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A Scoping Review of Oral Feeding Skill Development in Typically Developing Children Part I: Methodologies, Populations, and Normative Data

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ABSTRACT

Purpose: This scoping review is the first in a two-part series aimed at synthesizing literature on oral feeding skills and informing the development of a classification system of observable skills. This article consolidates research on feeding skill development in typically developing children. The second paper analyzes individual skills identified. This review addresses three questions: (a) What methods have been used to study feeding skill development? (b) What populations of typically developing children without feeding disorders have been studied? (c) What normative data on feeding skills are available?
Method: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews guidelines, studies were included if they examined oral feeding skills in typically developing children born at ≥ 37 weeks gestation, aged at least 4 months, with a focus on skills related to drinking liquids by cup and eating solids, using direct observation.
Results: Fourteen studies met inclusion criteria. Findings revealed significant methodological variability, particularly in the number of skills assessed, feeding procedures used, and participant characteristics. While some normative data exist, they were limited and inconsistently reported. A key challenge was the lack of standardized definitions and categorization of feeding skills, which limited cross-study comparisons.
Conclusions: Multiple approaches have been used to study typical feeding skill development, presenting an opportunity for methodological standardization. Greater clarity around individual feeding skills, addressed in Part 2, may help resolve inconsistencies in developmental timelines and support the development of an observational clinical measure.

The importance of age-appropriate feeding skill expectations has become increasingly evident in the field of pediatric feeding. The pediatric feeding disorder (PFD) consensus has transformed how feeding dysfunction is diagnosed by introducing the first set of diagnostic criteria (Goday et al., 2019). PFD is defined as "impaired oral intake that is not age-appropriate" across medical, nutrition, feeding skills, and psychosocial domains (Goday et al., 2019). Therefore, the reference standard for diagnosing PFD is age-appropriate feeding, which must be defined within each of these domains.

Age-appropriate feeding skills—including oral sensory responses and oral motor movements—serve as diagnostic criteria within the feeding skills domain. The development of these skills is necessary for transitioning from a liquid diet to eating solid foods safely and efficiently. When a child's feeding skills do not support expectations, adverse events may occur such as coughing, choking, gagging, pain, discomfort, and reduced intake. Feeding skill dysfunction is observed in more than 50% of children diagnosed with feeding problems (Benfer et al., 2016; Pados, 2019; Pados et al., 2025; Rommel et al., 2003). Use of parent report measures developed and used by

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Pados and colleagues (Pados, 2019; Pados et al. 2025) and Marshall et al. (2023) to identify feeding skill dysfunction has increased the awareness of PFD for early identification. However, age-appropriate norms for children weaning from a liquid-only diet and available tools for measuring feeding skill dysfunction by clinicians are lacking (Barton et al., 2018; Benfer et al., 2012; Marshall et al., 2023; Rabaey et al., 2023). Without standardized benchmarks, clinicians face challenges in determining whether a child's feeding skills fall within typical developmental ranges or suggest a disorder. This gap may lead to overdiagnosis or underdiagnosis, complicating timely intervention. Furthermore, the absence of a well-defined skill set may lead to feeding interventions based on incomplete or inconsistent information, potentially delaying effective treatment, reducing its impact, or resulting in unnecessary interventions. Existing studies have shown that no single measure comprehensively evaluates feeding skills in children older than 6 months, with significant variation in content, assessment methods, and psychometric properties (Barton et al., 2018; Benfer et al., 2012; Marshall et al., 2023; Rabaey et al., 2023). This reflects the complexity of feeding and the broader scarcity of normative data on typical feeding skill development. Identification of feeding skill dysfunction is particularly important in early childhood, as nutritional needs change significantly. Before 6 months, 100% of a child's nutrition comes from liquids, which then decreases by 50% as they begin to transition to solid foods by 12 months with ongoing transition over the next 2 years to a primarily solid food diet (Delaney et al., 2021; Samour & King, 2012). The skills used by children to consume nutrition during this time are a critical aspect of age-appropriate feeding. Despite its importance, there remains a lack of consensus regarding the precise timeline and the key factors involved in the development of these feeding skills.

Observational studies and parent reports have outlined a general progression of feeding skills from 6 months to over 3 years of age (Carruth & Skinner, 2002; Gesell & Ilg, 1937; Morris, 1982; Stolovitz & Gisel, 1991). These studies have contributed to our understanding of the progression from breast or bottle feeding to drinking from a cup and eventually eating solid foods. However, the exact age at which these skills should be acquired remains unclear, with timelines varying as much as 26 months across different studies (Carruth & Skinner, 2002; Morris, 1982; Stolovitz & Gisel, 1991). The lack of standardized methodology makes it difficult to determine whether the observed variability in skill acquisition timelines reflects true developmental difference or methodological inconsistencies. Original data on feeding skill development were often collected from small sample sizes (Gesell & Ilg, 1937; Morris, 1982), employed varied feeding procedures (Morris, 1982; Stolovitz & Gisel, 1991), and had inconsistent or unassessed rater reliability (Gesell & Ilg, 1937; Morris, 1982; Stolovitz & Gisel, 1991). Moreover, different studies evaluated different numbers and types of feeding skills. Comprehensive reviews by Delaney and Arvedson (2008) and Delaney and Rudolph (2012) highlight these issues.

With the introduction of the PFD consensus definition, a standardized framework now exists that encourages clinicians and researchers to consider feeding skills not only in terms of dysfunction but also in relation to acquisition timeline. This shift calls for a more nuanced understanding of typical and atypical feeding skills across different stages of childhood. Establishing benchmarks for feeding skills at various ages is essential for identifying children at risk of feeding difficulties and providing timely targeted interventions that support healthy development. While these developmental trajectories are increasingly recognized, further research is needed to define specific feeding skill milestones and age-based expectations.

Considering these challenges and inconsistencies, this scoping review aims to consolidate existing research on observational feeding skill development in typically developing children with the end goal for developing an observational clinical measure. Specifically, it seeks to address three research questions: (a) What research methods have been employed across studies to examine oral feeding skill development in typically developing children? (b) What populations of children without feeding and swallowing disorders have been studied to date? (c) What normative data on feeding skills are available?

By synthesizing findings from existing studies, this review will provide a comprehensive analysis of the evidence on oral feeding skill development, identify methodological trends, and highlight gaps in research that require further exploration. Ultimately, the goal is to contribute to the development of more standardized, reliable, and inclusive frameworks for assessing oral feeding development in children.

Method

This scoping review follows the search methodology established by Arksey and O'Malley (2005). It was designed and conducted according to the protocol of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018).

Search Strategy

Working with a librarian trained in scoping reviews, a team of three reviewers collaboratively developed search

criteria to address the review objective. Literature searches were designed and run in PubMed, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and PsycINFO. The search results were limited to studies reported in English and dated through 2024. The initial search strategy was developed using a combination of database-specific terminology, Medical Subject Headings (MeSH), and text words in PubMed (see the Appendix). The search was conducted using key words such as chewing, chewing development, feeding assessment, normal feeding development, normal oral motor development, oral motor, oral motor assessment, feeding behavior, and eating or drinking physiology, with advanced search criteria including all article types, infants and children, human, and all years. Terms were developed to exclude breastfeeding or bottle feeding. The search strategies had a total yield of 31,870 results. After removing duplicates, the total number of articles was reduced to 26,052.

Screening, Inclusion, and Exclusion of Articles

Articles were included if they met the following inclusionary criteria: (a) peer-reviewed article studying feeding skill development in typically developing children born at 37 weeks or greater gestation, (b) examined feeding skills for drinking liquids by cup/straw and/or eating purees and chewable solid foods, (c) rated feeding skills using direct visual observation (online or videotaped review), (d) provided a list of all feeding skills studied, (e) reported the expected age of feeding skill performance based on study results or identified skills as typical for infancy through early childhood, and (f) participants were at least 4 months of age.

Articles were excluded if they met the following exclusionary criteria: (a) skill observations required instrumentation (e.g., videofluoroscopic swallowing evaluations, electromyography, kinematic measurement, chewing duration measures, or only reflexes) as clinically observable measures were of interest; (b) examined feeding skills only related to bottle feeding or breast feeding; (c) feeding skills were not listed; (d) no age performance of feeding skills was stated, nor was a description of the skills observed; or (e) children in the study were only less than 4 months of age.

