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Approaches to infant weaning and the issues caregivers face: a rapid review

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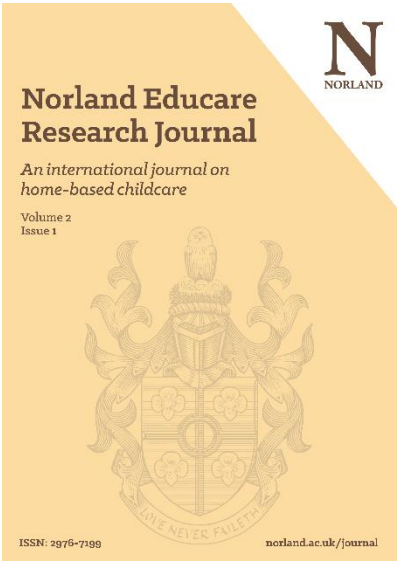

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Abstract

The World Health Organization's global advice is that infants should be exclusively breastfed for six months and beyond with complementary feeding until two years old. The literature and guidelines on weaning (academic and popular) are vast and contradictory. The primary aim of this review is to examine the current scientific literature about infant complementary feeding. As such, the research questions were: (1) what are the key approaches to weaning and complementary feeding, and (2) what are the key issues or influences for caregivers when deciding how to wean their child? During August 2021, six databases were systematically searched for both qualitative and quantitative studies related to weaning. Thirty-three academic studies met the inclusion criteria. Thematic analysis of scientific evidence revealed an overarching theme of practitioner/expert perspective versus caregiver perspective. Five key themes were identified: weaning style – benefits and risks; guidance and advice; optimal time for weaning; influence of solid-food introduction on growth; and sociodemographic

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influences. Overall, other approaches to weaning include spoon-feeding, baby-led weaning, or a combination of the two.

Keywords: weaning, complementary feeding, infant nutrition, rapid review, caregivers, baby-led weaning

Introduction

The initial 1,000 days of a child's life represent a crucial period for developmental milestones (Vasconcelos *et al.*, 2021). Nutrition plays a pivotal role during this window, with choices surrounding breastfeeding, formula feeding and the introduction of complementary foods shaping outcomes such as child mortality, obesity and the onset of chronic diseases, while also impacting cognitive, motor and socio-emotional development and learning capacities (da Cunha *et al.*, 2015). Long-term repercussions of malnutrition within this critical phase include stunting (Martorell *et al.*, 1994), compromised cognitive abilities (Pollitt *et al.*, 1995) and, later in adulthood, diminished physical work capacity (Haas *et al.*, 1996) and potential issues with reproductive health and childbirth. It is evident that poor nutrition not only affects individuals on a micro level but also carries implications for the wider population.

Caregivers typically opt for breastfeeding or formula feeding as primary methods of nourishing infants. The benefits of breastfeeding have been discussed and explored extensively within the literature. Breast milk, a natural elixir, provides infants with essential nutrients that are vital for robust growth and development while serving as a shield against a spectrum of infections and diseases, spanning gastrointestinal, respiratory and endocrine ailments, and even certain cancers. Moreover, breastfeeding mitigates the risk of allergies and fosters psychomotor development (Del Ciampo and Del Ciampo, 2018; Horta *et al.*, 2015; Kramer and Kakuma, 2012). Consequently, the World Health Organization (WHO) has unequivocally recommended exclusive breastfeeding for the initial six months of a child's life (World Health Organization, 2019).

After the initial six months of breastfeeding or formula feeding, caregivers are advised to commence complementary feeding, defined by the WHO and UNICEF as the introduction of additional foods and liquids when breast milk or formula alone no longer suffices to meet infants' nutritional needs (World Health Organization and United Nations Children's Fund, 2008). The WHO (2002) outlined four key components of appropriate complementary feeding: timeliness (introducing foods when energy and nutrient needs surpass what exclusive breastfeeding or formula can provide), adequacy (ensuring foods supply sufficient energy, protein and nutrients), safety (proper storage, preparation and serving) and responsiveness to hunger and satiety cues (feeding frequency and method tailored to the child's age and cues). Methods of complementary feeding typically include spoon-feeding (a method of introducing solid foods to infants where a caregiver uses a spoon to feed puréed or mashed foods to the baby) and baby-led weaning (BLW), which is an approach to introducing solid foods to infants where the baby is encouraged to feed themselves finger foods and participate in mealtime independently, skipping the puréed or mashed-food stage.

Guidelines concerning the introduction of complementary feeding exhibit a fairly uniform consensus globally. However, within Europe, the European Society for Paediatric Gastroenterology, Hepatology and Nutrition suggests a window for introduction spanning from four to six months of age. Other entities have issued updated guidelines, particularly regarding the incorporation of allergenic foods at the onset of complementary feeding and the avoidance of added sugars for the initial two years (Fewtrell *et al.*, 2017). However, according to Fewtrell *et al.* (2017), it seems that numerous caregivers do not adhere to international recommendations concerning optimal complementary feeding

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practices, which may be due to a lack of understanding of the guidelines. Further, an understanding of the types of caregivers who do not adhere is warranted for the future development of complementary feeding interventions (Nantel and Gingras, 2023). Thus, this review aims to evaluate scientific literature on infant complementary feeding. Two main research questions guide this review: (i) what are the key approaches to weaning and complementary feeding, and (ii) what are the key issues or influences for caregivers when deciding how to wean their child?

Methodology

A rapid review was conducted to provide focused research under time constraints, allowing greater emphasis on research questions, broader search strategies and key variable extraction. Rapid review involves a modified systematic review to accelerate the review process for existing research while maintaining systematic, transparent methods (Klerings *et al.*, 2023). This rapid review utilises the principles of mixed methods from the Joanna Briggs Institute's convergent integrated design (Stern *et al.*, 2021). This refers to a process of combining extracted data from quantitative studies and qualitative studies, and transforming it – or 'qualitising' it (Aromataris and Munn, 2020). Qualitising involves translating or converting numerical data into 'textual descriptions' to allow integration with qualitative data, and then providing a narrative interpretation of the results. As rapid reviews do not require papers to be critically discussed or appraised on the basis of quality, this was not undertaken.

