Instruments and scales used in determining PEB

Author (year)	Screening Tools	n (%)
1. Food responsiveness/ length of time for each meal and eating activities		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Chao (2018), Tan et al. (2022), Derks et al (2018), and Shettiwar & Wade (2019)	CEBQ	6 (75.0)
2. Emotional overeating		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Chao (2018), Tan et al. (2022), Derks et al (2018), and Shettiwar & Wade (2019)	CEBQ	6 (75.0)
3. Food preferences/ high selective intake		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Chao (2018), Tan et al. (2022), Derks et al (2018), and Shettiwar & Wade (2019)	CEBQ	7 (87.5)
Chao (2018)	Modified version of UKSQ	
Kumar et al. (2018)	SFQ	
4. Desire to drink		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Chao (2018), Tan et al. (2022), and Shettiwar & Wade (2019)	CEBQ	4 (50.0)
5. Satiety responsiveness		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Tan et al. (2022), Derks et al (2018), and Shettiwar & Wade (2019)	CEBQ	5 (62.5)
6. Slowness in eating		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Tan et al. (2022), and Shettiwar & Wade (2019)	CEBQ	4 (50.0)
7. Emotional undereating		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Tan et al. (2022), and Shettiwar & Wade (2019)	CEBQ	4 (50.0)
8. Food fussiness/ refusal of specific food groups		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Tan et al. (2022), and Shettiwar & Wade (2019)	CEBQ	5 (62.5)

Kwon et al. (2017)	Self-administered survey	
9. Specific food preparation methods		
Kwon et al. (2017)	Self-administered survey	1 (12.5)
10. Eating a small amount/ number of meals, diversity and amount of food consumed per day		
Kwon (2017)	Self-administered survey	2 (25.0)
11. Emotional or behaviors/ eating behaviors		
Chao (2018)	Modified version of UKSQ	2 (25.0)
12. Neophobic behavior/Fear of feeding		
Kwon et al. (2017)	Self-administered survey	2 (25.0)
Kumar et al. (2018)	SFQ	
13. Enjoyment of food		
Hikmah & Nur Islami (2022), Yaqob Qazaryan & Kazim Karim (2019), Chao (2018), Tan et al. (2022), Derks et al (2018), and Shettiwar & Wade (2019)	CEBQ	6 (75.0)
14. Parental misperception		
Kumar et al. (2018)	SFQ	1 (12.5)

young children. Currently, there is no standardized definition of picky eating, nor is there a universally accepted and well-defined assessment method (Taylor & Emmett, 2019). The prevalence of picky eaters varied widely across studies and can be attributed to differences in study designs, assessment tools, and sociocultural factors employed in various studies. Additionally, this review identified that the age at which children develop persistent picky eating behaviour may vary. Yaqob Qazaryan & Kazim Karim (2019) observed the highest prevalence of picky eaters emerging at 36 months of age. These findings align with a previous systematic review by Fitriana et al. (2019) and Taylor & Emmett (2019), which indicated that the peak prevalence of picky eating occurs at about age 3 years and remains stable with increasing age. At this age, the children were picky as they were reflecting on the parental feeding styles in response to increased child autonomy (Taylor & Emmett, 2019).

Screening tools

Similarly, we found a varying screening tool used to identify picky eaters among the respondents. However, despite the differences, all the screening tools were answered based on parental reports about their children's eating behaviour. Several of these tools have been validated. Examples include CEBQ, a self-administered questionnaire by Kwon et al. (2017), the UKSQ, and SFQ.

Most of the studies reported on the scoring of the assessment tools used to assess eating style in children. For the CEBQ, a self-administered questionnaire by Kwon et al. (2017), eating style is assessed based on the level of scoring. Meanwhile, Chao (2018) has not reported on the clinical practicability and scoring implications for the Modified version of UKSQ. Thus, even though PEB has been considered a complex behaviour, the accurate definition, assessment, and standardized method to identify PEB is not yet established.