All 26,052 citations were placed into the Rayyan software program (Ouzzani et al., 2016) to organize, screen, and synthesize articles. See Figure 1 for the PRISMA process. Three reviewers participated in the screening of articles. Titles and abstracts were reviewed to identify articles meeting inclusionary criteria. A coding table was established to ensure interrater reliability. Using Rayyan, reviewers marked each study as "include," "maybe," or "exclude." Articles coded as "maybe" required further discussion for consensus or review of the full text. Articles given a code of "exclude" had a mention of any of the exclusion criteria for this study. Full-text articles were retrieved if the title and abstract were insufficient to determine inclusion. Full-text articles were reviewed by two authors and were included if the previous criteria were met. A snowball search was conducted by two authors on the sources in the included studies. Sources that did not appear in the original search were included if they met inclusion criteria and observed separate feeding skills from the original article or tested different age groups for the same feeding skills.

Data Extraction

Two authors reviewed the methodologies in each of the included studies, and data were compiled across eight variables: number of textures used, number of skills studied, number of feeding trials, rater reliability, measurement tools utilized, observational setting, main findings, and participant demographics. Specific participant information obtained included the cohort size and the age, sex, and racial background of all participants if provided by the articles. Information was also obtained for any studies that included non–typically developing children along with the typical cohort of participants.

Quality Assessment

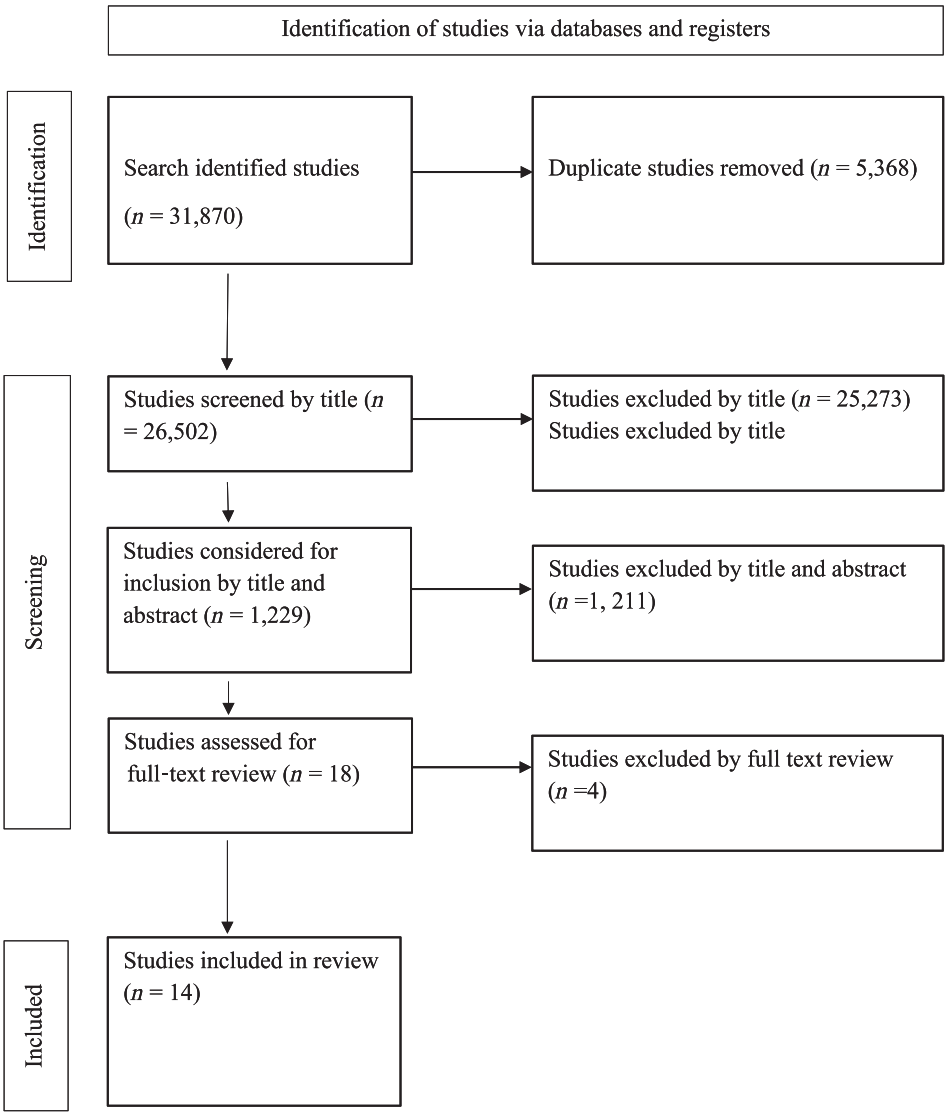
The Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018) was used to analyze the quality of the included studies. Two reviewers independently rated each study with the criteria for the two study designs. Questions were answered with a "yes" for meeting criteria, "no" for not meeting criteria, or "unsure" for information that was not clarified in the study. They were then given a score of "high," "medium," "moderate," or "low" for quality of study.

Results

Included Studies

After screening titles and abstracts, 18 full-text articles were reviewed. Four of these articles were excluded due to the following exclusion criteria: parent report only (Carruth & Skinner, 2002), only reported reliability (Sonies et al., 2009), and the study not including typically developing children (Kenny et al., 1989; Kumin & Bahr, 1999). See Figure 1 for the process of identifying and excluding articles. In total, 14 articles were identified through the original search and the snowball search as meeting criteria for this scoping review (den Boer & Shipper, 2013; Gisel, 1991; Gisel et al., 1986; Ishida et al., 2011; Reilly et al., 1995; Remijn et al., 2014; Şahan et al., 2021; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b; Sheppard & Mysak, 1984; Stolovitz & Gisel, 1991; van den Engel-Hoek et al., 2014).

Figure 1. Processes performed to include or exclude sources of typical feeding skills for infants and young children.



Quality Assessment Using the MMAT

The MMAT assesses five categories of studies: qualitative, quantitative randomized controlled trials, quantitative nonrandomized, quantitative descriptive, and mixed methods. The most relevant among the included studies was quantitative nonrandomized studies (6/14; den Boer & Shipper, 2013; Gisel et al., 1986; Ishida et al., 2011; Reilly et al., 1995; Remijn et al., 2014; Şahan et al., 2021) and quantitative descriptive studies (8/14; Gisel, 1991; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b; Sheppard & Mysak, 1984; Stolovitz & Gisel, 1991; van den Engel-Hoek et al., 2014). A summary of the MMAT results for the ratings of the quantitative nonrandomized studies is shown in Table 1. When assessing quantitative nonrandomized studies, the reviewers rated different components including the population studied, measurements used, data outcome, accountability of analysis, intervention, and implementation. Two articles were rated as "moderate," meaning they did not include the necessary information on three components (Ishida et al., 2011; Reilly et al., 1995). Three articles were rated as "medium," meaning one component was not fully addressed in the study (den Boer & Shipper, 2013; Gisel et al., 1986; Şahan et al., 2021). One article was rated as "high," as it included and described all relevant components (Remijn et al., 2014).

To address quantitative descriptive studies, Table 2 shows the MMAT ratings for the quality of the sampling strategy, the populations studied, measurements used, bias

Table 1. Mixed Methods Appraisal Tool ratings for six quantitative nonrandomized studies.

Study	Screening questions		Quantitative nonrandomized studies					
	S1. Are there clear research questions?	S2. Do the collected data allow to address the research questions?	Are the participants representative of the target population?	Are the measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete data outcome?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?	Quality judgment (high, med, mod, low)
den Boer & Shipper (2013)	Y	Y	Y	Y	Y	Y	U	Med
Gisel et al. (1986)	Y	Y	Y	U	Y	Y	Y	Med
Ishida et al. (2011)	Y	Y	N	U	Y	Y	N	Mod
Reilly et al. (1995)	Y	Y	Y	U	Y	Y	U	Mod
Remijn et al. (2014)	Y	Y	Y	Y	Y	Y	Y	High
Şahan et al. (2021)	Y	Y	U	Y	Y	Y	Y	Med

Note. Med = medium; Mod = moderate; Y = yes; U = unsure; N = no.

Table 2. Mixed Methods Appraisal Tool ratings for eight quantitative descriptive studies.