Search strategy

Using EBSCOhost, a comprehensive search was conducted of the databases Academic Search Complete, British Education Index, Child Development and Adolescent Studies, CINAHL Plus, ERIC, and SocINDEX. The search strategy combined synonyms for *weaning*, *influences/issues*, *family*, *medical terms, food* and *age*. Terms were searched separately then as a string. English Boolean operators of 'and', 'or' and '*' were used. Crafting a search strategy is an ongoing process, requiring constant evaluation and fine-tuning. The effectiveness of keywords or key terms in a search is gauged by the resulting outcomes, and as many key terms as possible are required (Aromataris and Riitano, 2014). Papers were searched according to the following: English language only, peer-reviewed, undertaken in predominantly Western countries and published between 2011 and 2021. It was decided that the last 10 years of publication would be the most suitable to assess current understanding and research. Papers were screened by two reviewers – the author and another academic – for their relevance to the aim of the study.

Eligibility

The search strategy followed the PRISMA guidelines (Page *et al.*, 2021) to assess the eligibility. This was done in three stages (see Figure 1). During stage one, 176 papers out of 927 were deleted (duplicates/exclusion criteria). During stage two, titles/abstracts were reviewed and 644 papers were excluded. Full texts (103) were downloaded for screening; 33 studies (Table 1) were included, and demographics (authors, year, country, participants) and design (focus, aims/objectives/hypothesis, methodology, results, conclusions/implications) were extracted.

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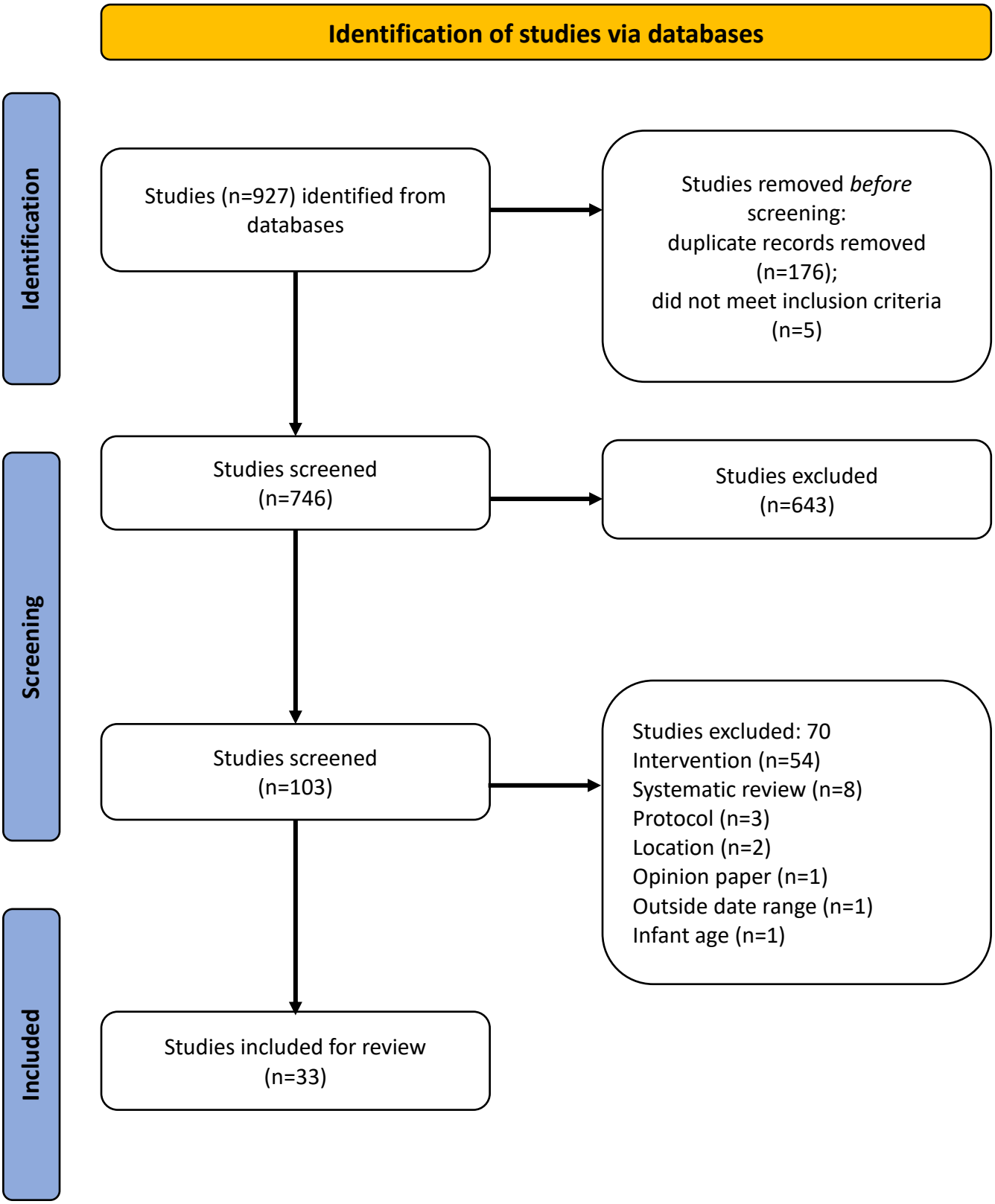

Figure 1 **Search strategy for scientific literature (adapted from Page *et al.*, 2020)**

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Table 1 **Main characteristics of studies included**

Reference	Location	Methods	Key focus	Purpose	Participants	Key findings
Addessi *et al.* (2021)	Italy	Questionnaire	Influence of solid-food introduction on growth	To investigate the variability in infant feeding practices and the association with developmental milestones in an Italian population	1,245 mothers of 6- to 12-month-old infants	High understanding of weaning guidelines predicts weaning age in this population. BLW correlates with breastfeeding, early exposure to complementary foods and finger and family foods, and family meal interest. BLW-introduced infants achieve more developmental milestones.
Arora *et al.* (2020)	Australia	Telephone interviews/ questionnaire at 8, 17, 34 and 52 weeks post-partum	Introduction of solid foods	To examine the timing of introduction of complementary (solid) foods and describe the maternal and infant characteristics associated with very early introduction of solids	Mother–infant dyads (n=1,035)	13.6% (n=127) of infants had received solids before 17 weeks of age, and 76.9% (n=719) before 26 weeks. The practice of introducing solids early decreased with older age of the mother.
Barrera *et al.* (2018)	USA	Data from 2009 to 2014 continuous National Health and Nutrition Examination Survey (NHANES)	Optimal time for weaning	To examine the timing of first introduction of complementary foods (incl. solids and liquids other than breast milk and infant formula) among US children	1,482 children aged 6–36 months	16% of US children are introduced to complementary foods too early (before four months of age); one in two children are introduced to complementary foods before six months.
Brown (2016)	UK	Self-report questionnaire	Maternal characteristics; weaning styles	To explore differences in maternal characteristics	604 mothers with an infant	Mothers with lower anxiety, higher extraversion and conscientiousness, and less