Association of Eating Behaviour and Nutritional Status Among Young Children

Children can exhibit picky eating behaviour due to various factors, including food and drink colour preferences (Kumar et al., 2018), taste perception (Keller et al., 2002; Petty et al., 2020), food texture (Kumar et al., 2018), refusal of specific food groups (Yaqob Qazaryan & Kazim Karim, 2019; Shettiwar & Wade, 2019), and preferences for certain food preparation methods (Kwon et al., 2017; Kumar et al., 2018; Shettiwar & Wade, 2019). PEB affects their dietary patterns by limiting the variety of foods consumed, which can lead to a lower quality diet in terms of certain micronutrients and overall energy intake (Norliza, 2021; Mok et al., 2022). Furthermore, pickiness among young children may have negative consequences on developmental quality, physical

activity levels, and general health status (Taylor & Emmett, 2019).

Limitation:

As the selection was restricted to articles in English, relevant publications in other languages may have been missed. Besides, the determinants of picky eaters were varying as different studies used different definitions for picky eating, resulting in a wide range of picky eater prevalence and making it unclear whether this finding would hold true for everyone.

Conclusion:

In this review, we provide insights into the prevalence of picky eaters among young children and its impact on their growth. The identification of picky eaters in the studies involved the use of various screening tools as different researchers may define PEB differently. The evidence gathered from various studies consistently demonstrated that PEB had significantly impacted the growth of young children for all growth indicators. In conclusion, the findings from this review emphasize the importance of addressing PEB in children and taking immediate action to manage them. Interventions such as nutritional education or guidance for parents should be developed by researchers and relevant organizations, including the Ministry of Health, to improve the nutritional status of children globally. Further research is warranted to explore effective strategies for addressing picky eating and its long-term implications on health outcomes.

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APPENDIX

Supplementary table: Characteristics of the studies.

Author (year)	Study Sample	Study Design	Screening tools for PEB	Prevalence of Picky Eater	Outcome/ Findings
Hikmah & Nur Islami (2022)	192 children aged 4-5 years.	Cross-sectional	Children's Eating Behavior Questionnaire (CEBQ).	31.8%	**Behavior assessment:** 1. A lower degree of food responsiveness, enjoyment of food and emotional overeating combined with higher degree of food fussiness and slowness in eating were prevalent among picky eaters ($p<0.05$). **Association PEB and nutritional status:** 1. PEB has significant association ($p<0.05$) with WAZ, HAZ and BAZ. 2. More picky eaters were underweight/stunted/wasted while more non-picky eaters were overweight/obese.
Kwon et al. (2017)	184 children aged 1-5 years.	Cross-sectional	Self-administered survey of 21 items	None	**Behavior assessment:** 1. The proportion of participants with the behavior: "eating small amounts" (29.9%); "limited variety" (66.9%); "preference for a specific food-preparation method" (49.5%); "refusal to eat specific food groups" (44.0%); and "neophobic behavior" (32.6%).

					2. Older children aged 4 to 5 years showed higher rates of "neophobic behavior" (47.5%, p = 0.0032). **Association PEB and nutritional status:** 1. Picky eaters "eating small amounts" aged 4 to 5 years had significantly lower z-scores for all three growth indices. 2. Picky eaters with "refusal of specific food groups" were related with lower HAZ in this age group.
Yaqob Qazaryan & Kazim Karim (2019)	800 children aged 2-4 years.	Cross-sectional	Eating behavior questionnaires inspired by CEBQ.	77%	**Behavior assessment:** 1. Picky eaters were commonly: Eating sweets or snacks instead of meals (52.6%); refusing food, particularly fruits and vegetables (37.8%); reluctant to eat regular meals (27.6%); do not like to try new food (neophobia, 23.3%); ingestion of specific kinds of food (16%); and excessive drinking of milk (14.2%). **Association PEB and nutritional status:** 1. Picky eaters had significantly lower average weight-for-age, height-for-age, and BMI-for-age percentiles.
Chao (2018)	300 children aged 2-4 years	Cross-sectional	Modified version of United Kingdom Department of Health	54%	**Behavior assessment:**