Study	Screening questions		Quantitative descriptive studies					
	S1. Are there clear research questions?	S2. Do the collected data allow to address the research questions?	Is the sampling strategy relevant to address the research questions?	Is the sample representative of the target population?	Are the measurements appropriate?	Is the risk of nonresponse bias low?	Is the statistical analysis appropriate to answer the research question?	Quality judgment (high, med, mod, low)
Gisel (1991)	Y	Y	Y	Y	Y	Y	Y	High
Schwaab et al. (1986a)	Y	Y	Y	Y	Y	Y	Y	High
Schwaab et al. (1986b)	Y	Y	Y	Y	Y	Y	Y	High
Schwartz et al. (1984a)	Y	Y	Y	Y	U	Y	Y	Med
Schwartz et al. (1984b)	Y	Y	Y	Y	Y	Y	Y	High
Sheppard & Mysak (1984)	Y	Y	Y	N	Y	Y	Y	Med
Stolovitz & Gisel (1991)	Y	Y	Y	Y	Y	Y	Y	High
van den Engel-Hoek et al. (2014)	Y	Y	Y	Y	Y	Y	Y	High

Note. Med = medium; Mod = moderate; Y = yes; U = unsure; N = no.

risks, and analysis relevance to research questions. Two articles were rated as "medium" (Schwartz et al., 1984a; Sheppard & Mysak, 1984). Six articles were rated as "high" (Gisel, 1991; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984b; Stolovitz & Gisel, 1991; van den Engel-Hoek et al., 2014). This review consisted of five case–control studies (den Boer & Shipper, 2013; Gisel et al., 1986; Reilly et al., 1995; Remijn et al., 2014; Şahan et al., 2021) and nine case-series studies (Gisel, 1991; Ishida et al., 2011; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b; Sheppard & Mysak, 1984; Stolovitz & Gisel, 1991; van den Engel-Hoek et al., 2014). Table 3 illustrates the 14 studies' participant demographic information and design characteristics. There were several noteworthy biases in the studies included in this review. The most frequently occurring bias was a lack of racial and ethnic diversity among participants. Most of the studies (n = 11) were conducted more than 10 years ago, as reflected in the selection of participants. One study had primarily male participants (91%, 51/56; Şahan et al., 2021). One study had a small participant size (n = 2; Sheppard & Mysak, 1984), and another had a somewhat small sample size (n = 19) spread over a large age range (Şahan et al., 2021). One study did not report on the participants' sex (Sheppard & Mysak, 1984). There were five studies that had a cohort of non–typically developing children in comparison with the typically developing cohort (den Boer & Shipper, 2013; Gisel et al., 1986; Reilly et al., 1995; Remijn et al., 2014; Şahan et al., 2021). The atypical cohorts consisted of preterm infants and children with Down syndrome, cerebral palsy, nonorganic failure to thrive, and autism spectrum disorder. Studies varied in how the role of the "feeder" was labeled as parent, child, researcher, speech-language pathologist, or not reported. There was no cohesive setting in which studies were conducted, whether it be a naturalistic home environment, a controlled lab setting, or not reported. All 14 articles included in this scoping review had the unit of their studies labeled as "child." For this article's inclusionary criteria, "child" was considered 4 months of age or older. Two studies started trials at a younger age than 4 months but continued into adolescence, allowing qualification of inclusion criteria (Sheppard & Mysak, 1984; van den Engel-Hoek et al., 2014).

Research Question 1: Methodological Variations Across Studies

Although this review did not aim to evaluate validated assessment measures, several included studies' utilized measurement tools. The tools included the Observation List Spoon Feeding (van den Engel-Hoek et al., 2014), the Schedule for Oral Motor Assessment (SOMA; Reilly et al., 1995), and the Karaduman Chewing Performance Scale (KCPS; Şahan et al., 2021). It is noteworthy that the SOMA is no longer available in print. For this review, individual skills measured within these tools were of particular interest. Table 4 outlines the measurements, main findings, and rater reliability of the studies.

The methods in these studies varied widely. Most studies employed a cross-sectional design, capturing only a single observation point. Only two studies involved repeated observations (Sheppard & Mysak, 1984; van den Engel-Hoek et al., 2014). The number of skills studied ranged from 1 to 30, with 1–20 trials per skill. Skills assessed included oral structure positioning, oral movements, timing or duration of movements, chewing rate, and swallowing concerns. See Part 2 of this scoping review for details regarding individual skills (Delaney et al., in press). Nine studies (64%) measured the position of oral structures (den Boer & Shipper, 2013; Ishida et al., 2011; Reilly et al., 1995; Remijn et al., 2014; Schwaab et al., 1986a; Schwartz et al., 1984a; Sheppard & Mysak, 1984; Stolovitz & Gisel, 1991; van den Engel-Hoek et al., 2014). Likewise, nine studies (64%) examined the movements of oral structures (den Boer & Shipper, 2013; Gisel et al., 1986; Ishida et al., 2011; Reilly et al., 1995; Remijn et al., 2014; Şahan et al., 2021; Sheppard & Mysak, 1984; Stolovitz & Gisel, 1991; van den Engel-Hoek et al., 2014). Four studies (29%) measured the chewing rate of children (Gisel, 1991; Şahan et al., 2021; Schwaab et al., 1986b; Schwartz et al., 1984b). Six studies (43%) measured swallowing concerns (den Boer & Shipper, 2013; Ishida et al., 2011; Reilly et al., 1995; Şahan et al., 2021; Schwartz et al., 1984a; Stolovitz & Gisel, 1991).

Several methods were used to quantify performance including the duration in seconds, average (mean) number of successful skill performance across the total number of trials, presence of specific movements, and tongue at distinct timepoints during a trial. For example, den Boer and Shipper (2013) reported the percentage of children who successfully maintained a bolus and demonstrated swallowing coordination, while Reilly et al. (1995) assessed these skills' frequency and efficiency. Chewing performance was quantified through various methods: cycle ratio (Gisel, 1991), mean score on the KCPS (Şahan et al., 2021), duration from chew initiation to swallow (Schwaab et al., 1986b), or number of chews needed per swallow (Schwartz et al., 1984b). Tongue position was reported as frequency prior to swallow (Schwaab et al., 1986a; Schwartz et al., 1984a) or as a mean frequency across 10 swallows (Stolovitz & Gisel, 1991).

There was also a variation in the number and type of textures used. Three studies (21%) used one texture (Ishida et al., 2011; Şahan et al., 2021; Sheppard &

Table 3. Measurement information and main findings from full-text articles retrieved from systematic search for sources providing typical feeding skills in children.

Study	Measurements	Measurement tools in study	No. of skills	No. of trials	Main findings	Rater reliability
den Boer & Shipper (2013)	% of the typically developing infants performing desired skill compared to preterm infants	N/A	7	Not reported	Minimal choking and gagging in participants at 9 months old. Higher overall skills reported compared to preterm infants.	Not reported
Gisel et al. (1986)	% of children aged 2–5 years prefer a certain side of the mouth for lateral tongue movements	N/A	2	10	A general shift of right to left side was preferred in majority of children 2–5 years old.	Total interobserver scores of .04–.28
Gisel (1991)	Duration from first chew to completion of swallow Mean ratio of time/cycles calculated	N/A	1	10 trials per 3 textures of food	Solid food resulted in longest chewing durations. Older children had more efficient chewing times per texture. No correlation between participant weight and chewing duration.	All observers scored all trials
Ishida et al. (2011)	% of children preferring a certain spoon type with minimal "confusion" (ability to open mouth fully without compensation), spillage, and choking	N/A	3	Not reported	Round, hemispherical spoon resulted in the least amount of confusion for lip position. No significant differences in spoon shape for spillage and choking.	Not reported
Reilly et al. (1995)	Number and efficiency of oral motor skills in children 8–21 months old via the SOMA	Schedule for Oral Motor Assessment (SOMA)	30	3 trials per 6 textures	Refusal behaviors were highest for spoon-fed solids and dried fruit textures.	$\kappa > .75$
Remijn et al. (2014)	Number of maximum scores for TD kids on the MOE with two different solid foods	Mastication Observation and Evaluation (MOE)	18	8 items	Increase in chewing efficiency until 12 months of age followed by a more gradual increase.	Interobserver scores of .51–.98
Şahan et al. (2021)	Mean score on KCPS measuring chewing performance level	Karaduman Chewing Performance Scale (KCPS)	5	3 items (T-FS-IS, BPFAS, KCPS)	TD children have a sooner transition time to solid food compared to those with ASD and less tongue thrust movements.	.89–.99
Schwaab et al. (1986a), tongue movements	Frequency of different tongue positions observed by 2-, 3-, and 4-year-olds upon presentation and upon swallow	N/A	8	20 for soft solid, 10 for solid, and 10 for puree	Tongue observed behind teeth most often for presentation for all categories. Most common response behaviors for swallow were "puckers," "tongue behind incisors," then "lips pursed" in that order.	.50–.84
Schwaab et al. (1986b), chewing rate	Duration from first chew to completion of swallow	N/A	2	10 times for 3 textures	Puree texture had shorter time and less cycles. Time and cycles decreased from 2 to 4 years of age and 4 to 5 years of age. Ratios were affected more by textures than by ages and sex.	Not reported