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				between those adopting baby-led and traditional approaches	aged 6–12 months	restrained eating were more likely to introduce complementary foods later and independently adopt BLW.
Brown (2018)	UK	Questionnaire	Risks of weaning: choking	To compare sample episodes of choking between infants being introduced to solid foods via baby-led and traditional methods, and to explore factors related to any choking episodes	1,151 mothers with an infant aged 4–12 months	BLW was not associated with increased risk of choking and the highest frequency of choking on finger foods occurred in those who were given finger foods the least often.
Brown and Lee (2011)	UK	Questionnaire	Parental beliefs/ experiences of BLW	To characterise a sample of women who have chosen to adopt the BLW method and to describe associated attitudes and behaviours	655 mothers with a child between 6 and 12 months	BLW linked to delayed complementary food introduction, more milk feeds, increased family meal participation, fewer maternal weaning concerns and higher socio-economic status (SES).
Cameron *et al.* (2012)	New Zealand	Semi-structured interviews	Practitioner and parental beliefs/ experiences of BLW	To examine healthcare professionals' and mothers' knowledge of BLW	Healthcare professionals (n=31) and mothers who had used BLW (n=20)	Healthcare professionals had limited BLW experience and raised concerns about choking, iron deficiency and inadequate energy intake. A knowledge, attitude and experience mismatch exists between healthcare professionals and mothers regarding BLW.
Cameron *et al.* (2015)	New Zealand	RCT Repeated interviews	Introducing solid foods too soon and early	To determine whether lactation consultant support, with educational resources, can delay the introduction of	802 mother–infant pairs	Providing a lactation consultant and educational resources at four months post-partum to predominantly well-educated,

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			breastfeeding cessation	complementary foods until around six months of age		mainly European, women can delay the introduction of complementary foods until five months, but not until the WHO recommendation of six months.
Castro *et al.* (2015)	Ireland	Questionnaire	Influence of solid-food introduction on growth	To identify predictors of early complementary feeding to help health professionals target population groups in greater need of dietary intervention and effective advice	A cohort of mothers (n=11,134) interviewed when infants were nine months of age	High prevalence of infants consuming complementary foods at 16–20 weeks indicates early introduction of solids, possibly signalling inappropriate feeding practices.
Caton *et al.* (2011)	UK	Postal questionnaire, interviews	Caregiver beliefs, and feeding practices	To explore parental feeding practices and their relationship to official recommendations and to discover the ways by which parents encourage their children to like and to consume vegetables	75 mothers with an infant aged 6–18 months for questionnaire; 13 parents/ caregivers (interview)	Mothers introduced solid food around 20 weeks, primarily fruits, vegetables and cereals, following British Dietetic Association guidelines. Infants were exposed to about three types of vegetables in the first month of weaning.
Coulthard *et al.* (2014)	UK	Infants' acceptance of a novel vegetable measured over a nine-day period	Nutrient-dense foods for infants	To examine the effectiveness of different vegetable exposure methods (variety vs single taste) over nine days in two groups of infants: those introduced to solids prior to the age of five and a half	60 parent–child dyads	Infants weaned at six months with a single taste may consume less of a new vegetable compared to those weaned onto a variety of tastes or weaned earlier. Rapid introduction to diverse

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				months, and those introduced after		vegetables is recommended for better acceptance.
de Barse *et al.* (2017)	Nether-lands	Questionnaire	Weaning risks and benefits; fussy eating	To examine the associations between infant feeding and child fussy eating in 4,779 participants of Generation R, a Dutch population-based cohort	Parents of 4,779 children	Results suggest that breastfeeding does not predict fussy eating. However, introducing vegetables into a child's diet before five months might be protective against fussy eating.
Fegan *et al.* (2015)	Canada	Longitudinal data from the Kingston, Frontenac, and Lennox & Addington (KFL&A) Infant Feeding Survey. Mothers completed a survey at the end of their hospital stay and were interviewed by telephone at 2, 4, 6 and 12 months.	Parental knowledge of and adherence to public health guidelines	To investigate adherence to the Nutrition for Healthy Term Infants (NHTI) recommendations	325 mothers	For adherence to NHTI recommendations, early infancy interventions delivering consistent, evidence-based guidance are essential. Support is needed for both breastfeeding and non-breastfeeding mothers, targeting those with infants under two months at common access points.
Fialkowski *et al.* (2020)	USA	Interviews	Family influences and cultural differences	To identify Hawaiian complementary feeding practices through in-depth interviews with grandparents	14 grandparents	Complementary feeding practices have evolved, but aspects of traditional Hawaiian feeding practices have

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						remained. These findings are important when working with Hawaiian families because grandparents have a prominent role in feeding infants.
Grote *et al.* (2011)	Germany	RCT	Influence of solid-food introduction on growth	To assess if the timing of solid-food introduction affects the weight, length or weight-for-length of formula-fed children at 24 months and their growth trajectories in the first two years	1,090 infants	Solid-food-introduction timing is influenced by culture, perinatal factors like birth weight, socio-economic status, and children's potential energy expenditure. Early solid introduction minimally affects early growth but adds extra energy to formula-fed-children's diets, supporting the recommendation against introduction before four months.
Hoffman *et al.* (2014)	USA	Questionnaire	Caregiver beliefs, health status and weaning practices	To ascertain the feeding practices of mothers with eating disorder histories	25 mothers with eating disorder histories and 25 mothers without, with children aged 6–36 months	Mothers with eating disorder histories tend to adopt restrictive feeding approaches, such as limiting processed or only offering organic foods, mirroring dietary rules seen in individuals with eating disorders.
Jones *et al.* (2020)	UK	Measurements; questionnaires	Weaning style; influence of solid-food introduction	To conduct the first UK-based study examining the impact of method of complementary feeding and how it interacts with milk feeding on infant	269 infants and 267 mothers	No significant differences in weight or body mass index were observed between infants introduced to complementary foods via spoon-feeding or self-

