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Barriers and enablers to caregivers' responsive feeding behaviour: A systematic review to inform childhood obesity prevention

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Summary

Responsive infant feeding is a critical component of childhood obesity prevention. However, there is little guidance for caregivers on how to do this successfully. The first step to developing an intervention to promote responsive feeding is to systematically identify its barriers and enablers. Searches were conducted in CINAHL, Cochrane Library, Medline, Embase, PubMed, PsycINFO, Maternity, and Infant Care from inception to November 2020. All study designs were included if they reported a barrier or enabler to responsive feeding during the first 2 years of life. We used a "best fit" framework synthesis, with the Capacity, Opportunity, Motivation, and Behaviour (COM-B) model. The Mixed Method Appraisal Tool (MMAT) was used to assess study quality. Forty-three studies were included in the review. Barriers (n = 36) and enablers (n = 21) were identified across five COM-B domains: psychological capacity, physical and social opportunity, and reflective and automatic motivation. Enablers were recognition of infant feeding cues, feeding knowledge and family and friends. Caregiver attitude toward control of feeding was a barrier, together with health care professional advice about formula feeding and breastfeeding expectation. These barriers and enablers provide a comprehensive evidence base to guide intervention development to improve responsive feeding and prevent obesity across individual and population levels.

KEYWORDS
Infan*, prevention, responsive feeding

1 | INTRODUCTION

Childhood obesity is a global public health concern affecting an estimated 41 million children under the age of five.[1] Infants develop rapidly during the first 2 years of life, and multiple inter-related factors influence feeding behaviour; therefore, this period is critical for obesity prevention.[2] Children's feeding behaviour develops as a result of a complex interplay between hormone regulation, brain-based reward systems, early motor, sensory and socio-emotional capacity, and cultural and social practices.[3] Infants and young children can self-regulate their energy intake by responding to internal signals of hunger and satiety, but their responses to food are also shaped by

feeding practices in their environment.[4,5] Caregiver responsiveness is a reciprocal dimension of feeding in which an infant or young child provides clear feeding cues, such as hunger and satiety, and the caregiver responds in a prompt and developmentally appropriate manner.[5] These supportive early interactions with caregivers enhance infants' self-regulation of energy intake leading to the development of regulatory capacity and feeding autonomy.[6] Infants whose caregivers are more responsive to their feeding cues have healthier weight gain trajectories.[7]

In contrast, lower maternal sensitivity to infant cues has been associated with greater weight gain in infants 6–12 months old.[8] Four types of non-responsive feeding have been identified: first, instrumental feeding such as using food treats as rewards[9]; second, pressurizing a child to eat which includes encouraging children to eat more healthy foods and/or more food overall,[9] for example, mothers putting cereal in their infant's bottle[10] and/or putting their infant to bed with a bottle[11]; third, restriction or controlling food intake refers to reducing access to unhealthy foods, in particular energy-dense snacks[9]; and finally, emotional feeding in which a parent offers food in response to their child's mood such as using food to soothe their infant.[10,12] Caregiver feeding practices such as controlling and restricting food intake have been associated with higher child Body Mass Index (BMI).[13]

To date, obesity prevention interventions which include a focus on promoting and supporting caregiver responsive feeding have demonstrated greater improvements for feeding and weight outcomes than interventions without a responsive focus.[14] However, there are inconsistencies in our understanding of the most effective ways of intervening with caregivers to improve responsive feeding. This may be attributable to an absence of a comprehensive empirical and theoretical underpinning to responsive feeding interventions. One approach, which would facilitate a robust and comprehensive method, is to use a model of behaviour change to guide intervention development. The Capability, Opportunity, Motivation, Behaviour (COM-B) model provides a basis for understanding behaviour prior to intervention design[15,16] and proposes that behaviour results from interactions between physical and psychological capability, physical and social opportunity, and reflective and autonomous motivation. The COM-B model provides a useful framework for evidence synthesis[17] and can be used to systematically identify barriers and enablers associated with a behaviour; this is an essential first step to developing an intervention to promote caregiver responsive feeding.

A qualitative synthesis found that environmental, psychological, and social factors influence parental experiences of infant feeding.[18] However, this review did not focus specifically on responsive feeding behaviour and did not utilise a framework such as the COM-B. Therefore, the barriers and enablers that caregivers experience when engaging in responsive feeding behaviours are missing from the literature. This review aims to synthesise the literature on barriers and enablers to responsive feeding, mapping these onto the COM-B model of behaviour change to inform the development of a future intervention. The specific research question is "what are the barriers and enablers associated with responsive feeding that could inform overweight and obesity prevention?"

2 | METHODS

The review is reported in line with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA-P) guidelines (see Supporting Information S1). The protocol has been published[19] and registered in PROSPERO (CRD42019144570).

2.1 | Inclusion and exclusion criteria

Studies that examined responsive feeding were included if participants were primary caregivers (parents and guardians) of healthy children ≤2 years old. Studies that combined data from caregivers of children ≤2 years old and children outside of this age range were excluded, unless the data could be separated. Studies of infants with medical conditions affecting feeding and growth, very preterm infants <32 weeks gestation, low birth weight (VLBW) <2,500 g, and those who had been fed via a naso-gastric tube were excluded. We excluded studies of infants with major sensory and physical disabilities (e.g., blindness and deafness) because of the additional challenges that caregivers of these infants may find implementing responsive feeding in early life. To ensure the findings can inform an intervention that prevents childhood obesity only studies carried out in economically developed countries were included (as indicated by membership of the Organisation for Economic Co-operation and Development [OECD]).[20] Studies conducted in countries where responsive feeding is used to improve weight gain in malnourished infants were excluded. The exposures of interest were the factors associated with enabling or preventing a primary caregiver to engage in responsive feeding.

2.2 | Outcomes

To be included, studies needed to report a barrier or enabler to responsive feeding, for example, an observational study identifying socio-demographic factors, an intervention including anticipatory guidance around responsive feeding during first 2 years of life, and outcomes measured using established scales, for example, Child Feeding Questionnaire.[21] We also included qualitative data in relation to caregiver feeding practices.

2.3 | Search strategy

A systematic literature search was conducted in seven electronic databases (CINAHL, Cochrane Library, Medline, Embase, PubMed, PsycINFO, Maternity, and Infant Care) from inception to September 2019. A second search was undertaken for the period from September 1, 2019, to November 1, 2020. Search terms were derived from concepts associated with infant feeding behaviours and styles and included proxy terms for responsive and nonresponsive feeding, and barriers and enablers to caregiver-infant engagement (see Box 1). Identified articles were exported into EndNote X9, where duplicates

Box 1 Inclusion and exclusion criteria for study selection

Criteria	Inclusion	Exclusion
Language	English	Any language other than English
Sample	Primary caregivers of healthy children aged ≤ 2 years old[a] Economically developed country (indicated by membership of the Organisation for Economic Co-operation and Development, OECD (10)	Studies of infants with medical conditions affecting feeding and growth Very preterm infants <32 weeks gestation Very low birth weight <2,500 g Infant who have been fed via a naso-gastric tube Infants with major sensory and physical disabilities (e.g., blindness, deafness) Countries where responsive feeding is used to improve weight gain in malnourished infants
Exposure(s) of interest	Barriers and enablers associated with responsive feeding	N/A
Article type	Peer-reviewed	Articles with limited or no results (e.g. conference abstract, protocols, editorials, commentaries)
Research type	Quantitative, qualitative, mixed-methods	N/A

[a] Studies where responsive feeding was measured during the specified age range but then future effects of this feeding were examined were also included.

were identified and removed before screening for eligibility. The reference lists and citations of the included papers were screened for potentially eligible studies.

2.4 | Study selection

All study titles and abstracts were screened independently by two researchers (VS and SR, JR, and EO) using the inclusion and exclusion criteria (see Box 1); disagreements were resolved by consensus with third party involvement where further clarity was needed. The full texts of potentially relevant studies were independently screened for inclusion by at least two members of the entire research team (VS, JR, SR, EO, and KMS). Discrepancies were considered by the whole team during a face-to-face meeting, and consensus was achieved through discussion.