(*table continues*)

Table 3. *(Continued).*

Study	Measurements	Measurement tools in study	No. of skills	No. of trials	Main findings	Rater reliability
Schwartz et al. (1984a), tongue movements	Frequency of different tongue positions observed by 4- and 5-year-olds upon presentation and upon swallow	N/A	8	20 for soft solid, 10 for solid, and 10 for puree	Tongue observed behind teeth most often for presentation for all categories. "Lips pursed, tongue not observed" was the most common response for position upon swallow. Females more often had "lips pursed"; males had "puckers in corner of mouth"	Interobserver score of .08
Schwartz et al. (1984b), chewing rate	Frequency of chews needed to swallow, duration of cycle (s) from time of insertion to swallow, duration of cycle (s) from first bite to swallow	N/A	2	20 for soft solid, 10 for solid, and 10 for puree	Time/cycle ratio was double for puree texture. Time cycles were slightly shorter for all foods in males than females. Time cycle ratios did not vary by age.	Interobserver range of .78–.95 for 4 years old and .82–.81 for 5 years old
Sheppard & Mysak (1984)	Frequency of oral and tongue movements upon stimulation and presentation of puree and liquid textures	N/A	7	5	Oral reflexes remained active until ~8 months old. Complexity diminished with age.	Not reported
Stolovitz & Gisel (1991)	Mean number of tongue positions and movements by texture, age, and sex	N/A	19	10 trials per 3 textures of food	Difficulty with solid food at 6 months old. Children at 8 months to 2 years of age showed consistency in most categories. Most children initiate swallowing by pressing lips together and drawing lower lip in.	2 observers scored all trials, agreement of 80% or higher
van den Engel-Hoek et al. (2014)	Mean duration (weeks) to reach maximum score on OSF (i.e. develop certain feeding behaviors)	Observation List Spoon Feeding (OSF)	7	5	Mean time to reach the maximum score was 5.7 weeks. Two participants did not receive max score because their tongue did not remain behind their lips. Abnormal behaviors were mainly choking and gagging.	4 raters tested first 5 bites from 5 participants

Note. N/A = not applicable; TD = typically developing; T-FS-IS = Turkish version of the Feeding/Swallowing Impact Survey; BPFAS = Behavioral Pediatrics Feeding Assessment Scale; ASD = autism spectrum disorder.

Table 4. Participant demographics and study characteristics for full-text articles retrieved from systematic search for sources providing typical feeding skills in children.

Study	Type of study	Quality appraisal study design	Age	Sex % female	Racial background	Setting
den Boer & Shipper (2013)	Cross-sectional	Quantitative nonrandomized study	*n* = 52 TD, 9 months *n* = 47 PT, 9 months	50% TD 47% PT	Not reported, conducted in the Netherlands	Hospital
Gisel et al. (1986)	Cross-sectional	Quantitative nonrandomized study	*n* = 96 TD; 17 2-year-olds, 19 3-year-olds, 40 4-year-olds, 20 5-year-olds *n* = 26 DS; 14 4-year-olds, 12 5-year-olds	50% TD 46% DS	White	Day care center, school, and home
Gisel (1991)	Cross-sectional	Quantitative descriptive study	*n* = 143 TD; 23 6-month-olds, 26 8-month-olds, 21 10-month-olds, 22 12-month-olds, 27 18-month-olds, 24 24-month-olds	48% TD	Not reported, conducted in Canada	Lab
Ishida et al. (2011)	Cross-sectional	Quantitative nonrandomized study	*n* = 11 TD, 10–18 months (M_{age} = 13 months)	27%	Not reported	Not reported
Reilly et al. (1995)	Cross-sectional	Quantitative nonrandomized study	*n* = 58 TD, 8–44 months (M_{age} = 8–21 months) *n* = 56 NOFT, 8–20 months (M_{age} = 15 months) *n* = 13 CP, 14–44 months (M_{age} = 20 months)	Not reported	Not reported	Home
Remijn et al. (2014)	Cross-sectional	Quantitative nonrandomized study	*n* = 80 TD, 6–48 months (M_{age} = 12 months) *n* = 44 CP, 24–72 month (M_{age} = 43 months)	Not reported	Not reported, conducted in the Netherlands	Naturalistic, quiet environment
Şahan et al. (2021)	Cross-sectional	Quantitative nonrandomized study	*n* = 19 TD, 4–12 years old (M_{age} = 9 years old) *n* = 37 ASD, 4–12 years old (M_{age} = 9 years old)	11% TD 8% ASD	Not reported, conducted in Turkey	Lab
Schwaab et al. (1986a)	Cross-sectional	Quantitative descriptive study	*n* = 56 TD, 17 2-year-olds, 19 3-year-olds, 20 4-year-olds	40% TD	Not reported	Day care facility, home
Schwaab et al. (1986b)	Cross-sectional	Quantitative descriptive study	*n* = 56 TD; 17 2-year-olds, 19 3-year-olds, 20 4-year-olds	40% TD	Not reported	Quiet environment
Schwartz et al. (1984a)	Cross-sectional	Quantitative descriptive study	*n* = 40 TD; 20 4-year-olds, 20 5-year-olds	50% TD	White	Quiet environment
Schwartz et al. (1984b)	Cross-sectional	Quantitative descriptive study	*n* = 40 TD; 20 4-year-olds, 20 5-year-olds	50% TD	White	Quiet school room
Sheppard & Mysak (1984)	Longitudinal	Quantitative descriptive study	*n* = 2 TD, 1–35 weeks	50% TD	Not reported	Pediatrician's office

(*table continues*)

Table 4. *(Continued).*

Study	Type of study	Quality appraisal study design	Age	Sex % female	Racial background	Setting
Stolovitz & Gisel (1991)	Cross-sectional	Quantitative descriptive study	*n* = 143 TD; 23 6-month-olds, 26 8-month-olds, 21 10-month-olds, 22 12-month-olds, 27 18-month-olds, 24 24-month-olds	48% TD	Not reported, conducted in Canada	Lab
van den Engel-Hoek et al. (2014)	Longitudinal	Quantitative descriptive study	*n* = 39 TD, 17–33 weeks (M_{age} = 24 weeks)	41% TD	Not reported, participants pulled from the Netherlands and Germany	Home

Note. TD = typically developing children; PT = preterm infants; DS = children with Down syndrome; NOFT = children with nonorganic failure to thrive; CP = children with cerebral palsy; ASD = children with autism spectrum disorder.

Mysak, 1984), three studies (21%) used two textures (den Boer & Shipper, 2013; Gisel et al., 1986; Remijn et al., 2014), six studies (43%) used three textures (Gisel, 1991; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b; Stolovitz & Gisel, 1991), one study (7%) used six textures (Reilly et al., 1995), and one study did not report the number of textures used (van den Engel-Hoek et al., 2014). Texture descriptions varied across studies. For example, "solid" could refer to "crunchy" (Remijn et al., 2014), "semisolid" (Reilly et al., 1995), or "bite-off solid" (Schwartz et al., 1984a).