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				growth during the first year using solely researcher-led measurements		feeding. However, spoon-fed infants were significantly longer than those self-feeding. Variations in infant diet due to complementary feeding method may influence length gains.
Jonsdottir *et al.* (2014)	Iceland	RCT and cohort study	Practitioner advice	To assess the effect of unlimited access to lactation consultants from five to six months for infants receiving complementary foods from four months of age in addition to breast milk and their effect on total breastfeeding duration	250 mother–infant pairs	Mother–infant pairs with unrestricted lactation consultant access delayed complementary food introduction initially. Those exclusively breastfeeding for six months had longer breastfeeding durations compared to those starting complementary feeding at four months, regardless of lactation consultant exposure.
Karp and Lutenbacher (2011)	USA	Survey and interview	Caregiver beliefs and practices	To specifically examine infant feeding practices in a sample of young mothers	70 first-time mothers	Infant diets mirror maternal diets and eating habits as early as seven months of age.
Lakhanpaul *et al.* (2020)	UK	Semi-structured interviews, focus groups and film	Caregiver beliefs, feeding practices/family influences and cultural differences	To optimise infant feeding and care practices among Bangladeshi infants aged 6–23 months	141 British-Bangladeshi mothers, fathers and grandparents of infants aged 6–23 months, key informants,	Recognising wider determinants of health and behaviours is vital for addressing health outcomes, particularly among high-risk or vulnerable populations. Parenting interventions must be community-coordinated, considering social and cultural

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					and community members	norms influencing infant feeding practices, especially in ethnically diverse communities. Moreover, improving UK infant feeding environment necessitates stricter regulation of infant food marketing to optimise early nutrition.
Lessa *et al.* (2020)	UK	Secondary analysis of three large population-based datasets	Optimal time for weaning; early breastfeeding cessation	To explore the extent to which starting solids early predicts shorter breastfeeding duration	10,407 infants	Evidence from the three surveys consistently demonstrates that early introduction of solid foods predicts a shorter breastfeeding duration and suggests that deferring solids is important to sustain breastfeeding.
Moore *et al.* (2012)	UK	Questionnaire	Parental knowledge of public health guidelines	To assess understanding of UK weaning guidelines in UK parents and investigate the associations of this understanding with weaning timing, and other influencing factors	3,607 parents	Poor understanding of the guidelines was the most reliable predictor of early weaning, together with young maternal age. Following BLW was the most reliable predictor of those weaning at 26 weeks, with the internet being the most influential source of advice.
Moore *et al.* (2014)	UK	Questionnaire	Caregiver beliefs; feeding practices	To explore knowledge of the UK weaning guidelines and the sources of weaning advice used by UK first-time mothers	1,348 first-time mothers	First-time mothers encounter conflicting weaning information from various sources. Younger, less-

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						educated mothers require particular support as they tend to initiate early weaning. Given the growing importance of the internet for weaning advice, health professionals should guide mothers to trustworthy online resources.
Poniedziałek *et al.* (2018)	Poland	Questionnaire	Parental belief; experiences of BLW	To learn the concerns, perceived advantages and disadvantages, and overall satisfaction of mothers who adopted BLW	373 Polish mothers	The pros of BLW outweigh the cons, and nearly all mothers would recommend it to other caregivers.
Rogers and Blissett (2019)	UK	Questionnaire	Caregiver beliefs; practices; optimal time for solid-food introduction	To investigate relationships between maternal feeding behaviours, infant temperament and the timing of introduction to solid food	81 mothers	Infant traits like birth weight and playfulness predict solid-food introduction more than maternal factors such as age, breastfeeding duration or postnatal depression. This is crucial as UK adherence to guidelines is lacking, and signs of readiness for solids are often misunderstood by parents.
Rowan *et al.* (2019)	UK	Online survey	Weaning style: spoon-fed/traditional vs BLW	To record and compare the exposure to different foods of infants aged 6–12 months weaned using traditional spoon-feeding and BLW	180 parents: 56 were strict BLW, 88 loose BLW and 36 were traditional spoon-feeding	Little negative impact was seen on the food choices offered by parents, with BLW giving greater exposure to vegetables, coupled with lower reliance on commercial products.

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Russell *et al.* (2018)	Australia	Quasi-experimental study design with a mobile health (mHealth) intervention group and a non-randomised comparison group	Interventions for parental practice	To describe the effects of an mHealth intervention on parental feeding practices, infant food preferences and infant satiety responsiveness	645 parents T1: intervention (n=301), control (n=344); T2: intervention (n=234), control (n=312); T3: intervention (n=225), control (n=293)	Although mHealth can be effective in promoting some health behaviours and offers many advantages in health promotion, the results suggest that design and delivery characteristics needed to maximise the impact of mHealth interventions on infant feeding are uncertain.
Saaka *et al.* (2015)	Ghana	Quantitative data collected using a structured questionnaire in face-to-face interviews during house-to-house visits	Influence of solid-food introduction on growth	To explore the difference between IYCF (infant and young child feeding) and child growth indicators	1,984 mother/child pairs	Poor timing of complementary food was associated with stunting. The association between nutritional status and timing of complementary feeding could be explained by the fact that early initiation of complementary feeding has a potential negative effect on breastfeeding frequency and duration.
Samady *et al.* (2020)	USA	Questionnaire	Practitioner advice	To describe current paediatric practitioners' recommendations regarding complementary food introduction, focusing on food type, age of introduction and	563 practitioners	Most paediatric practitioners did not advise waiting three days between introducing foods unless allergy risk was present. This recommendation restricts food diversity and

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				waiting periods between the introduction of new foods		might delay early peanut introduction. Given changes in food allergy prevention, a reassessment of feeding guidelines may be needed.
Spyreli *et al.* (2021)	UK	Questionnaire	Caregiver beliefs and practices	To explore differences between mothers' and fathers' complementary feeding practices	60 mothers and fathers (non-dyads)	Study findings revealed no gender differences in parental complementary feeding practices apart from the use of BLW.
Usheva *et al.* (2021)	Bulgaria	Questionnaire	Influence of solid-food introduction on growth	To investigate the association between the timing of complementary feeding and breastfeeding, and overweight prevalence in preschool children	7,500 parents from six EU countries (Belgium, Bulgaria, Germany, Greece, Poland and Spain)	Other variables have a greater impact on the risk for childhood obesity than the timing of complementary food introduction. Mothers should be educated about healthy eating practices and other possible risk factors for being overweight.
Wright *et al.* (2011)	UK	Questionnaire	Weaning style: BLW	To define the range of ages at which infants reach out for and eat finger foods and relate this to developmental status	923 children	BLW suits most infants but may pose nutritional risks for developmentally delayed ones. A pragmatic approach is to incorporate BLW's positives, emphasising self-feeding with finger foods and family meal inclusion while initially offering spoonable foods as well.
Zielinska *et al.* (2019)	Poland/ Austria	Questionnaire	Socio-demographic	To determine sociodemographic and birth-related factors associated with	5,815 parents of children aged 12–36	Lower maternal age and education were the primary sociodemographic factors

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			status and weaning	the age of introducing complementary foods	months from Poland and Austria	associated with early complementary feeding introduction. Pregnancy-related factors included preterm birth and birthweight to gestational age, while never breastfeeding and post-hospital infant formula use were key feeding-related determinants.