2.5 | Data extraction

Standardised data extraction forms were used to extract characteristics and data from the quantitative studies (VS, checked by KMS and EO) and qualitative studies (SR and JR). Data extracted included study authors, title, year of publication, country of origin, source of funding, study aims, study design, recruitment strategies, participant sex, age, ethnicity and socio-economic status, and study outcomes (including definitions). Where trials of interventions were conducted, intervention and control details were extracted. For quantitative studies (including trials), estimates of effect and significance values were extracted; for qualitative studies, reported results were extracted. Where disagreement occurred, this was resolved by discussion.

2.6 | Quality assessment

The Mixed Methods Appraisal Tool (MMAT)[22] was chosen due to its ability to assess the methodological qualities of five categories of studies: qualitative research, randomised controlled trials, non-randomised studies, quantitative descriptive, and mixed method studies. The MMAT provides an assessment of the quality of each paper by rating "yes," "no," or "can't tell" to a series of questions. Two reviewers (SR and VS) independently assessed the methodological quality of the included papers. There was 65% consistency between these two reviewers after the first round of assessment. Therefore, further independent appraisal was conducted by JR and KMS, and consensus reached by discussion.

2.7 | Synthesis of results

We used a "best fit" framework synthesis,[23] with the COM-B model[15,16] as the framework for both the quantitative and qualitative data. Initially, quantitative and qualitative findings were separately

mapped to the framework. For the quantitative results, extracted data on factors reported to be associated with responsive feeding were coded to the COM-B framework. Coding was conducted in an iterative manner, with on-going discussion and consensus among the research team to ensure appropriate categorization of quantitative findings. For the qualitative data, participant quotations and authors' interpretations in the results sections of included papers were coded to the COM-B framework (see Table 1 for the initial coding framework). These initial codes were further developed into barriers and enablers under each aspect of the COM-B framework using inductive thematic analysis. The concepts were revisited and synthesised into a final set of barriers and enablers. For both the quantitative and qualitative analyses, any barriers and enablers to responsive feeding that did not fit within the COM-B framework were noted. The qualitative and quantitative findings were then synthesised narratively together for the results section. Throughout the process, disagreements were discussed and resolved by consensus by the whole team.

3 | RESULTS

The study selection process is outlined on the Prisma Flow Diagram (see Figure 1). For the first search, after de-duplication, 29,269 records were returned; of these, 29,138 were excluded during title and abstract screening as they did not meet the inclusion criteria. A total of 131 full text articles were screened, of which 35 were eligible for inclusion. One paper reported two studies,[24] so there was a total of 36 studies. The second search identified 3,990 records after duplicates were removed; of these, 3,944 were excluded during title and abstract screening. A total of 46 full text papers were screened of which a further seven were eligible for inclusion. This resulted in 43 studies (42 papers) included in this review.

TABLE 1 Initial COM-B coding framework

COM-B component[16]	Definition
Physical capability	Caregivers have the physical strength, skill, or stamina to engage in responsive feeding.
Psychological capability	Caregivers are psychologically able to feed responsively. This involves having the knowledge of how to feed responsively, understanding why it is important, learning and developing the necessary feeding and interpersonal skill. It could also involve memory, attention decision making and cognitive capacity to feed responsively, the ability to self-monitor, and action plan.
Physical opportunity	Opportunity for caregivers to feed responsively, rather than feeding unresponsively, as a result of environmental influences such as time, resources, locations, cues, and physical "affordance."
Social opportunity	Opportunity for caregivers to feed responsively, rather than feeding unresponsively, as a result of interpersonal influences, social cues, and cultural norms.
Reflective motivation	Caregivers choose or intend to feed responsively rather than feeding unresponsively at that moment. This includes self-conscious intentions, planning, and evaluations around feeding.
Automatic motivation	Automatic processes such as habit or impulses that drive caregivers to feed responsively rather than feeding unresponsively at that moment. Includes emotional reactions, desires (wants and needs), impulses, inhibitions, reflex responses, and habits.

3.1 | Study characteristics

The majority of studies were conducted in the USA (n = 20),[24–43] followed by Australia (n = 10),[44–53] United Kingdom (n = 8),[54–61] New Zealand (n = 1),[62] Norway (n = 2),[63,64] and Sweden (n = 1).[65] Thirty-four studies, reported in 33 papers, employed a quantitative design, including RCTs of an intervention (n = 5),[32,39,50,62,63] observational cohort studies (n = 8),[24,27–29,35,54,59,60] cross-sectional studies (n = 11),[24,30,38,41–44,46,48,53,64] a case–control study,[26] a within-subject experimental study,[40] a quasi-experimental study,[51] and observational descriptive/measurement development.[31] Six studies undertook secondary analyses; two used cross-sectional data,[25,37] two studies used data from observational cohort studies,[33,45] one used control group data,[34] and one used data from an RCT.[36] Nine studies utilised qualitative methodology,[47,49,52,55–58,61,65] including one study informed by feminist theory[55] and one which used the COM-B framework.[52] The remaining seven studies used inductive thematic analysis (n = 3),[47,49,58] content analysis (n = 2),[57,65] and template analysis[61]; one qualitative study did not report their methods.[56] There were no mixed-method studies. Further details about the study characteristics can be found in Tables 2 and 3.

3.2 | Quality assessment

Quality assessment scores are presented in Supporting Information S1–S3. Only one qualitative paper failed to meet the MMAT criteria for screening[56]: the majority clearly addressed the research questions[47,52,55,57,58,61,65] and derived their findings adequately from the data.[47,49,52,55,57,58,61] The randomised trials all conducted appropriate randomization and had comparable groups at baseline.[32,36,39,50,62,63] Three of the trials had low follow-up,[32,39,63] and some of the included papers[32,36,39,50,62] did not report whether participants adhered to the assigned intervention, although this may have been reported elsewhere. The quantitative non-randomised studies all included participants who were representative of the target population.[28,30,31,40,41,51] The quantitative descriptive studies were generally well conducted although it was not always possible to ascertain sample representativeness.[26,27,29,33,34,37,38,44,45,48,53,59,60,64] Some of the quantitative descriptive studies focused on participants from particular groups such as infants who had been adopted,[33] and as such, these findings are not generalizable.