Research Question 2: Populations Studied

Participants represented a range of ages, primarily between 6 months and 5 years (range: 4 months to 12 years; den Boer & Shipper, 2013; Gisel, 1991; Gisel et al., 1986; Ishida et al., 2011; Reilly et al., 1995; Remijn et al., 2014; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b; Stolovitz & Gisel, 1991). Monthly intervals for data collection occurred in the first year of life and yearly intervals from 2 years and older. There were three studies that provided an age range for participants but did not provide a breakdown of participants per age within the range, 8–44 months (M = 8–21 months; Reilly et al., 1995), 6–48 months (M = 12 months; Remijn et al., 2014), 10–18 months (M = 13 months; Ishida et al., 2011), and 4–12 years (M = 9 years; Şahan et al., 2021) for a total of 168 participants. Some of the studies used the same cohort of participants but tested different feeding skills (Gisel, 1991; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b; Stolovitz & Gisel, 1991), in which case those participants were only counted once when calculating the total number of children observed. We identified 427 unique participants from studies that provided specified ages. Notably, 50% of the children (215 out of 427) were 24 months or older. The most common ages studied were 2 through 5 years old (Gisel et al., 1986; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b). Just over 40% of children (185 out of 427) were between 4 and 12 months old, leaving a gap in available data for children 12–24 months old. Thus, normative data are based on approximately 200 children each between 4–12 months and 2–12 years of age.

Most studies (n = 11) did not report participant race. Of the three studies that did, all participants were White (Gisel et al., 1986; Schwartz et al., 1984a, 1984b). Geographically, three studies were conducted in the Netherlands (den Boer & Shipper, 2013; Remijn et al., 2014; van den Engel-Hoek et al., 2014), and two were conducted in Canada (Gisel, 1991; Stolovitz & Gisel, 1991). Three studies noted that participants were recruited from upper- to middle-class homes (Gisel et al., 1986; Schwaab et al., 1986a; Schwartz et al., 1984a). Two studies, using overlapping participants pools, stated that children came from families from military personnel, faculty, or university students (Schwaab et al., 1986b; Schwartz et al., 1984b).

Research Question 3: Normative Data

Oral Structure Position

Studies commonly examined lip and tongue positioning during spoon feeding and swallowing. For children aged 6 months to 2 years, anticipatory movements such as holding mouth open and the tongue resting inside the mouth behind the teeth were measured (den Boer & Shipper, 2013; Stolovitz & Gisel, 1991). Between ages 4 months and 5 years, the tongue was most frequently located behind the lips and teeth at the moment of swallowing (Schwaab et al., 1986a; Schwartz et al., 1984a; van den Engel-Hoek et al., 2014). Additional observations included lip pursing or puckering at the mouth corners during swallow, with the former being more common among girls aged 4–5 years (Schwartz et al., 1984a).

Oral Structure Movement

For the movement of oral structures, each study observed movements that could occur in any part of the feeding process. Results varied depending on the age of participants, textures used, and structures examined. One result that overlapped across studies was difficulty maintaining solid textures in the mouth compared to purees or liquids (Gisel, 1991; Reilly et al., 1995; Şahan et al., 2021; Schwaab et al., 1986a; Stolovitz & Gisel, 1991). This result was observed from the youngest age of 6.5 months (Gisel, 1991) up until 2–5 years of age (Schwaab et al., 1986a). Around 6 months, children began demonstrating more efficient upper lip use to remove puree from a spoon, improved bolus maintenance, and early rotary chewing movements (van den Engel-Hoek et al., 2014). Sheppard and Mysak (1984) reported similar findings around 6 months for early chewing efficiency, such as mandibular chewing cycles and lateral movements of the tongue. Some studies did not provide detailed age trends (Reilly et al., 1995; Remijn et al., 2014).

Chewing Rate

Chewing rate was defined as the number of chewing cycles per bite duration in seconds (Gisel, 1991; Schwaab et al., 1986a; Schwartz et al., 1984a). A chewing cycle was defined as "one down-and-up movement of the mandible" (Gisel, 1991; Schwaab et al., 1986a; Schwartz et al., 1984a) with bite duration calculated from placement into the mouth until the first swallow. Across various ages and textures (i.e., puree, viscous [jello], and solid), chewing rate decreased with age (Gisel, 1991; Schwaab et al.,

1986a; Schwartz et al., 1984a; Sheppard & Mysak, 1984). The largest decrease occurred for solids between 6 and 12 months old (from approximately 29 to 17 cycles; Gisel, 1991). Chewing frequency for solids was relatively stable beyond this period, but efficiency improved. For example, 12-month-olds averaged 17 cycles in 25 s, while 24-month-olds required only 15 cycles in 16 s (Gisel, 1991). Solid textures consistently required the most cycles and time per bite (Gisel, 1991; Schwaab et al., 1986a; Schwartz et al., 1984a). The longest chewing duration time was at 6 months old for a solid (approximately 42 s; Gisel, 1991). The solid texture required the most chewing cycles and time to swallow across each age compared to other textures (Gisel, 1991; Schwaab et al., 1986a; Schwartz et al., 1984a). Findings regarding sex-based differences were inconsistent.

Swallowing Concerns

Swallowing was evaluated through signs of gagging or choking and facial movements during the swallow. At 9 months, more children (44%) choked when drinking than when eating (31%; den Boer & Shipper, 2013). Ishida et al. (2011) found no significant differences in swallow success across three spoon shapes. Consistent with other studies, Stolovitz and Gisel (1991) identified lip pursing and lower lip drawing as common indicators of swallowing onset. With age, children required fewer swallows per bite, although specific age thresholds were not reported.

Discussion

This scoping review aimed to synthesize the current literature on normative references for feeding skill development using direct, noninstrumental observation in typically developing children by examining the methodologies and populations used in relevant studies. The findings highlight several key features when studying feeding skill development, with a wide range of methods and measurements utilized across these studies. This review provides valuable insights into important feeding methodologies and considerations for future research in this field.

Research Question 1: Methodological Variations Across Studies

This review illustrates the complexity of feeding skill development, given the diversity in methods used to observe and measure feeding skills. Some studies employed direct observation of feeding in naturalistic settings, such as the home or clinic (Gisel et al., 1986; Reilly et al., 1995; Remijn et al., 2014; Schwaab et al., 1986a, 1986b; Schwartz et al., 1984a, 1984b; Sheppard & Mysak, 1984; van den Engel-Hoek et al., 2014), while others have used controlled environments to standardize conditions (Gisel, 1991; Şahan et al., 2021; Stolovitz & Gisel, 1991). Environment plays a role in feeding outcomes for participants (Martens et al., 2023); thus, it is essential to consider where observations were acquired. These contextual factors influence our ability to interpret feeding related to caregiver interactions and cultural practices in the home, which can significantly influence the development of feeding skills. Studies such as Stolovitz and Gisel (1991) emphasized the utility of standardized procedures in isolating oral-motor contributions to chewing and swallowing, accurately measure physiological and motor control in acquiring feeding milestones, which may more effectively be obtained in a lab setting or with specific instructions for feeding presentations. These variations mirror similar methodological issues seen in early motor development studies, where naturalistic play observations are favored for ecological validity (O'Grady & Dusing, 2015), while structured tasks are used for precision and comparability (Smith & Thelen, 2003). Not only does the type of procedure need to be specified, but there are also reasons for both natural observations and structured tasks.

There were also substantial inconsistencies in the way feeding skills were defined and operationalized with a focus on different aspects of the feeding process. For example, definitions of a chewing cycle varied across studies—from "one down-and-up movement of the mandible" (Gisel, 1991) to a three-phased jaw movement (Schwaab et al., 1986b). Across studies, a key finding is the emphasis on observing specific movements and their timing, rather than relying on broader feeding milestones, such as "mature chewing" or "mature swallows" (Schwartz et al., 1984a). This distinction is important for understanding the underlying mechanism of feeding skills, rather than simply tracking milestone achievements. However, a major challenge identified across these studies is the lack of standardization in defining and categorizing feeding skills, making it difficult to compare results across studies. Similar definitional variability is well documented in broader pediatric therapy literature, where lack of consensus can limit reproducibility and clinical utility (Benfer et al., 2016). This underscores the need for interdisciplinary agreement on definitions, which could benefit from Delphi consensus approaches commonly used in allied health research (Diamond et al., 2014).

Research Question 2: Populations Studied

Most studies included in this review focused on racially and socioeconomically homogeneous samples from Western nations. Similar critiques have been raised in broader developmental psychology and anthropology literature, where "WEIRD" (Western, Educated, Industrialized,

Rich, and Democratic) samples dominate research (Henrich et al., 2010). Feeding development, in particular, is highly shaped by cultural practices such as mealtime routines, weaning age, and food texture preferences (Bentley et al., 1999; Kruger & Gericke, 2003; Tournier & Forde, 2024; Zielinska et al., 2019), which are largely absent from the current literature base. The lack of diversity in study populations raises concerns about the generalizability of findings and underscores the need for more inclusive research that reflects a wider range of experiences and practices. For example, the structured spoon-feeding described in Gisel (1991) may not reflect where baby-led weaning may be practiced (Gomez et al., 2020). This limits the generalizability of normative data and feeding milestones. In contrast, recent ethnographic research has illustrated how caregiver responsiveness and feeding contexts can vary dramatically, influencing the pace of feeding development and feeding preferences (Johnson & Hayes, 2017). As with the naturalistic versus structured tasks, both approaches offer important valid and important information regarding feeding development.