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Data analysis

Following data extraction, thematic analysis was employed to explore key themes regarding approaches to weaning, as well as influences, issues and factors arising during the weaning process. This method of analysis was used due to its flexibility (Terry *et al.*, 2017) and ability to systematically identify, organise and offer understanding of themes (Braun and Clarke, 2012). Moreover, it is an accessible approach which provides an audit trail with a structure to answer the review questions directly by capturing the ideas underpinning a number of themes (Braun *et al.*, 2016). Figure 2 summarises the overarching theme, key themes and subthemes which were identified from the analysis of the reviewed papers.

Limitations

Due to time constraints of the project, a systematic review was not possible. Consequently, the search was confined to one online research platform (EBSCOhost), although it did include six databases in total. As a result, PubMed, Web of Science and Scopus were not explored, nor was 'grey' literature included. It is acknowledged that search terms may have been limited, thus meaning more papers on the topic of weaning and complementary feeding were not included. Quality appraisal of the papers was not undertaken as per the rapid review methodology (Klerings *et al.*, 2023).

Key findings and discussion

Key approaches to weaning and complementary feeding (research question 1)

1. Weaning style – benefits and risks

Spoon-fed/traditional vs BLW. Wright *et al.* (2011) examined the timing of infants reaching for food and its relation to development, parental provision of finger foods and socio-economic status (SES). At 12 months, 57% had been breastfed, but only 21% were breastfed for over four months; 56% of infants reached for food before six months, correlating with later developmental milestones. Forty per cent were offered finger foods before six months, rising to 90% by eight months. Most were offered common foods like bread, fruits and vegetables. Despite early exploration, self-feeding was not widespread by eight months. Wright *et al.* suggested that while BLW may suit most, it could pose challenges for developmentally delayed infants. Brown and Lee (2011) explored the BLW approach, particularly the mothers' experiences of it. Additionally, their research compared a sample of women using BLW with those using spoon-feeding. A wide range of infrequency regarding the use of spoon-feeding and puréed foods was reported, and roughly half of the demographically diverse sample were categorised as using the BLW method. The BLW approach was associated with a later introduction of complementary foods (whole form), a higher number of milk feeds, higher SES, higher level of education, higher occupation, marriage, increased participation in family mealtimes, and fewer maternal concerns about the weaning process. Additionally, mothers using BLW were more confident in feeding their infant and were less concerned about mess and amount of nutrients consumed. Brown (2016) then examined maternal characteristics in relation to weaning approaches. Results showed that 58% practised BLW, associated with higher education and professional occupation. The mean age for introducing solids was 20.76 weeks, with 65.9% starting before six months. Later introduction correlated with lower maternal anxiety and personality traits like extraversion and conscientiousness.

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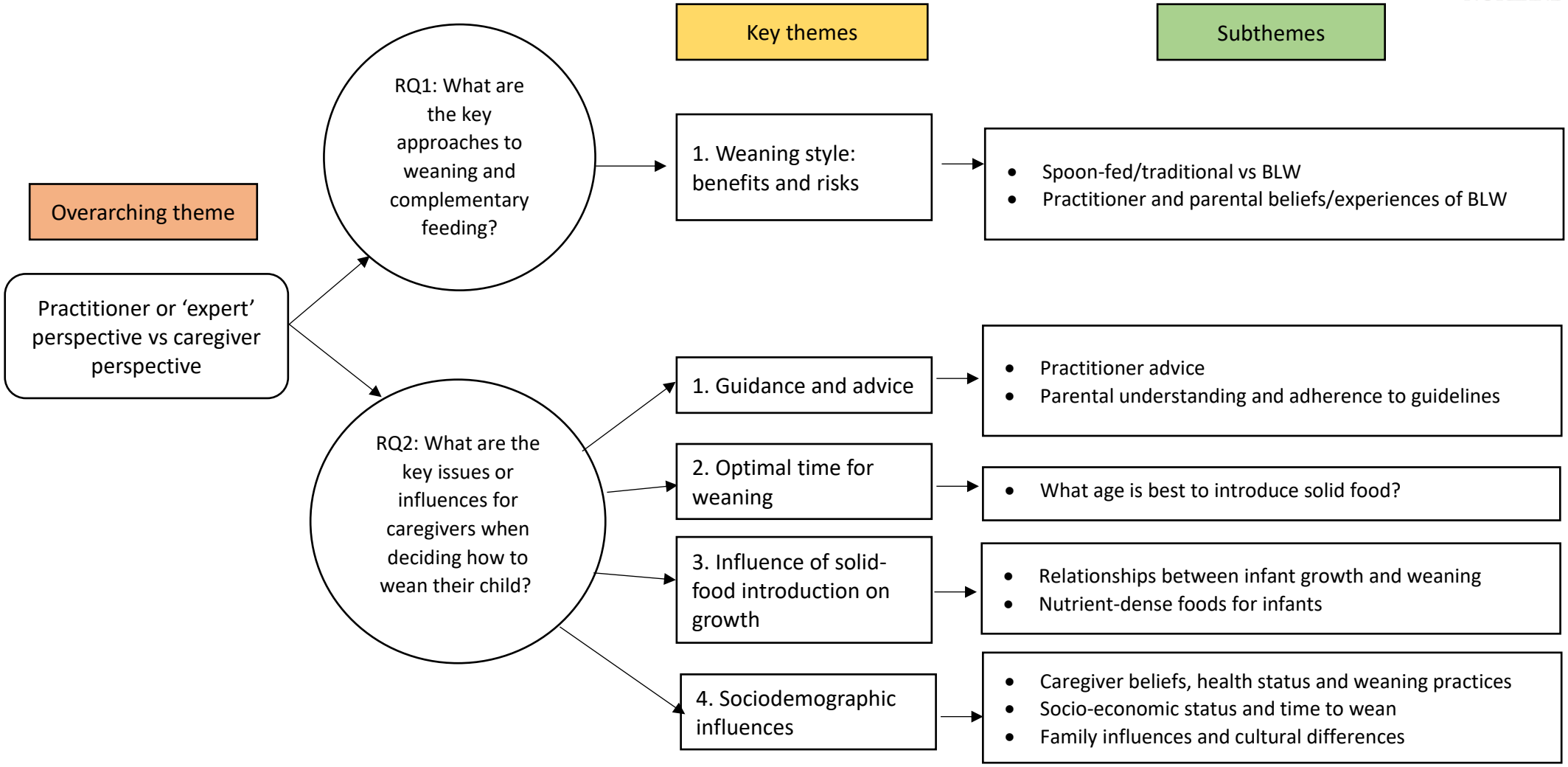

Figure 2 **Thematic map of key themes and subthemes**

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While BLW is associated with various benefits such as later introduction of complementary foods and increased maternal confidence, concerns persist regarding its suitability for developmentally delayed infants, highlighting potential challenges in its widespread adoption.