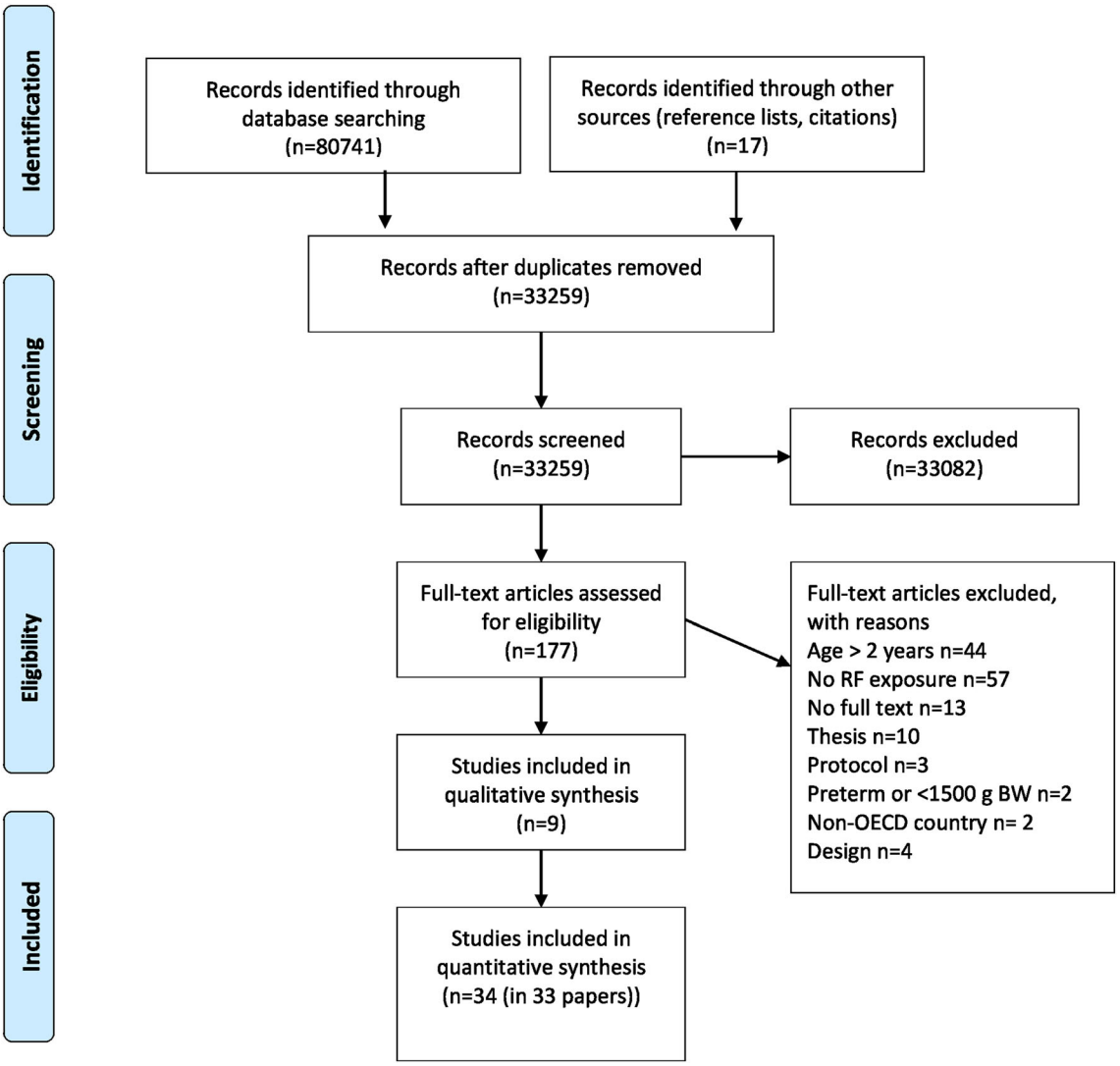

FIGURE 1 Prisma flow diagram

3.3 | Findings

Barriers and enablers to responsive feeding developed during the qualitative and quantitative data analysis and synthesis as mapped on to the COM-B components are presented in Supporting Information S4 and Table S4, respectively. Barriers and enablers from all studies are narratively synthesised below.

3.4 | Psychological capability

The influence of psychological capability on responsive feeding was identified in 17 studies.[32,36,39,43,47,49–52,55–58,61–63,65] Four barriers and enablers were identified related to psychological capability: (1) responsive feeding skills; (2) knowledge and understanding of feeding, appetite, and nutrition; (3) caregiver attitude to who controls feeding; and (4) education to support responsive feeding.

3.5 | Responsive feeding skills

The overarching enabling skill identified in six of the nine qualitative studies was parents' ability to recognise their child's feeding cues and signs.[47,52,56,57,61,65] Recognizing their child's feeding cues was evident for parents who were milk feeding and for those who were feeding solid food. Parents spoke about the challenges deciphering infants' cues for hunger and satiety[61] and three specific skills that were needed to enable responsive feeding: first, the ability to balance both external information (instructions about usual volumes of milk for particular sized infants on formula milk tins and hospital feeding regimes) and the child's cues to inform feeding decisions[47,52]; second, their need to learn how to recognise and respond to their child's cues[47] and the perspective of the child as a learner[49]; and third, there was the ability of mothers to soothe their child without food.[47] There was evidence from two studies that parental inability to recognise their child's feeding cues is a barrier to responsive feeding.[56,65]

TABLE 2 Characteristics of included qualitative studies (*n* = 8)

Study	Country	Participants	Recruitment	Study Aim	Study design	Data collection	Analytic approach
Appleton et al.[47]	Australia	Mothers (*n* = 25/51) of infants 9–11 months of age (17 female, 7 male); 12 mothers had Socioeconomic Index for Areas (SEIFA) index > 7	Parents were recruited to the Baby's First Foods longitudinal cohort study via websites, online parenting forums and social media	To explore parents' formula feeding practices, factors influencing this practice and the source of advice used by parents.	Observational descriptive study	Semi-structured telephone interviews	Thematic analysis, (pragmatic, inductive approach)
Bramhagen et al.[65]	Sweden	Parents (*n* = 18/35) of children 12 months of age, 32% of sample classed as immigrants	Invitation from Child Health Service nurse	To describe parents' experiences of feeding situations and their contact with the Child Health Service	Observational descriptive study	Semi-structured, face to face interviews	Qualitative content analysis
Brown and Lee[57]	UK	Mothers (*n* = 36) of infants 12–18 months	On-line advert on baby-led weaning forum, snowballing	Examination of the attitudes and reasoning of mothers about baby-led weaning	Observational descriptive study	Semi-structured interviews	Content and thematic analyses
Cescutti - Butler et al.[55]	UK	Mothers (*n* = 14) of preterm infants. All sample classified as white (*n* = 14) comprising British (*n* = 11), Eastern European (*n* = 2), South African (*n* = 1)	Women recruited from an NHS Trust	Women's experiences of feeding their preterm infants	Observational, descriptive study	Semi-structured, face to face interviews 14 women interviewed T1 in hospital and 13/14 at T2 at home	Feminist perspective, collaborative analysis with participants, followed by Template Analysis by the researchers.
Crow[56]	UK	Mothers of 3 day old infants who were breast-fed (*n* = 50) and formula-fed (*n* = 50).	Not reported	Infant feeding knowledge of mothers participating in a broader ethological study	Observational, descriptive study	Interviews	Not reported
Guell et al.[58]	UK	Mothers, intervention arm (*n* = 10), control arm (*n* = 9) of a trial to reduce infant formula-milk intake and promote healthy weight gain. Research nurses (*n* = 3) who delivered intervention and control	Invitation from trial team	To explore the underlying mechanisms that might have been at play when implementing and participating in the Baby-Milk trial	Process evaluation of Baby-Milk Trial	Semi structured interviews	Thematic analysis

TABLE 2 (Continued)

Study	Country	Participants	Recruitment	Study Aim	Study design	Data collection	Analytic approach
		group protocols					
McNally et al.[61]	UK	Mothers (*n* = 11) of infants 7–24 months	Invitation to mothers who had taken part in a previous observational study	To understand how mothers using different feeding practices (Baby-Led Weaning and Traditional Weaning) perceive, understand and respond to their infant's feeding cues	Observational cross-sectional study	Video-elicited semi-structured interviews	Template analysis underpinned by critical realism
Harris et al.[49]	Australia	Parents (*n* = 12) participated and *n* = 9 of these had an infant <2 years	Parents purposively recruited when calling Child Health Line	To describe how parents present child fussy eating at 'crisis point' and to identify the feeding interactions described by the parent that led to the telephone call	Observational, cross-sectional study	Parent calls to telephone help line were audio-recorded	Inductive, thematic approach
Russell et al.[52]	Australia	Mothers (*n* = 29) of infants aged 2–11 months (16 male, 13 female). Australian (*n* = 20, Caucasian (*n* = 5), Other (*n* = 4)	Advertising via Playgroups newsletter and snowballing	To explore antecedents of infant feeding practices in mothers with low educational to inform the design of obesity prevention programs.	Observational, cross-sectional study	Semi-structured telephone interviews, with interview schedule informed by the COM-B framework	Thematic coding to the COM-B model, plus additional inductive codes.