In addition, while several studies observed infants at monthly intervals during their first year, few provided detailed longitudinal data beyond 8 months of age. This is concerning, as significant skill acquisition occurs following 8 months and through the second and third years of life that are critical for refining self-feeding, bolus control, and chewing coordination (Carruth et al., 2004). Unlike gross motor or speech milestones, feeding behaviors lack large-scale longitudinal data sets (e.g., Centers for Disease Control and Prevention [CDC] motor milestone norms), which makes developmental comparisons difficult (CDC, n.d.).

Research Question 3: Normative Data

Despite the methodological inconsistencies, several studies identified similar timelines for key feeding transitions. The introduction of spoon feeding for purees and liquids can occur around 6 months of age based on development of lip control (Ishida et al., 2011; Stolovitz & Gisel, 1991). Another key transition is the emergence of chewing efficiency around 8 months with improved tolerance to and maintenance of solid foods (den Boer & Shipper, 2013; Gisel, 1991; Remijn et al., 2014; Şahan et al., 2021). Other data show a rapid increase of chewing efficiency until about 12 months old and then gradually increased to 4 years (Remijn et al., 2014). Most studies observing chewing efficiency concluded that efficiency was faster for puree or soft-solid textures opposed to hard, crunchy solids, but no significant difference between sexes was reported (Schwaab et al., 1986b; Schwartz et al., 1984b). Moreover, very few studies compared skill development between sexes or controlled for caregiver feeding style, which research has shown can significantly impact feeding behaviors (Blissett & Fogel, 2013). Unlike motor development literature (Darrah et al., 2009), these key feeding transitions offer broad age ranges for skill expectations that leave identification of feeding problems vague. Redefining and narrowing age ranges for skill expectations would afford earlier and more reliable identification of PFD.

Common Issues for Future Consideration

Common methodological issues—such as small sample sizes, unclear terminology, and inconsistent reporting of participant characteristics—mirror limitations found in adjacent research for clinical feeding interventions (Morgan et al., 2012; Wilson et al., 2021). Additionally, participant characteristics, such as age, sex, and developmental history, were often insufficiently reported, which limits the generalizability of the findings to broader populations (den Boer & Shipper, 2013; Ishida et al., 2011; Reilly et al., 1995; Remijn et al., 2014; Schwaab et al., 1986a, 1986b; Sheppard & Mysak, 1984). Cross-disciplinary comparisons may help clarify some of this ambiguity. For example, anticipatory responses to feeding stimuli are akin to cue-based regulation seen in infant state regulation research (Thoyre et al., 2013). Integrating frameworks from neurodevelopmental science and behavioral pediatrics may enrich future operational definitions and assessments. These challenges highlight the need for standardized assessment measures and more inclusive, reliable research to establish clear benchmarks for typical feeding skill development.

Additionally, there was variability in terminology used across studies, which affects replicated assessments of feeding skills and how they can be measured reliably. For example, a chewing cycle was defined differently by three studies. The study by Gisel (1991) explained a chewing cycle as "one down-and-up movement of the mandible" like the definition by Schwartz et al. (1984b) as "an upward and downward movement of the chin." Contrastingly, another cycle definition was explained as a three-phased jaw movement occurrence of "opening, closing, and occlusion" (Schwaab et al., 1986b). Discrepancies in the definitions of individual skills were also prevalent. The study by Stolovitz and Gisel (1991) measured anticipation as "the child holding their tongue and jaw quietly," the study by van den Engel-Hoek et al. (2014) measured anticipation as "the [child] opens the mouth when the spoon reaches the mouth," and the study by Reilly et al. (1995) measured anticipation as the child's "head orientation to the spoon." These inconsistencies demonstrate the difficulty of standardizing data when it is defined, interpreted, and measured in various ways.

Implications for Practice

The findings from this review have important implications for pediatricians, speech-language pathologists, and occupational therapists working with young children. Understanding the typical trajectory of feeding skill development provides a foundation for assessing and supporting children who may be experiencing feeding difficulties. The trajectory of feeding skill development can serve as guidelines to recognize when children are not progressing as expected. The specific feeding skill norms can guide the feeding clinicians (i.e., speech-language pathologist or occupational therapist) whether a child is meeting age-appropriate feeding skill expectations and identify any potential delays in feeding development. While current feeding skill trajectories offer a reference point for typical development, clinicians should be cautious in their application due to variability in assessment methods. Incorporating caregiver practices, cultural beliefs, and family mealtime routines into assessments would also allow for more culturally sensitive and accurate evaluations (Lohse & Satter, 2021).

Limitations

There were a few limitations to this scoping review. First, only studies published in English were included in the search strategy, which may have limited to amount of data available to use. We excluded instrumental studies to focus on the literature directly supporting clinical observations. In addition, the participants that were used in the studies were primarily White, leaving for gaps in data across other races. Furthermore, this scoping review was intentionally narrowed in scope, with feeding skills analyzed in more depth in Part 2 (Delaney et al., in press).

Future Research Directions

This scoping review highlights several important areas for future research. To address issues of sample size and diversity, future research should aim for larger, more inclusive populations that reflect a range of racial, ethnic, and socioeconomic backgrounds. There is a clear need for studies that include more diverse populations to ensure that feeding skill milestones are applicable across different racial, ethnic, and socioeconomic groups. Research in this area could help address the current lack of generalizability and improve the inclusivity of feeding development benchmarks.

Second, longitudinal studies tracking feeding skills over time in naturalistic settings and with structured procedures are crucial for providing a more accurate representation of typical feeding development. These studies could explore how feeding behaviors evolve as children progress through various developmental stages, offering valuable insights into how feeding skills are influenced by age, environmental factors, and caregiver involvement.

To enhance consistency and comparability in research, future studies should prioritize aligning and standardizing methodologies. One important step is developing consistent assessment tools and protocols for measuring feeding skills, ensuring that studies use common definitions and categorization of feeding skills. This will help reduce the variability in how skills such as sucking or chewing are defined and assessed. Additionally, standardizing participant characteristics—such as age, sex, and developmental history—along with consistent reporting across studies, would improve the generalizability of findings. Standardizing the number of trials, types of textures (Delaney, Staskiewicz, et al., 2025), and measurements used would also improve the generalizability of findings. By aligning methodologies in these key areas, research can provide more reliable benchmarks for typical feeding skill development and guide more informed clinical practice. Finally, Part 2 of this scoping review analyzes individual feeding skills identified in this article with discussion regarding potential areas for standardization (Delaney et al., in press).

Conclusions

This study underscores the significant methodological variability in the study of typical feeding skill development. Key opportunities for standardizing feeding skill research include the need for standardization in definitions, measures, and population sampling. With continued research and alignment across disciplines, a more reliable and inclusive framework for understanding feeding development can emerge. A critical area for future investigation involves further review of the specific feeding skills used across studies. Part 2 of this scoping review (Delaney et al., in press) reports on the analysis of individual skills with suggestions for future research on improving the description and standardization of feeding skills to provide a more reliable framework for understanding normal and atypical feeding development.

Author Contributions

Amy L. Delaney: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Anna Flatt:** Formal analysis, Writing – original draft, Writing – review

& editing. **Hannah Koepp:** Data curation, Methodology, Project administration, Writing – review & editing. **Alissa V. Fial:** Data curation, Formal analysis, Methodology, Resources, Software, Writing – review & editing. **Katherine C. Hustad:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing.

Ethics Statement

This study did not include human subjects.

Data Availability Statement

Data are available from the authors upon request.