Practitioner and parental beliefs/experiences of BLW. Cameron *et al.* (2012) investigated healthcare professionals' and mothers' perceptions of BLW. Professionals generally viewed BLW favourably, citing benefits such as healthier dietary habits, improved appetite regulation and enhanced oral skills. However, concerns over choking and nutritional adequacy were prevalent among professionals. Mothers typically initiated BLW around five and a half to six months, following healthcare professional guidance and WHO recommendations. Gagging was commonly reported by mothers but was generally perceived as a normal part of the learning process. Poniedziałek *et al.* (2018) explored the experience of Polish mothers using BLW through a self-report questionnaire, which covered demographics; intentions, advantages and disadvantages of using BLW; sources of information; and family attitudes towards BLW. It was found that the main motivations to adopt BLW were child curiosity, the child's interest in solid foods and the health benefits for development. Online (non-scientific) resources were the main source of information on BLW, as well as books, family and friends. Only a very small number read scientific sources but did not mention advice of healthcare professionals. Choking was a key fear for these mothers; some faced some form of criticism and negative attitudes towards BLW from family and friends – usually because of choking, mess, generation of food waste, and risk of undernourishment. Despite this, the vast majority would recommend BLW to other parents, with the pros of BLW outweighing the cons.

Rowan *et al.* (2019) aimed to record and compare exposure to different foods among infants aged 6–12 months weaning using spoon-feeding and BLW. Significant differences were found in exposure to vegetables, protein and composite meals between the groups; those in the strict BLW group had higher exposure to vegetables and protein than the spoon-fed group. For composite meals, the strict BLW group was offered fewer portions than the spoon-fed group. Overall, the authors reported that BLW appears to encourage a higher intake of vegetables/protein through finger foods, while spoon-fed infants are more likely to be reliant on commercial foods (e.g., jars/pouches). Research by Jones *et al.* (2020) was the first UK-based study to examine the impact of weaning type on infant weight during the first year of life. Infants who were spoon-fed and formula-fed were significantly heavier than those who were spoon-fed and breastfed. This may be due to the limited opportunities for infants to regulate their own intake and satiety.

Despite healthcare professionals' concerns over choking and nutritional adequacy, BLW is favoured by caregivers because it promotes healthier dietary habits, and although these caregivers face criticism mainly due to fears of choking and messiness, BLW infants show higher exposure to vegetables and protein compared to spoon-fed counterparts, and a lower likelihood of excessive weight gain than breastfed infants.

Brown (2018) compared episodes of choking between infants being introduced to solid foods via BLW and traditional methods, and explored factors related to any choking episodes. Analysis revealed that 412 mothers followed BLW strictly, 337 followed it loosely and 362 mothers preferred spoon-feeding. Mothers in full-time employment were more likely to follow the traditional approach, while those who were not working were more likely to be strictly BLW. The timing of introduction of solids differed by weaning group: the strict BLW group introduced solids significantly later than those following a loose BLW approach or a traditional approach, with those following a loose BLW approach introducing solids significantly later than the traditional group. It was reported that 155 infants had choked at least once; those who had choked were offered more portions of food a day than those who had not, specifically lumpy foods. Overall, there were 341 episodes of choking: 237 on finger foods, 93 on lumpy purées and 11 on smooth purées; however, babies being spoon-fed had significantly more choking episodes

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than those following either a strict BLW or a loose BLW approach. De Barse *et al.* (2017) investigated the link between infant feeding practices and fussy eating. Results indicated that breastfeeding duration did not significantly affect food fussiness scores, except for children breastfed for a very short period. Earlier introduction of vegetables was associated with lower food fussiness scores, suggesting a potential strategy to mitigate fussy eating.

Key issues or influences for caregivers deciding when and how to wean their child (research question 2)

1. Guidance and advice

Practitioner advice. Three studies (Cameron *et al.*, 2015; Jonsdottir *et al.*, 2014; Samady *et al.*, 2020) focused on healthcare professionals, notably lactation consultants. Jonsdottir *et al.* (2014) analysed the impact of unlimited lactation consultant access, finding slower complementary food introduction and possibly prolonged exclusive breastfeeding. Cameron *et al.* (2015) investigated the impact of lactation consultant support on delaying complementary food introduction using an RCT. They found group differences in the number of infants introduced to complementary foods before five months, with those receiving support and resources more likely to wait until at least five months. Older, highly educated, higher socio-economic status caregivers were less likely to introduce complementary feeding early compared with younger, less-educated, welfare-dependent caregivers. Finally, Samady *et al.* (2020) found variations in first food recommendations and timing, with discrepancies from published guidelines. Conflicting advice underscores the need for additional practitioner training and education to avoid caregiver confusion and incorrect feeding practices, particularly among those in the lower socio-economic strata.

Parental understanding and adherence to guidelines. Caregivers encounter a plethora of information regarding weaning approaches from various international, national and regional sources. Moore *et al.* (2014) found that for mothers adhering to the recommended six-month weaning age, BLW was the favoured approach. BLW is an alternative approach to being spoon-fed purée by the caregiver; instead, the infant is presented with finger foods to eat independently (Addessi *et al.*, 2021). Awareness does not guarantee compliance; Addessi *et al.* (2021) found 80% of mothers who introduced solids before five months and 65% of those who introduced them before four months were aware of recommendations. BLW was also positively associated with breastfeeding, exposure to complementary foods after six months, earlier exposure to finger foods and higher interest in family food and meals. Demographics and SES of families were key for complementary feeding, alongside maternal employment/return to work after birth. Younger, less-educated, welfare-dependent and minority-group mothers had limited awareness, correlating with early weaning. Meanwhile, BLW mothers were using breastfeeding for significantly longer: 65% of the sample reported waiting until the infant was six months before beginning complementary feeding, complying with the guidelines.