3.6 | Knowledge and understanding of feeding, appetite, and nutrition

In six of the eight qualitative studies, parental knowledge and understanding of feeding, nutrition, and appetite were reported in relation to responsive feeding behaviour.[47,49,52,55,57,65] One study found that mothers believed healthy eating patterns could be achieved by enabling the child to feed according to their appetite.[57] Feeding according to appetite was reported as a challenge for mothers of late preterm infants (33–36 weeks) who were subject to strictly enforced hospital feeding regimes, suggesting these schedules are a barrier to responsive feeding.[55] It was reported that confusing gagging with choking was a barrier for responsive feeding,[49] but there was a suggestion from one mother that recognizing gagging was a skill that could be learnt.[57]

3.7 | Caregiver attitude to control of feeding

Caregiver attitude toward control of feeding was found to be both a barrier[65] and an enabler[43,52,55,57,65] to responsive feeding. A controlling attitude to feeding (where caregivers are concerned with restricting access to unhealthy foods[9]) was supported by a belief that parents know best, and this could lead parents to override their child's feeding cues.[65] In contrast, a flexible attitude (where caregivers read and responded to their infant's cues) supported by a sense of trust in the infant's abilities enabled mothers to give control of feeding to their child.[57] Mothers with higher executive function were found to use more infant-based responses to hunger behaviours at 3 months, suggesting this may be both a barrier and enabler.[35] Two further enablers were identified in a study conducted with non-Hispanic Black parents in the United States. First, parents who do not overly

TABLE 3 Characteristics of included quantitative studies (*n* = 27)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
Byrne et al.[45]	Australia	*n* = 330 mothers (aged 18–46) and their infants (12–16 months; 49% male, 51% female)	Mothers from the NOURISH RCT were a consecutive sample of first-time mothers of healthy infants recruited from postnatal wards, in seven hospitals. Mothers from the SAIDI observational cohort study were a convenience sample approached 1–3 days post-partum in 11 hospitals.	To identify which maternal and child characteristics were associated with maternal perception of her child as a fussy eater	Secondary data analysis of observational cohort data from the NOURISH control group and primary data from SAIDI	At T1 (infant age 12–16 months): Infant weight, dietary intake. At T2 (2 years): Feeding Practices and Structure Questionnaire (FPSQ-28)
Daniels et al.[50]	Australia	*n* = 598 (at follow up) mothers (aged 18–46) and infants (49% male, 51% female)	As above, NOURISH RCT	To evaluate a universal obesity prevention intervention commencing in infancy	RCT	Infant weight and length and Infant Feeding Questionnaire (IFQ)
DiSantis et al.[25]	USA	*n* = 154 mothers (mean age = 30.4 years) of infants (aged 7–11 months; 46.3% male, 53.8% female). Mothers (mean age = 30.5 years) of toddlers (12–24 months; 42.1% male, 57.9% female)	Convenience sampling through a volunteer database. In person, fliers at target locations	To evaluate the association of breastfeeding duration with a range of maternal feeding approaches later in infancy and toddlerhood	Secondary data analysis of cross-sectional study	Infant weight and length and Infant Feeding Styles Questionnaire (IFSQ)
Fangupo et al.[62]	New Zealand	*n* = 666 (at follow up) mothers (mean age = 32 years) and their infants	Enrolled antenatally by research staff	To assess the effect of intervention from 0–18 months of age on food and nutrient intake, eating behaviours, and parental feeding practices in 18–24 month old children	RCT	Dietary intake via Eating Assessment in Toddlers (EAT) and parent feeding practices questionnaires.
Farrow and Blissett[60]	UK	*n* = 87 mothers (mean age = 31.67 years) and their infants (43 males, 44 females)	Recruited during pregnancy as part of a wider study	To explore whether breast-feeding, mediated by lower maternal use of controlling strategies, predicts more positive mealtime	Observational cohort study	Infant weight, observation, Child Feeding Questionnaire (CFQ), Child Feeding Assessment

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
				interactions between mothers and their 1 year old infants		Questionnaire (CFAQ)
Farrow and Blissett[59]	UK	*n* = 74 mothers (mean age = 32 years) and their 6–12 month old infants (35 males, 39 females)	Recruited from antenatal clinics	To explore whether maternal mind-mindedness predicts more sensitive and positive parental feeding behaviour and whether this is mediated by greater maternal sensitivity	Observational cohort study	Infant weight, observation of parental feeding practices and parental sensitivity during play, maternal mindedness questions
Fildes et al.[54]	UK	*n* = 1920 families with younger infants <8.11 months and older infants >8.11 months (49.5% males, 50.5% females)	Participants were recruited from the Gemini study.	To investigate whether differences in maternal use of restriction and pressure in early infancy are associated with infant appetite and weight. To test whether mothers respond differently according to feeding method	Observational cohort study	Infant weight from Child Health Records, parental control, feeding method, appetite and weight concern questionnaire
Fuglestad et al.[35]	USA	*n* = 69 mothers and their infants assessed at age 2 weeks and 3 months (39% female); 93% White, 1% Hispanic	Recruited from the community using fliers, letters and emails.	To examine associations between maternal executive function, feeding decisions and infant weight and adiposity gains	Observational cohort study	Infant body composition, weight and growth, NIH Toolbox Cognition sub-tests, Maternal Feeding Decisions Checklist
Golen and Ventura[34]	USA	*n* = 28 mothers (aged 18–40, m = 26.9 years) infant (60% female, aged 0–6 months, m = 2.8 months) dyads.	Fliers posted in WIC offices, libraries, coffee shops and pediatric offices. An advertisement in a magazine	To assess the association between maternal distraction during infant feeding interactions. To assess whether mothers who were distracted would show lowers levels of sensitivity to their infants' cues compared to mothers who were not distracted.	Secondary analysis of control condition of an experimental study	Infant weight and length, Nursing Child Assessment Feeding Scale (NCAFS). Maternal distraction
Gross et al.[30]	USA	*n* = 208 "low risk" infants (54.8%	Recruited from pediatric care	To identify modifiable	Cross-sectional study	Infant weight, maternal

(Continues)

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
		male) and mothers (mean age = 34.7 years) *n* = 204 "high risk" infants (54.4% male) and mothers (mean age = 27.7 years). Mean infant age 4.7 months	centers (low risk) or WIC center (high risk)	maternal–infant feeding behaviours that may contribute to disparities in early child obesity		perceptions of infant hunger and satiety and pressurizing feeding style questionnaire
Harris et al.[39]	USA	Mothers randomised to responsive feeding (*n* = 105) or home safety (*n* = 102) intervention	INSIGHT study. Mothers and newborns recruited from one maternity ward in Pennsylvania between January 2012 and March 2014.	To examine the effects of a responsive feeding intervention on mother-reported child emotional overeating and explore whether effects are mediated by mother-reported use of food to soothe.	RCT	Breast or formula feeding, Baby' Basic Needs Questionnaire (at 18 months) Child Eating Behaviour Questionnaire (CEBQ) (at 30 months) Infant Behaviour Questionnaire (IBQ) (at 16 weeks), Early Childhood Behaviour Questionnaire (ECBQ; at 2 years)
Harrison et al.[48]	Australia	*n* = 263 mothers (mean age = 31.4 years) and their infants (51.9% female, 48.1% male; mean age = 8.8 months)	Social media (dedicated Facebook community page), parenting websites, parenting organizations	To investigate maternal perception of infant weight and its relationship to feeding practices and infant dietary intake	Cross-sectional survey	Infant weight and length, Queensland Infant Feeding Survey, Maternal Parenting Style and Feeding Practices questionnaire
Helle et al.[63]	Norway	*n* = 533 mothers (mean age; control = 30.3 years, intervention = 30.9 years) and their infants (control = 50.4% female; intervention = 49.6% female).	Social media (the university's Facebook page), and child health clinics	To evaluate the effects of an eHealth intervention on parental feeding practices and infant eating behaviours	RCT	Infant weight and length, Child Eating Behaviour Questionnaire (CEBQ), Food Frequency Questionnaire (FFQ), IFQ
Hittner et al.[33]	USA	*n* = 86 mothers, infants (*n* = 52 males, 34 females), age 12 months at T1, 6 years at final follow-up) dyads. White (93.4%)	Through adoption agencies or local hospitals	To test whether mealtime infant emotional distress and maternal restriction at infant age 12 months predict BMI gain through 6 years of age	Secondary analysis of data from an adoption cohort study	Mother–child feeding interactions videotaped in home setting at infant age 12 months. Weight and length at years 1–4 by scale and tape measure. Child weight and height (age 5–6) by parent-report.