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Search Strategies

Database	Search strategy
PubMed	(Feeding OR "Feeding Behavior"[Mesh] OR "Feeding Behaviors" OR "feeding skill" OR "feeding skills" OR "eating skills" OR "Eating Behavior" OR "Eating Behaviors" OR "Feeding-Related Behavior" OR "Feeding Related Behavior" OR "Feeding-Related Behaviors" OR "Feeding Patterns" OR "Feeding Pattern" OR "Food Habits" OR "Food Habit" OR "Eating Habits" OR "Eating Habit" OR "Dietary Habits" OR "Dietary Habit" OR "Diet Habits" OR "Diet Habit" OR Oral[ti] OR oral[text word] OR "Mastication"[Mesh] OR "Mastication/physiology"[Mesh] OR Masticat* OR Chewing OR "Eating/physiology"[Mesh] OR eating OR "Eating"[Mesh] OR "Drinking"[Mesh] OR "Drinking/physiology"[Mesh] OR Drinking* OR "water consumption" OR "water intake" OR "Deglutition"[Mesh] OR "Deglutition/physiology"[Mesh] OR Deglutition* OR Swallowing* OR Biting OR "Sucking Behavior"[Mesh] OR Sucking OR "sucking behavior" OR "sucking behaviors" OR "Infant Food"[Mesh] OR "infant food" OR "infant foods" OR "Mouth"[Mesh] OR "Mouth/physiology"[Mesh] OR Mouth OR "oral cavity" OR "cavitas oris" OR "vestibule of the mouth" OR "oral cavity proper" OR "cavitas oris propria" OR "Jaw"[Mesh] OR "Jaw/physiology"[Mesh] OR Jaw OR "Lip/physiology"[Mesh] OR Lip OR Lips OR Philtrum* OR "Tongue/physiology"[Mesh] OR "Tongue"[Mesh] OR Tongue* OR "Cooking and Eating Utensils"[Mesh] OR "Eating Utensils" OR "Eating Utensil" OR cutlery OR Spoon[text word] OR Spoons[text word] OR Fork[text word] OR forks[text word] OR Cup[text word] OR "drinking straw" OR "Food textures" OR "Food texture" OR "Beverages"[Mesh] OR Beverage* OR liquid OR Liquids OR Purees OR "Semi-solids" OR "semi solids" OR "semi solid" OR "semi-solid" OR Solids[ti] OR Solids[text word]) AND ("Child Development"[Mesh] OR "child development" OR "Child Development/physiology"[Mesh] OR "infant development" OR "skill development" OR "motor development" OR "oral-motor" OR "oral motor" OR "Visual Motor Coordination" OR "Visual Motor Coordinations" OR "Perceptual Motor Performance" OR "Perceptual Motor Performances" OR "Sensory Motor Performance" OR "Sensory Motor Performances" OR "motor learning" OR "Motor Skills"[Mesh] OR "motor skill" OR "motor skills" OR "Acquisition of skill" OR "skill acquisition" OR "skill performance" OR "age expectations" OR "age expectation" OR "Fingers"[Mesh] OR Finger* OR Grip OR Grips OR Grasp OR Grasps OR "Deglutition Disorders"[Mesh] OR "Deglutition Disorder" OR "Deglutition disorders" OR "Swallowing Disorders" OR "Swallowing Disorder" OR Dysphagia OR "Oropharyngeal Dysphagia" OR "Esophageal Dysphagia" OR "Feeding and Eating Disorders of Childhood"[Mesh] OR "feeding and eating disorders of childhood" OR "Pediatric feeding disorder" OR "Pediatric feeding disorders" OR "Feeding and Eating Disorders"[Mesh] OR "feeding and eating disorders" OR "Eating and Feeding Disorders" OR "Feeding Disorders" OR "Feeding Disorder" OR "Eating Disorders" OR "Eating Disorder" OR "Appetite Disorders" OR "Appetite Disorder") AND ("Surveys and Questionnaires"[Majr] OR "Questionnaires and Surveys" OR "Survey Methods" OR "Survey Method" OR "Survey Methodology" OR Survey* OR "Questionnaire Design" OR "Questionnaire Designs" OR "Baseline Survey" OR "Baseline Surveys" OR Respondents OR Respondent OR "Randomized Response Technique" OR "Randomized Response Techniques" OR Questionnaire* OR "Psychometrics"[Mesh] OR Psychometric* OR Assess OR Assessing OR Assessed OR Assessment OR Measurement OR Scale[text word] OR Scales[text word] OR Tool[text word] OR Evaluat* OR "Nutrition Assessment"[Mesh] OR "Nutrition Assessments" OR "Nutritional Assessment" OR "Nutritional Assessments" OR "Nutrition Indexes" OR "Nutrition Indices" OR "Nutritional Index" OR "Nutritional Indices" OR "Nutrition Index" OR "Prognostic Nutritional Index" OR "PNI" OR "Prognostic Nutritional Indices" OR "Prognostic Nutritional Index" OR "Prognostic Nutritional Indices" OR "Mini Nutritional Assessment" OR "Mini Nutritional Assessments" OR "Mini Nutrition Assessment") AND ("Child"[Mesh] OR Child OR children OR "Child, Preschool"[Mesh] OR "preschool child" OR "preschool children" OR "Infant"[Mesh] OR Infant* OR Infancy OR Newborn* OR Neonate* OR Baby OR Babies OR Toddler OR Toddlers) **Filters:** Human, English
CINAHL	(Feeding OR "Feeding Behavior*" OR "feeding skill*" OR "eating skill*" OR (MH "Eating Behavior") OR "Eating Behavior*" OR "Eating Behaviour*" OR "Feeding-Related Behavior*" OR "Feeding Related Behavior*" OR "Feeding Pattern*" OR (MH "Food Habits") OR "Food Habit*" OR "Eating Habit*" OR "Diet* Habit*" OR (TI oral) OR oral OR (MH "Mastication/PH") OR (MH "Mastication") OR Masticat* OR Chewing OR (MH "Eating/PH") OR (MH "Eating") OR eating OR (MH "Drinking Behavior") OR Drinking* OR "drinking behavior*" OR "drinking behaviour*" OR "water consumption" OR "water intake" OR (MH "Deglutition") OR (MH "Deglutition/PH") OR Deglutition* OR Swallowing* OR Biting OR (MH "Sucking Behavior") OR Sucking OR "sucking behavior*" OR "sucking behaviour*" OR (MH "Infant Food") OR "infant food*" OR "baby food*" OR (MH "Mouth") OR (MH "Mouth/PH") OR Mouth* OR "oral cavity" OR "cavitas oris" OR "vestibule of the mouth" OR "oral cavity proper" OR "cavitas oris propria" OR (MH "Jaw") OR (MH "Jaw/PH") OR Jaw* OR (MH "Lip/PH") OR (MH "Lip") OR Lip OR Lips OR Philtrum* OR (MH "Tongue") OR (MH "Tongue/PH") OR Tongue*OR "Eating Utensil*" OR cutlery OR Spoon OR Spoons OR Fork OR forks OR Cup OR "drinking straw" OR "Food texture" OR (MH "Beverages") OR Beverage* OR liquid OR Liquids OR Purees OR "Semi-solid*" OR "semi solid*" OR (TI solids) OR Solids) AND ((MH "Child Development") OR "child* development" OR (MH "Infant Development") OR "infant development" OR "baby development" OR "skill development" OR "motor development" OR "oral-motor" OR "oral motor" OR (MH "Psychomotor Performance") OR "Visual Motor Coordination*" OR "Psychomotor Control" OR "Psychomotor Performance*" OR "Psychomotor Skill*" OR "Sensory Motor Performance*" OR "Perceptual Motor Performance*" OR "motor learning" OR (MH "Motor Skills") OR "motor skill*" OR "Acquisition of skill" OR (MH "Skill Acquisition") OR "skill* acquisition*" OR "skill performance*" OR "age expectation*" OR (MH "Fingers") OR Finger* OR Grip OR Grips OR Grasp OR Grasps OR (MH "Deglutition Disorders") OR "Deglutition Disorder*" OR "Swallowing Disorder*" OR Dysphagia OR "Oropharyngeal Dysphagia" OR "Esophageal Dysphagia" OR (MH "Feeding and Eating Disorders of Childhood") OR "feeding and eating disorders of childhood" OR "Pediatric feeding disorder*" OR "childhood eating and feeding disorder*"

(*table continues*)