Cameron *et al.* (2015) observed similar trends. Fegan *et al.* (2015) reported that less than 2% adhered to the NHTI guidance, with only 19% waiting until six months. Finally, Russell *et al.* (2018) investigated a mobile health intervention (Growing Healthy) and regular appointments with maternal and child nurses that aimed to impact parental feeding practices, infant food preferences and satiety responsiveness. Few differences were found between the groups, suggesting the need for further research on mHealth intervention design, delivery and evaluation in infant feeding. Despite the abundance of information on weaning approaches, caregivers struggled with compliance, particularly among marginalised groups, highlighting the ineffectiveness of current interventions like the Growing Healthy programme and the necessity for more thorough research into mHealth intervention strategies for infant feeding.

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2. Optimal time for weaning – what age is best to introduce solid food?

Barrera *et al.* (2018) found that formula-fed infants were commonly introduced to solid foods earlier, while breastfed babies tended to have a delayed introduction. Rogers and Blissett (2019) reported that earlier introduction correlated with higher birth weight, shorter breastfeeding and younger maternal age. Arora *et al.* (2020) reported weaning age to be between four and six months, with a median age of six months. Earlier, Grote *et al.* (2011) reported in their European Union study that formula feeding starts as early as up to eight weeks, with a median age of 19 weeks, and solid foods are introduced by the age of six months. The timing was associated with demographics and SES factors. They also reported that the timing of introduction to solid food had no influence on the weight/length of formula-fed children at 24 months, nor the growth trajectories of these children during their first two years of life.

Only one study, Lessa *et al.* (2020), explored the extent to which starting solids early predicts shorter breastfeeding duration through secondary analysis of three population datasets. Statistical analysis revealed univariate associations between breastfeeding duration and age at introduction to solids, as well as social class, maternal age and education level. Further analysis highlighted that the risk of stopping breastfeeding before six months was highest in those starting solids before the age of four months, and lowest in those who delayed weaning until five months old. Lessa *et al.* (2020) argued that health services need to maintain consistent messages to parents that introduction to complementary foods should be delayed until the infant is six months old, as well as stressing the importance of continued feeding using breast milk or formula. Inconsistent findings regarding the timing of introducing solid foods to infants highlight the importance of delaying complementary food introduction until six months, as early introduction correlates with shorter breastfeeding duration and potential adverse outcomes, underscoring the need for consistent messaging from health services.

3. Influence of solid-food introduction on growth

Relationship between infant growth and weaning. Saaka *et al.* (2015) examined differences between the WHO's IYCF indicators and child growth indicators in Ghana. Analysis revealed that late timing of complementary foods was associated with stunting, with males more likely than females to be stunted in their growth due to inadequate energy intake. Usheva *et al.* (2021) investigated associations between complementary feeding, breastfeeding and being overweight through a standardised self-administered questionnaire. Feeding practices showed a different relationship to the prevalence of obesity at different stages of childhood. The introduction of complementary foods at four to six months had a negative association with the prevalence of being overweight at six and 12 months of age, with no differences between breastfed and non-breastfed children. It is more likely, according to the authors, that sociodemographic/lifestyle factors may have a greater impact on childhood obesity than initial feeding type. Late introduction of complementary foods is associated with stunting, particularly among males, while the timing of complementary feeding may have a nuanced relationship with childhood obesity, influenced more by sociodemographic and lifestyle factors than initial feeding type.

Nutrient-dense foods for infants. Coulthard *et al.* (2014) examined the effectiveness of different vegetable exposure over a nine-day period in two groups: those introduced to solids prior to five and a half months, and those introduced after five and a half months. Exposure to variety was crucial for late introducers; those weaned later onto a single taste ate significantly less than those weaned later onto a variety of vegetables. Caton *et al.* (2011) utilised a mixed-methods approach to examine parental feeding practices and strategies to promote vegetable consumption. Initial weaning foods mostly comprised baby cereal, with minimal use of fruits and vegetables. Spoon-feeding was prevalent, with a few adding solids to bottles. Themes identified were vegetable introduction, diet

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concerns, eating patterns, guideline adherence and sleep. Nutrient quality influenced choices, but guidelines and professional advice felt restrictive, leading parents to seek alternative sources. Some linked weaning to sleep patterns, suggesting perceived impacts on infant feeding habits. This study underscores the influence of parental perceptions, external advice and dietary concerns on early feeding practices. Parental perceptions, external advice and dietary concerns significantly influence early feeding practices, emphasising the importance of varied vegetable exposure during weaning and the impact of guideline adherence on parental strategies to promote vegetable consumption.

4. Sociodemographic influences

Caregiver beliefs, health status and weaning practices. Karp and Lutenbacher (2011) surveyed first-time mothers aged 15–22 about their feeding practices for infants aged 6–12 months. Results revealed concerning practices, such as early introduction of infant cereal, often to promote longer sleep. Many mothers were unaware of appropriate food-introduction timing and potential hazards, reflecting a lack of education and support. Additionally, infant diets often mirrored maternal eating habits, with limited intake of fruits and vegetables. Hoffman *et al.* (2014) compared feeding practices of mothers with and without histories of eating disorders. The timing of solid-food introduction after seven months for children of mothers with eating disorder histories underscores the need for further investigation into the influence of maternal eating behaviours on infant feeding practices and child outcomes.

Moore *et al.* (2014) delved into the understanding of and adherence to weaning guidelines among first-time mothers, investigating their primary sources of advice. They found robust awareness of guidelines among caregivers, yet comprehension varied, particularly among younger, less-educated and financially disadvantaged mothers. Despite high awareness, some initiated weaning prematurely, consistent with prior research. Although health visitors were a common source of advice, they did not hold much influence, highlighting a disconnect between accessibility and impact. Instead, informal sources like the internet, books, friends and grandmothers held sway. Conflicting advice from multiple sources underscored the challenges mothers faced. Family and friends often recommended early weaning or weaning upon signs of readiness, diverging from official recommendations. These findings spotlight the imperative of targeted education and support programmes to enhance adherence to evidence-based guidelines.

Finally, Spyreli *et al.* (2021) addressed the dearth of research on paternal involvement in infant feeding practices, comparing maternal and paternal roles in complementary feeding. No notable disparities emerged between mothers and fathers in adherence to recommended practices, with most aligning with WHO guidelines on breastfeeding duration and timing of solid-food introduction. Both genders demonstrated commendable practices, including offering multiple fruit portions daily and eschewing sugary and caffeinated beverages. However, a gender discrepancy surfaced regarding BLW, with mothers more inclined to let infants dictate feeding. Notably, peers with parenting experience were the most trusted information source for both genders, underscoring the influence of social networks. While fathers' involvement in complementary feeding is promising, addressing gender disparities in BLW adoption warrants examination.