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
						Self-reported weights and heights of adoptive and birth mothers
Hodges et al.[31]	USA	*n* = 157 mothers (non-Hispanic White = 56, non-Hispanic black = 51, Hispanic = 50) and their infants (7 to 24 months; female = 81, male = 66)	Convenience sampling. Volunteer database, fliers, on-site recruiting at child-care centers, festivals attracting families, doctor's offices, retail shops, churches.	To develop and assess the Responsiveness to Child Feeding Cues Scale (RCFCS)	Observational, descriptive study to develop a feeding scale	Infant weight and length, maternal weight and height and demographics. Midmorning feeding sessions digitally recorded.
Khalsa et al.[43]	USA	*n* = 240 parent-infant dyads, female parents (*n* = 182, black race *n* = 138). Infants mean age at recruitment *n* = 8.8 months	Parent-infant dyads recruited by consecutive sampling during their pediatric well-child visits at two large hospital-affiliated urban primary care clinics.	To examine the relationship between parental intuitive eating behaviours and infant feeding styles in a low-income non-Hispanic Black population.	Cross-sectional study	Infant weight and length, infant feeding practices, demographics, Infant Feeding Style Questionnaire (IFSQ), Intuitive Eating Scale (IES-2)
Kavanagh et al.[32]	USA	*n* = 40 mothers (mean age, intervention = 24.7; control = 26.1) and their infants (intervention group = 52% male, control group = 47% female; exclusively formula fed; birth weight at least 2,500 g)	Caregivers of infants aged 3–10 weeks attending 2 WIC clinics in California were invited to take part.	Evaluate whether encouraging formula-feeding caregivers to be more sensitive to infant satiety cues would alter feeding practices and reduce infant formula intake	RCT	Infant weight and length at baseline and 4 months. Baseline interview collected demographics, breastfeeding history, infant feeding practices, care arrangements and attitudes toward control of infant feeding. 2-day self-report formula intake records at baseline, 2 weeks post-class and 3.5 months of age. Exit interview to assess reactions to educational messages
Little et al.—Study 1[24]	USA	*n* = 626 breastfeeding mothers (age range = 20–44 years, mean age = 30.71) of infants (age range 0.23–24.91 months,	Social media postings within U. S-based parenting groups	To explore whether behaviours consistent with proximal care predict a responsive breastfeeding philosophy. To	Cross-sectional survey	Online survey to collect demographics; parenting practices facilitative of physical contact; beliefs about

(Continues)

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
		mean age 9.36 months).		explore whether having a responsive feeding philosophy predicts breastfeeding outcomes.		responsiveness via Keller's parental ethnotheory questionnaire; feeding philosophy and breastfeeding outcomes
Little et al.—Study 2[24]	USA	*n* = 99 breastfeeding mothers (age range = 21–42 years, mean age = 30.97) of infants (age range 0.23–24.91 months, mean age 9.36 months)	Subset of mothers from study 1, who logged at least 12 breastfeeding sessions over 3 consecutive days—recruited through social media postings within U.S-based parenting groups	To examine whether individual variation in mother–infant physical contact predicted increased likelihood of feeding in response to early hunger cues rather than waiting for the onset of distress or feeding for other reasons	Observational cohort study	Online survey of demographics and maternal beliefs about responsiveness. Self-report feeding logs about feed method, infant location, reason for feeding
Mallan et al.[46]	Australia	*n* = 413 mother (mean age = 30 years) -infant (51% male, mean age = 17 weeks) dyads. 72% Australian born.	All eligible women receiving antenatal care over a 6 month period at the Royal Brisbane and Women's Hospital (RBWH) were invited by mail or face to face in the antenatal clinic.	To examine the cross- sectional relationship between maternal feeding beliefs and practices and infant eating behaviours in a community sample.	Cross-sectional questionnaire study with covariate data from an observational cohort	At 16 weeks gestation pre-pregnancy weight, maternal height, demographic data. At birth infant weight and sex from hospital records. At 4 months self-reported data on feeding mode, maternal wellbeing, feeding practices and beliefs (IFQ), and baby eating behaviours (Baby Eating Behaviour Questionnaire (BEBQ)
McMeekin et al.[44]	Australia	*n* = 698 mothers (mean age = and their infants (51% female, mean age = 4.3 months)	All first-time mothers delivering healthy term infants over a consecutive 4-month period at three public maternity hospitals approached for consent to be contacted regarding study	To investigate the association between infant temperament and feeding practices of their first-time mothers.	Cross-sectional secondary analysis of baseline data from an RCT	Infant weight and length, Short Infant Temperament Scale for Infants (STSI), IFQ

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
			enrolment by mail at infant age 4–7 months			
Messina et al.[28]	USA	*n* = 116 mothers (aged 16–45, mean age = 29.5) and infants. 84% = Caucasian	Through birthing classes at three hospitals, when women were in their third trimester of pregnancy	To examine maternal attachment contributions on infant feeding behaviours	Observational cohort study	At T1 (third trimester of pregnancy) Adult Attachment Interview (AAI) conducted in person and audio recorded. At T2 (infant age 6 weeks) mothers and fathers completed the Infant Behaviour Questionnaire (IBQ). At T3 (infant age 8 months) mother–infant dyads were videotaped during feeding and they completed the Centre for Epidemiological Studies depression scale (CES-D)
Mihrshahi et al.[53]	Australia	*n* = 612 mother (mean age = 30.3 years) –infant (male = 49.8%, female = 50.2%, mean age = 4.3 months)	Consecutive sample, recruited face to face. Birth and baseline data from NOURISH RCT, see above	To determine which modifiable variables are associated with rapid weight gain in early life	Cross- sectional analysis of baseline data from an RCT	Demographics, birth weight data from hospital records. At 4–7 months infant weights and lengths were measured by trained assessors and self-report questionnaires collected data on feeding type, and feeding style (using two questions from Infant Feeding Practices Questionnaire)
Odar Stough et al.[26]	USA	High birth weight infants, *n* = 21 (43% female, 57% male; mean age = 241.05 days). Normal birth weight infants *n* = 20 (male = 50%, female = 50%; mean age = 251.75 days)	Fliers, face-to-face, pediatricians practice, emails	To explore personal and relational risk factors and nutrition-related risk factors at both the child and family spheres related to obesity among high birth weight infants	Case–control study	Infant weight and length at baseline. Demographics, maternal feeding practices and beliefs via IFQ, child appetite and eating behaviour using the BEBQ. For a random selection of 16

(Continues)

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
						dyads, child sucking variables were measured by a NFANT device (NFANT Labs, Atlanta).
Overby et al.[64]	Norway	*n* = 98 parents of infants 10.9 months old (female 45%)	Parents were recruited through social media (Facebook) posts targeting parents of 12 month old infants	To explore potential associations between feeding practices and family meals among infants.	Cross-sectional analysis of baseline data from Food4toddlers RCT	Demographics, food frequency questions of child and parent diet, Comprehensive Feeding Practices Questionnaire (CPFQ)
Paul et al.[41]	USA	*n* = 279 mothers of infants 18 months of age (90.7% white, non-Hispanic 93.4% married 77.6%, college graduates 65.3%)	INSIGHT study. Mothers and newborns recruited from one maternity ward in Pennsylvania between January 2012–March 2014	To examine use of infant signing including signs related to meals, hunger and satiety, among parents and children and assess whether the brief signing intervention imbedded in the INSIGHT study was effective	Cross-sectional data from an RCT	Infant weight and length, online survey related to infant signing, Structure and Control in Parent Feeding questionnaire (at 1,2,3 years), Child Eating Behaviour questionnaire (CEBQ) at 30 months, Child Feeding Questionnaire at 3 years.
Reisz et al.[27]	USA	n = 118 father (age range = 19–51)–infant (41% female) dyads. 82% White	Through childbirth classes, radio announcements, fliers	To longitudinally examine connections between fathers' attachment representations, assessed prenatally using the Adult Attachment Interview, and their observed feeding practices with their 8-month-old infants.	Observational cohort study	At T1 (third trimester of pregnancy)—The Adult Attachment Interview (AAI) was conducted in the laboratory, and questionnaires. At T2 (infant age 8 months) fathers' feeding interactions were video recorded at a home visit. The feeding sessions were coded to the Feeding Scale
Russell et al.[51]	Australia	intervention *n* = 301 (male = 49.8%, female = 50.2%, mean infant age = 7 weeks, mean maternal age = 30.4 years) control *n* = 344 (male = 58.5%, female = 51.5%, mean infant age = 7.9 weeks,	Via their primary healthcare provider, face-to-face, web advertising	To describe the effects of an mHealth intervention on parental feeding practices, infant food preferences, and infant satiety responsiveness.	Quasi-experimental study	T1 Baseline survey collected socio-demographics, pre-pregnancy weight and height, and feeding mode. Also at T1, T2, (infant age 6 months) and T3 (infant age 9 months)