			Survey of the Diets of British School Children Questionnaire (UKSQ) (preferences for food and food types) and CEBQ.		1. The picky eater group behavior included: being unwilling to eat regular meals (18.5%); refusing food, particularly fruit and vegetables (16.7%); eating sweets or snacks instead of meals (14.8%); being unwilling to try new foods (14.2%); excessive drinking of milk (14.2%) and accepting only a few types of food (13.6%). 2. Picky eaters did not like to eat meat (37.1%); vegetables (38.9%); fruit (22.2%) and specific kinds of vegetables or fruit (21.6%). 3. Significant lower number of accepted foods and lower score in food preference were found in picky group (15.1 ± 3.7 vs. 26.7 ± 4.1, P < 0.001; 3.0 ± 1.3 vs. 3.6 ± 1.1, P < 0.001). **Association PEB and nutritional status:** 1. Compared with non-picky eaters, WAZ, HAZ, and BAZ in picky eaters was 0.91, 0.73, and 0.44 SD lower, respectively. 2. There were significant differences of rates in the weight-for-age, height-for-age, and BMI-for-age percentiles <15, between picky and non-picky eaters (P= 0.04, 0.023, and 0.005, respectively).
Tan et al. (2022)	500 children aged 24–59 months	Cross-sectional	CEBQ	None	**Behavior assessment:** 1. “Food approach” eating behaviour were positively correlated as each scale independently.

					2. Meanwhile, the "food avoidant" eating behaviour demonstrated positive inter-correlations between each scale independently. **Association PEB and nutritional status:** 1. There were significant positive association between food responsiveness, emotional overeating, enjoyment of food with BAZ ($p<0.05$; unstandardized regression coefficient: 0.17 to 0.38). 2. There were significant negative association between satiety responsiveness, slowness of eating, food fussiness with BAZ ($p<0.01$; unstandardized degression coefficient: −0.35 to −0.36).
Derks et al. (2018)	7294 children recruited at birth but only 3331 children at age 4 years completed the study to the end at 10 years old.	Cross-sectional	CEBQ	None	**Behavior assessment:** 1. Non-picky eaters scores higher to food approaching behavior, namely: emotional overeating, food responsiveness and enjoyment of food, as well as the subscale satiety responsiveness. **Association PEB and nutritional status:** 1. Cross-lagged models at both directions showed that a higher BMI at the age of 4 years predicted more food responsiveness and enjoyment of food and less satiety responsiveness at 10 years (e.g. satiety responsiveness: $\beta = -0.10$, 95% CI = −0.14, −0.07).

Shettiwar & Wade (2019)	200 parents of children between 1 to 5 years age	Prospective cohort	CEBQ	25 %	**Behavior assessment:** 1. Maximum age of PEB was 49 to 60 months (38%). **Association PEB and nutritional status:** 1. 26% of subjects with PEB had HAZ < -3SD (severely stunted). 2. 38% of subjects with PEB had weight-for-height z-score (WHZ) < -3SD (severely wasted) as compared to only 4% in non-picky eaters.
Kumar et al. (2018)	1652 parents of children between 1-6 years age	Cross-sectional	Stanford Feeding Questionnaire (SFQ) on Child- Parent Feeding Behavior	32.2% at 1 year of age to 69.2 % at 6 years of age	**Behavior assessment:** 1. Two or more criteria were met to determine picky eater, characterized by eating a limited variety of foods (94%) with strong likes (93%) and dislikes (100%), not accepting new foods readily (0%) and strong opinions about the preparation of food (68%). **Association PEB and nutritional status:** 1. The mean weight and height of the children is lower in picky eaters than the non-picky eaters.