First-time mothers in the USA display concerning feeding practices driven by misinformation and mirrored maternal eating habits, while UK caregivers demonstrate varied comprehension of weaning guidelines, often influenced by informal sources, indicating a need for targeted education. Furthermore, while both parents in the UK generally adhere to recommended practices, a gender discrepancy emerges in BLW adoption, emphasising the influence of social networks and highlighting the necessity of addressing gender disparities in infant feeding practices.

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SES, cultural differences and time to wean. Zielinska *et al.* (2019) explored sociodemographic and birth-related determinants influencing the age at which complementary foods were introduced, examining disparities between Poland and Austria. They found that younger, less-educated parents tended to introduce complementary foods earlier. Despite the high breastfeeding rate, formula use on maternity wards was prevalent, underscoring possible inadequacies in breastfeeding support. Over half of the children were introduced to solids between four and six months, yet almost one-third of children received them after six months, potentially missing critical developmental windows. Notably, premature birth and lack of breastfeeding or formula post-discharge were associated with earlier introduction, indicating vulnerabilities in certain populations, particularly those who come from low SES. Such findings underscore the influence of socio-economic factors on infant feeding practices, necessitating targeted interventions to mitigate disparities and ensure optimal infant nutrition.

Lakhanpaul *et al.* (2020) examined common complementary feeding practices and social/cultural influences among a British-Bangladeshi population. Their analysis revealed that early introduction of solids was influenced by beliefs in improved nutrition and faster growth. Food advertising also played a role, with a few parents delaying solids beyond six months, perceiving milk as sufficient. Hand-feeding was predominant, impacting children's later ability to use utensils. Some parents favoured formula milk due to perceived benefits. A societal norm of a 'chubby', healthy child persisted, despite high reliance on fast food and sweets. Cultural differences were noted in food choices and family dynamics, with grandparents and in-laws viewed as either supportive or pressuring. The study underscores the need for culturally sensitive support programmes for caregivers and extended family members, grounded in evidence-based practices.

Lastly, Fialkowski *et al.* (2020) explored Hawaiian complementary feeding practices. Analysis revealed family dynamics strongly influenced decision-making, with homemade foods and processed items being staples in childhood diets. Women predominantly fed infants, while men had cooking responsibilities. Participants learned feeding practices from family or self-teaching. Traditional Hawaiian foods were introduced around six months, often mixed with sugar, milk or rice cereal. Grandchildren's diets featured fresh produce alongside convenience foods. Lack of exposure to traditional Hawaiian diets was attributed to knowledge gaps, limited land access for cultivation and busy family lives. This study highlights intergenerational transmission of feeding practices and challenges in maintaining cultural diets amid modern lifestyles.

In summary, socio-economic disparities influence the timing of complementary food introduction, emphasising the need for targeted interventions; cultural beliefs and societal norms play a significant role in early solid-food introduction among specific populations, calling for culturally sensitive support programmes; and intergenerational transmission of feeding practices presents challenges in maintaining traditional diets amid modern lifestyles.

Concluding thoughts and recommendations

Practitioner or 'expert' perspective vs caregiver perspective

This rapid review sought to answer two key questions. First, what are the key approaches to weaning and complementary feeding as chosen by caregivers? Put simply, the methods of weaning tend to be spoon-feeding, BLW or a blend of both. The studies discussed in the paper focus on various aspects of infant feeding practices, including cultural influences, weaning styles, benefits and risks of different approaches, and practitioner and parental beliefs. BLW weaning may have benefits, such as higher vegetable and protein intake, but also poses risks such as choking incidents. The timing of introducing solid foods was suggested to impact infant growth, with early introduction potentially leading to

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obesity. Caregiver beliefs, health status and weaning practices also play a role in infant feeding practices. Next, several studies focused on guidance and advice for parents on introducing solid foods to infants, with variations in recommendations and timing. Parental understanding of guidelines varies, with factors such as education, age and SES influencing compliance.

For the second question, which concerned key issues or influences for caregivers when deciding how to wean their child, the findings highlighted the importance of considering cultural sensitivity, family dynamics and evidence-based practices in supporting caregivers and promoting healthy feeding practices for infants. Further, socio-economic factors, cultural differences and paternal involvement also impact infant feeding practices. Maternal eating disorders and sources of advice also influence decisions related to infant feeding practices.

Overall, the key findings emphasise the complexity of infant feeding practices, the importance of considering cultural and individual factors, and the need for further research to understand the implications of different feeding approaches for infant health and development. It is apparent that the basis for these papers revolves around the extent to which populations understand and adhere to WHO/NICE/NHS guidelines, comparing timing of introduction, food type and parental perspectives.

It is unclear how findings were disseminated; this is salient, as there has been little progress within the last decade of research to address gaps in knowledge, formulate a standard definition of BLW or explore perspectives of other population groups. This makes academic work inaccessible; indeed, although research on weaning is expansive, it is of little use to caregivers who do not seek advice from academic papers or journals or have access to them. If more research took time to translate findings into outputs or community engagement opportunities, perhaps practitioners and caregivers would be able to utilise the most up-to-date advice available.

Following examination of the 33 papers within this review, this article makes several recommendations. Firstly, caregivers should have better access and support from healthcare professionals during the early months of an infant's life to increase the prevalence of exclusive breastfeeding or formula feeding for the first six months of their lives (as advised by the WHO). It should be acknowledged that advice given by healthcare professionals differs and can be conflicting when compared with the guidelines. Therefore, additional training and education for healthcare professionals is needed to ensure the advice has both a scientific and applied grounding.

Practitioners should also step away from trying to implement a one-size-fits-all approach to guidance; advice and support should be tailored for caregivers depending on their SES, family situation and accessibility. Caregivers should be alerted to the content of food consumed and be advised about the frequency of use rather than recommending specific foods and ingredients.

More co-produced research for the design and delivery of interventions is warranted. Research needs to be conducted using a social perspective or framework to highlight lived experiences of individuals. Better understanding comes from undertaking research with and for the population under investigation. Finally, research into weaning tends to be limited to white, cisgender, middle-class, heterosexual, older mothers (Boswell, 2021); to encourage diversity, it would be beneficial to explore the perspectives of fathers, parents and families that do not sit within these categories. This may come from the perspective of using breast milk and formula depending on the caregiver. Indeed, given that several studies in this review have highlighted that young, single mothers with low SES and education tend to wean their children too early without understanding official guidelines, such interventions would benefit from being co-produced with this population group using a social perspective or framework, rather than only focusing on the recommended guidance as the basis for the research questions and objectives. For example, the use of qualitative or mixed methods will allow for the lived experiences of the participants to come to the fore. Further research is needed to validate these

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findings and better understand the impact of different feeding practices on infant health and development.

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