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
		mean maternal age = 31.2 years)				surveys measured parental feeding practices and beliefs via IFQ, Infant Satiety Responsiveness (3 items via BEBQ. At T3 survey data on infant food exposure and parental intentions to offer food.
Saltzman et al.[42]	US	*n* = 110 families (subsample from a larger STRONG Kids 2 Birth study). Mothers average age 30.9 years, children 20.96 months. 42.1% of mothers had postgraduate or college degree. White 81%, Asian 7%, Black 6%, American Indian/ Alaska Natives 6%	Women in third trimester of pregnancy recruited from healthcare facilities from 2014–2017	1.To characterise and describe the proportion of time that mothers, fathers and children spend in distraction in a sample of predominantly two parent families 2. To examine how father presence-absence is associated with maternal and child mealtime behaviours 3. To examine the relative associations between family members mealtime distractions and routines, rituals with mothers feeding responsiveness	Observational cross-sectional study	Demographics, Feeding Behaviour Coding System, Distractions Coding Scheme from ABC of Family Mealtimes System, Family Ritual Questionnaire.
Savage and Birch.[38]	USA	*n* = 60 mothers (aged 18–43, mean = 25.6 years). The analysis of	Fliers in WIC clinics, face-to-face	To explore how maternal depressive symptomatology is related to childhood obesity-promoting parenting behaviours and whether depressive symptomatology moderate the association between perceived child	Cross-sectional study	Questionnaires collected maternal characteristics including demographics, self-reported height and weight, and data about maternal and child sleep. Maternal depressive symptoms were measured with the CES-D scale. Parent feeding

(Continues)

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
				negativity and the use of the food to soothe among low income mothers		practices were assessed with the Use of Food to soothe subscale from the Baby's Basic Needs Questionnaire (BBNQ). Mother–infant feeding interactions assessed with the feeding assessment form. Child temperament measured using Infant behaviour questionnaire-revised very short form.
Savage et al.[36]	USA	*n* = 279, (male intervention = 75%, male control = 69%; maternal mean age intervention = 28.7 years, control = 28.7 years)	Recruited from a maternity ward over a 26 month period	Examine the effect of a responsive parenting intervention designed for obesity prevention on parents' infant feeding practices in the first year after birth	Secondary analysis of data from a RCT	Infant weight and length from medical charts, Phone interviews and surveys collected maternal age, pre-pregnancy weight. Data on infant feeding practices were collected at infant age 8, 20, 32, and 52 weeks. At infant age 28 weeks mothers completed the IFSQ. At 1 year, the Structure and Control in Parent Feeding (SCPF) questionnaire measured controlling feeding practices. Use of food to soothe was measured at 8, 16, 32, and 44 weeks using items from the BBNQ
Ventura et al.[37]	USA	*n* = 86 mothers (mean age = 29.8 years) and infants (*n* = 86) (female = 53.5%, mean age = 15.5 weeks)	Adverts in local newspapers, WIC officers, fliers in local shops, coffee shops, or pediatric offices, local parent support groups, social media	To explore variability in, and correlates of, infant clarity of cues during infant feeding interactions	Secondary analysis of cross-sectional data combined from previous infant feeding studies	3 day feeding diaries completed by mothers. Video recorded feeding observations in lab assessing infant intake by weighing the

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
						bottle or infant. Videos coded using the Nursing Child Assessment Parent–Child Interaction Feeding Scale (NCAFS). Infant weight and length, infant temperament using IBQ Very Short Form, BEBQ and the responsive feeding style subscale from IFSQ. Maternal weight and length/height.
Ventura et al.[40]	USA	*n* = 25 mothers (mean 31.2 years of age) of infants (mean 19.3 years of age)	Participants were recruited through flyers posted in Special Supplemental Nutrition Program for Women, Infants and Children (WIC) offices, breastfeeding support groups, libraries, coffee shops and local pediatric offices as well as through targeted Facebook advertisements	To explore whether mothers watching digital media during infant feeding affects the quality of maternal–infant dyadic interaction	Within-subject experimental study	Videorecorded feeding sessions, infant food intake, duration of feeding, rate of feeding, Nursing Assessment Parent–Child Interaction Feeding Scale (NCAFS), demographics.
Zeanah et al.[29]	USA	*n* = 32 couples (mothers aged 22–35, fathers aged 23–38), predominantly White, and middle to upper-middle class	From child-birth classes	To investigate whether prenatal perceptions of temperament related to perceptions at 6 months postnatally, and whether these perceptions of temperament related to infant or to maternal behaviour.	Observational cohort study	Infant Temperament Questionnaire (ITQ) (abbreviated) and semi-structured interviews with parents at 37 weeks gestation, and infant age 1 month. Full version of the ITQ at infant age 6 months. Home feeding interactions in a random subgroup of 22 mothers and their 6 month old infants were videotaped

(Continues)

TABLE 3 (Continued)

Study	Country	Participants	Recruitment	Study aim	Study design	Data collection
						on 2 consecutive days and coded using NCASF.

restrict the foods they eat were less likely to exhibit pressuring feeding styles, and second, parents with a college or graduate degree were less likely to exhibit pressurizing feeding styles compared to those with less than a high school degree.[43]

3.8 | Education and information

Educational information and support interventions for parents were identified in six randomised controlled trials[32,36,39,50,62,63] and could be a barrier[63] or an enabler.[32,36,39,50,62] The FAB (Food, Activity, and Breastfeeding) intervention, which included additional support and education around breastfeeding, feeding, and activity over the first 18 months of an infant's life, was associated with mothers exerting less pressure to eat on their infants and allowing infants more control over their eating, relative to usual care control conditions.[62] The INSIGHT RCT[36] examined guidance on recognizing and responding appropriately to infant cues and using structure-based, non-controlling feeding practices. The findings reported that mothers who received the intervention were less likely to pressure their infant to eat, to use food to soothe their infant, to use emotion-based use of food, and immediately use food to soothe their <1 year old infants. A later INSIGHT study reported a positive intervention effect on infants' negative affect at 16 weeks, food to soothe at 18 months, and emotional overeating at 30 months compared to controls.[39] In contrast, following a complex, mainly nutritional, information support intervention that included anticipatory guidance for responsive feeding practices mothers reported more infant food responsiveness and food approach (food responsiveness, emotional overeating, enjoyment of food, and desire to drink).[63] Kavanagh et al.[32] undertook a RCT of an intervention that included raising mothers' awareness of infant-satiety cues when breastfeeding or bottle feeding; 95% of mothers stated it was easy to follow the advice to identify and act on early cues of fullness. Another RCT of an intervention involving provision of information on healthy eating patterns, trust in satiety cues, fussing, and toddler feeding behaviours reported higher maternal-reported awareness of infant cues following the intervention.[50] In a quasi-experimental intervention study, there was no difference in maternal awareness of infant cues between the intervention group receiving information on healthy infant feeding and the control group.[51]

3.9 | Physical opportunity

Eleven papers,[24,30,47,49,52,55–58,61,65] reported the findings of 12 studies on barriers and enablers related to physical opportunity. Four barriers and enablers related to the COM-B component of "Physical Opportunity" were developed: (1) influence of the physical environment on parental responsiveness; (2) mother–infant physical contact; (3) maternal distraction to physical objects during feeding; and (4) structural/environmental factors.