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Search Strategies

Database	Search strategy
	OR "eating and feeding disorders in children" OR "rumination disorder*" OR "Feeding Disorder*" OR (MH "Eating Disorders") OR "Eating Disorder*" OR "Appetite Disorder*") AND ((MM "Surveys") OR "Survey Method*" OR Survey* OR (MM "Questionnaires") OR Questionnaire* OR "Questionnaire Design*" OR "Baseline Survey*" OR Respondent* OR "Randomized Response Technique*" OR (MH "Psychometrics") OR Psychometric* OR Assess OR Assessing OR Assessed OR Assessment OR Measurement OR (MH "Scales") OR Scale OR Scales OR Tool OR (MH "Evaluation") OR Evaluat* OR (MH "Nutritional Assessment") OR "diet* assessment*" OR "Nutrition* Assessment*" OR "Nutrition* Index*" OR "Nutrition* Indice*" OR "Prognostic Nutritional Index*" OR "PNI" OR "Prognostic Nutritional Indice*" OR "Mini Nutrition* Assessment*") AND ((MH "Child") OR Child OR children OR (MH "Child, Preschool") OR "preschool child*" OR "child* preschool" OR (MH "Infant") OR Infant* OR Infancy OR (MH "Infant, Newborn") OR Newborn* OR Neonate* OR Baby OR Babies OR "baby newborn" OR "newborn infant*" OR Toddler*) **Limiters –** English Language
PsycINFO	(Feeding OR "Feeding Behavior*" OR "feeding skill*" OR "eating skill*" OR (DE "Eating Behavior") OR "Eating Behavior*" OR "Feeding-Related Behavior*" OR "Feeding Related Behavior*" OR "Feeding Pattern*" OR "Food Habit*" OR "Eating Habit*" OR "eating pattern*" OR "Diet* Habit*" OR (TI oral) OR oral OR Masticat* OR (DE "Chewing") OR Chew* OR Drinking* OR "water consumption" OR "water intake" OR Deglutition* OR (DE "Swallowing") OR Swallowing* OR Biting OR (DE "Sucking") OR Sucking OR "infant food*" OR (DE "Mouth (Anatomy)") OR Mouth OR "oral cavity" OR "cavitas oris" OR "vestibule of the mouth" OR "oral cavity proper" OR (DE "Jaw") OR Jaw OR Mandibula OR Maxilla OR (DE "Lips (Face)") OR Lip OR Lips OR Philtrum* OR (DE "Tongue") OR Tongue* OR "Eating Utensil*" OR cutlery OR Spoon OR Spoons OR Fork OR forks OR Cup OR "drinking straw" OR "Food texture*" OR (DE "Beverages (Nonalcoholic)") OR Beverage* OR liquid OR Liquids OR Purees OR "Semi-solid*" OR "semi solid*" OR (TI Solids) OR Solids) AND ((DE "Childhood Development") OR "child develop*" OR (DE "Infant Development") OR "infant develop*" OR "skill develop*" OR (DE "Motor Development") OR "motor development" OR "motor learning" OR "oral-motor" OR "oral motor" OR (DE "Visual Motor Integration") OR "visual motor integrat*" OR "Visual Motor Coordination*" OR (DE "Perceptual Motor Coordination") OR "perceptual motor coordinat*" OR (DE "Perceptual Motor Development") OR "perceptual motor develop*" OR (DE "Perceptual Motor Learning") OR "perceptual motor learn*" OR (DE "Perceptual Motor Processes") OR "perceptual motor process*" OR "Perceptual Motor Performance*" OR "Sensory Motor Performance*" OR (DE "Motor Skills") OR "motor skill*" OR "Acquisition of skill" OR "skill acquisition*" OR "skill performance" OR "age expectation*" OR (DE "Fingers (Anatomy)") OR Finger* OR Grip OR Grips OR Grasp OR Grasps OR "Deglutition Disorder*" OR "Swallowing Disorder*" OR (DE "Dysphagia") OR dysphagia OR "Oropharyngeal Dysphagia" OR "Esophageal Dysphagia" OR "feeding and eating disorders of childhood" OR "Pediatric feeding disorder*" OR (DE "Eating Disorders") OR "eating disorder*" OR "appetite disorder*" OR (DE "Feeding Disorders") OR "feeding disorder*") AND ((DE "Surveys") OR "Survey Method*" OR Survey* OR (DE "Questionnaires") OR Questionnaire* OR "Questionnaire Design*" OR Respondent* OR (DE "Psychometrics") OR Psychometric* OR Tests OR Test OR Assess OR Assessing OR Assessed OR Assessment OR (DE "Measurement") OR Measurement OR (DE "checklist (testing") OR Checklist* OR Scale* OR Tool OR (DE "Evaluation") OR Evaluat* OR "Nutritional Assessment*" OR "Nutrition* Indice*" OR "Nutrition* Index*" OR "Prognostic Nutritional Index" OR "PNI" OR "Prognostic Nutritional Indices" OR "Mini Nutrition* Assessment*") AND ((Feeding OR "Feeding Behavior*" OR "feeding skill*" OR "eating skill*" OR (DE "Eating Behavior") OR "Eating Behavior*" OR "Feeding-Related Behavior*" OR "Feeding Related Behavior*" OR "Feeding Pattern*" OR "Food Habit*" OR "Eating Habit*" OR "eating pattern*" OR "Diet* Habit*" OR (TI oral) OR oral OR Masticat* OR (DE "Chewing") OR Chew* OR Drinking* OR "water consumption" OR "water intake" OR Deglutition* OR (DE "Swallowing") OR Swallowing* OR Biting OR (DE "Sucking") OR Sucking OR "infant food*" OR (DE "Mouth (Anatomy)") OR Mouth OR "oral cavity" OR "cavitas oris" OR "vestibule of the mouth" OR "oral cavity proper" OR (DE "Jaw") OR Jaw OR Mandibula OR Maxilla OR (DE "Lips (Face)") OR Lip OR Lips OR Philtrum* OR (DE "Tongue") OR Tongue* OR "Eating Utensil*" OR cutlery OR Spoon OR Spoons OR Fork OR forks OR Cup OR "drinking straw" OR "Food texture*" OR (DE "Beverages (Nonalcoholic)") OR Beverage* OR liquid OR Liquids OR Purees OR "Semi-solid*" OR "semi solid*" OR (TI Solids) OR Solids) AND ((DE "Childhood Development") OR "child develop*" OR (DE "Infant Development") OR "infant develop*" OR "skill develop*" OR (DE "Motor Development") OR "motor development" OR "motor learning" OR "oral-motor" OR "oral motor" OR (DE "Visual Motor Integration") OR "visual motor integrat*" OR "Visual Motor Coordination*" OR (DE "Perceptual Motor Coordination") OR "perceptual motor coordinat*" OR (DE "Perceptual Motor Development") OR "perceptual motor develop*" OR (DE "Perceptual Motor Learning") OR "perceptual motor learn*" OR (DE "Perceptual Motor Processes") OR "perceptual motor process*" OR "Perceptual Motor Performance*" OR "Sensory Motor Performance*" OR (DE "Motor Skills") OR "motor skill*" OR "Acquisition of skill" OR "skill acquisition*" OR "skill performance" OR "age expectation*" OR (DE "Fingers (Anatomy)") OR Finger* OR Grip OR Grips OR Grasp OR Grasps OR "Deglutition Disorder*" OR "Swallowing Disorder*" OR (DE "Dysphagia") OR dysphagia OR "Oropharyngeal Dysphagia" OR "Esophageal Dysphagia" OR "feeding and eating disorders of childhood" OR "Pediatric feeding disorder*" OR (DE "Eating Disorders") OR "eating disorder*" OR "appetite disorder*" OR (DE "Feeding Disorders") OR "feeding disorder*")

(*table continues*)

Appendix (p. 3 of 3)

Search Strategies

Database	Search strategy
	AND ((DE "Surveys") OR "Survey Method*" OR Survey* OR (DE "Questionnaires") OR Questionnaire* OR "Questionnaire Design*" OR Respondent* OR (DE "Psychometrics") OR Psychometric* OR Tests OR Test OR Assess OR Assessing OR Assessed OR Assessment OR (DE "Measurement") OR Measurement OR (DE "checklist (testing") OR Checklist* OR Scale* OR Tool OR (DE "Evaluation") OR Evaluat* OR "Nutritional Assessment*" OR "Nutrition* Indice*" OR "Nutrition* Index*" OR "Prognostic Nutritional Index" OR "PNI" OR "Prognostic Nutritional Indices" OR "Mini Nutrition* Assessment*") AND (Child OR children OR "preschool child*" OR Infant* OR Infancy OR Newborn* OR Neonate* OR Baby OR Babies OR Toddler*)) **Limiters –** English; Population Group: Human