3.10 | Influence of the physical environment on caregiver responsiveness

This theme was apparent in eight qualitative studies.[47,49,52,55–58,65] Five qualitative studies found the physical environment could pose barriers and enablers to responsive feeding by parents.[47,52,55–57] For mothers who were formula feeding, measurements on bottles and written instructions on formula packaging[47,52] acted as physical cues to parental feeding which vied with their child's feeding cues. The broader physical environment was discussed as a factor influencing responsive feeding in two studies. Although being at home could enable responsive feeding,[55] being out of the house could be a barrier if necessary facilities, such as those needed to make up a bottle feed, were not available.[47]

3.11 | Mother–infant physical contact

For breastfeeding mothers, maternal–infant physical contact was found to be an enabler in two studies published in the same paper.[24] One cross-sectional study found that contact predicted feeding in response to early hunger cues, rather than feeding infants due to infant distress.[24] Physical contact throughout the day and night was also associated with an "on-demand" feeding philosophy.[24] A further study, reported in the same paper, of 626 mothers[24] reported that a belief in proximal care predicted a self-reported responsive feeding style.

3.12 | Maternal distraction to physical objects during feeding

Maternal distraction was found to be a barrier in two quantitative studies. In a cross-sectional survey, 75% of mothers who were distracted during bottle feeding scored low on the sensitivity to cues subscale, whereas only 30% of mothers who were not distracted scored low on this subscale.[34] Maternal use of digital media was found to be a barrier in a recent study that found it led to significantly less cognitive growth fostering

(caregiver encouragement, engagement, and responsiveness) during infant feeding.[40]

3.13 | Structural/environmental factors

Structural and environmental factors such as low income, ethnicity, and high risk of obesity were found to be barriers to responsive feeding in one study.[30] A secondary analysis of differences in feeding practices between families receiving care at a hospital which served low-income, primarily Hispanic families ("high risk of infant obesity") and families receiving care at a private pediatric practice serving primarily high-income white families ("low risk of infant obesity"), reported more pressuring feeding and more restrictive feeding in the high-risk group. High-risk mothers were also more likely to believe in their ability to recognise infant hunger and satiety cues; low-risk mothers were more likely to believe in infant's ability to recognise their own hunger and satiety.[30] This study compared two different socio-economic/racial groups and did not explore any within-group characteristics that may have influenced the findings.

3.14 | Social opportunity

Social opportunity for parents to feed responsively was evident in 14 studies.[28,37,38,41,42,45–47,52,55,58,59,61,65] Five barriers and enablers were identified: (1) advice and support; (2) social and cultural norms and expectations; (3) child cues; (4) influence of the social environment on caregiver response; and (5) interactions with child during feeding.

3.15 | Advice and support

All five of the qualitative studies relevant to social opportunity[47,52,55,58,65] included advice and support as both barriers and enablers to responsive feeding. Three main sources of advice and support were identified: health care professionals; family and peers; and online information/sources. For mothers who were formula feeding, perceived reluctance of healthcare professionals to provide advice and support,[47,52,58] a focus on weight gain by healthcare professionals,[58] and conflicting advice from different health professionals[58] were all barriers to responsive feeding. For breastfeeding mothers, an absence of advice on non-nutritive feeding from healthcare professionals was a barrier.[52] Healthcare professional advice and support could also act as an enabler if the parent was prepared to be proactive when seeking information relevant to formula feeding,[47] if the healthcare professional listened to the parent's concerns[55] or was reassuring,[47] or if the mothers had a "flexible attitude."[65] Health professionals' verbal instructions to breastfeeding parents to wake their baby up three hourly[55] were reported as a barrier to responsive feeding in one study. Advice and support from family and peers[47,58,65] and from online sources[47,52,58] only featured as an enabler, particularly for formula feeding parents.

3.16 | Social and cultural norms and expectations

In three qualitative studies,[47,52,58] the cultural expectation of breastfeeding was described as a barrier to responsive feeding, with mothers in all three studies feeling stigmatised by the negative attitudes of health professionals and others to formula feeding.[58] The influence of social norms, both as barrier and enabler, was also apparent in a study of baby-led weaning,[57] where mothers felt they needed to feed the infant *neatly* in public, whereas at home, baby-led weaning fitted *easily with family lifestyle and mealtimes*. A cross-sectional survey of 413 mother–infant dyads in Australia found that scheduled feeding was neither a barrier nor an enabler to food responsiveness and satiety responsiveness.[46]

3.17 | Maternal perception of child cues

One qualitative and five quantitative studies examined maternal perception of child cues, which were reported to act as both a barrier and an enabler.[37,38,44–46,61] One barrier emerged when infants consumed more than mothers anticipated making it hard to decipher satiety cues.[61] One study reported an association between greater infant clarity of cues and greater maternal sensitivity of cues.[37] A cross-sectional analysis of Australian mothers found a positive association between perceived infant enjoyment of food and maternal awareness of infant cues.[46] A further cross-sectional study reported a positive association between perceived infant negativity and use of food to soothe, among women without depressive symptoms.[38] A secondary data analysis reported an association between maternal perception of child as a fussy eater with who decides amount of food eaten.[45] A further secondary analysis[44] reported that a more difficult infant temperament was associated with decreased maternal awareness to cues and increased use of food to calm the infant.

3.18 | Influence of the social environment on caregiver responses

Factors in the social environment were found to be barriers to responsive feeding in a U.S. cross-sectional observational study that videotaped a family meal. Observed maternal responsiveness was significantly lower among families in which fathers were absent compared to those with a father present.[42] The same study found that non-technology object-related distractions and fathers' total distractions were negatively associated with maternal feeding response.[42] Baseline data from the Norwegian Food4toddlers study revealed that not eating family meals together was a barrier which enacted negative practices such as pressure to eat and restriction.[64]

3.19 | Interactions with child during feeding

Mealtime negativity and feeding conflict were found to be barriers in two studies.[28,59] An observational study of 87 mother–infant dyads reported associations between mealtime negativity and increased maternal verbal control, controlling behaviour, negative emotion, inappropriate behaviour, insensitivity, observed conflict, and control.[59] An observational study of 116 mothers of infants reported an association between feeding control and feeding conflict during feeding interactions and an association between feeding duration and controlling feeding behaviours.[28] One study reported a positive association between child self-feeding and maternal responsiveness to child hunger cues.[31] Zeanah examined parent self-report of infant temperament and independent observers' behavioural ratings and found that infants rated as difficult by parents were less responsive during feeding sessions which is a barrier.[29] An infant signing intervention delivered to parents as part of the INSIGHT study enabled infants to signal signs of satiety to their parents.[41]

3.20 | Reflective motivation

We found evidence of barriers and enablers of responsive feeding related to reflective motivation in 11 studies.[46–49,52,54,55,57,59,61,65] Two barriers and enablers were distinguished in the data: (1) beliefs about consequences of parental feeding practices and (2) feeding goals, intentions, and plans.

3.21 | Beliefs about consequences of caregiver feeding practices

One study found that a belief that non-nutritive feeding is without negative consequences for a child[52] is a barrier to responsive feeding. Similarly, an enabling belief in the positive consequences of allowing the infant to control their own intake of food was commonly held among mothers who followed baby-led weaning[57] but was not identified in the other studies that did not focus on this feeding approach.

3.22 | Caregiver feeding goals, intentions, and plans

Parental feeding goals, intentions, and plans influenced responsive feeding in seven qualitative studies.[47,49,52,55,57,61,65] Having goals for child's intake of food was a barrier for parents accessing child health support,[49] mothers of preterm babies,[55] mothers who had been identified by the study authors as having a controlling attitude,[65] and some mothers who used traditional rather than baby-led weaning techniques.[61] In one study "success" was measured by "getting food in," rather than the teaching process of increasing preferences for nutritional foods.[49]

Parental planning around responsive feeding was an enabler in a study of mothers who followed baby-led weaning.[57] Mothers talked about adapting the timing of meals "to suit the infants' natural hunger pattern," using equipment to manage the mess when infants feed themselves, and choosing foods which were "less messy and easier to eat in public" when out and about.[57] In contrast, Russell et al.[52] found that mothers "plans about feeding to appetite or to settle were largely absent from the discussion about feeding to appetite/use of non-nutritive feeding," whereas Appleton et al.[47] found that some mothers plan to feed to a "specific feeding regime."

Perception of child appetite was a barrier to responsive feeding in two observational studies. A study of 87 mother–infant dyads reported that lower observed consumption of food was associated with greater food restriction.[59] Another study reported that higher perceived infant appetite was associated with increased parental restriction and lower perceived infant appetite was associated with increased parental pressure to eat.[54]

Maternal concern about infant under/overweight and hunger was a barrier in three studies. A survey of 263 Australian mothers found a positive association between concern about infant underweight and pressuring feeding style and concern about infant overweight and restrictive feeding style.[48] A cross-sectional analysis of 413 mother-infant dyads reported that mothers who reported higher concern about infant over-eating/overweight rated their infants higher on food responsiveness, enjoyment of food.[46] There was no association between concerns about infant over-eating/overweight and satiety responsiveness.[46] A study of 1,920 families reported associations between lower maternal concern about infant underweight and increased restriction and between high maternal concern about infant underweight and increased pressure.[54]

3.23 | Automatic motivation

Barriers and enablers to responsive feeding that were related to automatic motivation were evident in 12 studies,[27,28,37,38,43,44,48,49,52,57,60,61,65] which were categorised into (1) caregiver emotions and (2) parental internal cues.

3.24 | Caregiver emotions

Caregiver affect was reported in two qualitative studies.[49,57] One paper[49] highlighted that parental distress when discussing feeding was driven by "internal tensions for parents between fear of child hunger and providing poor nutrition." (p. 1,525). In contrast, the enabling influence of an empathetic response to their child's experience of feeding was identified in one study.[57] There was evidence that maternal anxiety about hunger drives a need to feed their child.[65] This, in turn, could lead to conflict, instrumental feeding, or even forcing a child to eat.[49,65]

Maternal depression was found to be a barrier in three quantitative studies.[28,38,44] A study of 60 mothers with elevated depressive symptoms reported increased likelihood of mothers putting cereal in their infant's bottle, using food to soothe their infant, putting their infant to bed with a bottle, and perceiving meal/feeding time interactions as stressful, hectic, and rushed.[38] A secondary analysis[44] reported an association between maternal depression and increased use of food to soothe and a decreased awareness of infant cues. A study of 116 mother–infant dyads reported that increased levels of maternal depression and passivity were associated with higher controlling behaviour; higher levels of maternal depressive symptoms involving anger were also significantly related to engaging in more controlling behaviour.[28] Higher levels of depressive symptoms and a preoccupied attachment classification predicted higher controlling behaviour.[28] Mothers who reported higher levels of depressive symptoms and higher levels of anger were significantly more likely to engage in more controlling feeding behaviour.[28]

Other maternal emotional and affective states were found to be both barriers and enablers in four studies. A cross-sectional survey reported a positive association between maternal hostility and pressuring feeding style.[48] An observational study of 87 mother–infant dyads reported that negative maternal emotion was associated with mealtime negativity and pressure to eat. In contrast, positive emotion and decreased mealtime negativity decreased pressure to eat.[60] A secondary analysis[37] reported no association between maternal negative affect and clarity of infant cues. Farrow and Blissett[59] noted an association between mothers who reported more mind-mindedness (which relates to perceptions of child as an individual having their own mind) and increased feeding sensitivity when their infants were aged 6 months. Paternal affect was identified as a barrier in a study exploring paternal attachment representations[27] that found an association between an unresolved attachment in fathers and feeding control.

3.25 | Parental internal cues

One enabler was described in a U.S. quantitative study conducted on a sample of primarily non-Hispanic Black parents. Parents who relied on their own hunger and satiety skills had higher responsive feeding style scores.[43]

3.26 | NON-COM-B theme

We identified barriers and enablers to responsive feeding which did not sit within the COM-B model of behaviour change framework. One study demonstrated that mothers who breastfed their infants for longer had greater sensitivity to infant satiety and hunger cues as well as being less likely to use pressurizing feeding style (in relation to cereal consumption).[25] Two further themes were developed.

3.27 | Changes over time

The influence of changes over time on responsive feeding was apparent in five qualitative studies.[47,49,52,58,61] There were two enabling effects of time passing on responsive feeding: mothers found that older children had more overt feeding cues[47,61] and as mothers gained experience over time, they felt more confident in their ability to feed responsively.[52] However, some parents calling a child health line[49] found their child's developing autonomy a challenge, and this posed a barrier to responsive feeding. Timing also affected parental ability to adopt responsive feeding advice. In a qualitative process evaluation of the Baby Milk Trial,[58] mothers suggested that the time of responsive feeding advice was critical, in that they needed to know early on their child's life because it was difficult to follow the responsive feeding advice when non-responsive feeding patterns were already established.[58]

3.28 | Child weight

One study comparing high and normal birth weight infants reported associations between infant size (high infant birth weight and weight for length ≥85th percentile) and lower maternal interaction with their infant during feeding.[26] A second study reported a negative association between infant birth weight and pressuring feeding style.[48] A secondary analysis of quantitative data reported that some caregiver restriction of food was associated with a decrease in BMI in boys aged 2–6 years.[33] Among girls aged 4–6 years, absence of caregiver restriction of food was associated with BMI reductions whereas restriction of food was associated with increases in BMI.[33] A further study reported that infants fed on a schedule demonstrated significantly more rapid weight gain than those fed on demand.[53]

4 | DISCUSSION

This review sought to identify the barriers and enablers to caregiver responsive feeding. The included studies used a range of methodologies and the barriers and enablers to responsive feeding identified were complex and heterogeneous. In terms of the psychological skills and knowledge needed by caregivers, our findings indicated that parents' recognition of a child's feeding and satiety cues are key to the development of responsive feeding.[47,52,56,57,61,65] The importance of recognizing child cues has been highlighted previously.[5] Our findings provide further evidence for this enabler. In addition, the finding that both caregivers and infants need to learn how to signal to each other is important for future intervention development.[41,47,49]

Our review provided consistent evidence that provision of information and education, often in the form of anticipatory guidance and support to caregivers, was a key enabler for responsive feeding.[32,36,39,50,62] A previous systematic review of health professional delivered interventions to improve infant feeding practices noted that although anticipatory guidance interventions demonstrate benefits,

interventions focusing on responsive feeding may be more effective.[14] Our findings also suggest that the timing of anticipatory guidance about responsive feeding is critical in order to prevent non-responsive feeding habits from forming.

Physical opportunity was identified as both a barrier and enabler to responsive feeding and was related to environmental and interpersonal factors. For instance, instructions on prepared infant foods were found to be unhelpful when they contradicted infant's feeding cues.[47,52] Similarly, although being at home was enabling, being away from home was not[55]; this was previously found in a review of more general infant feeding[18] and is commonly reported in relation to women's comfort and confidence in breastfeeding.[66] Other environmental barriers to responsive feeding included maternal distraction, low income, and ethnicity. Maternal distraction with mobile technology has been shown to have an impact on responsiveness generally; research is emerging in relation to its impact on feeding interactions,[40] and our findings indicate that this is an important area for future research. Physical contact between mother and infant enabled better reading of hunger cues, which is not entirely surprising given that skin-to-skin contact (Kangaroo care) between caregivers and infants improves bonding and breastfeeding uptake in preterm infants.[67]

In terms of social opportunity, advice and support were both enablers and barriers to responsive feeding. Caregivers found some encounters with health professionals enabling[47] which has been reported previously.[12] Hospital-based scheduled feeding regimes for preterm infants were a barrier to responsive feeding.[55] The cultural norm for health professionals to support breast but not formula feeding was also identified as a barrier,[47,52,58] and this has been reported elsewhere.[68,69] For instance, formula feeding has been described as a stigmatised practice,[58,68,70,71] and conflicting advice given to parents who formula feed[58] was identified as a barrier in the current review. The importance of clear, consistent, and non-judgmental advice and support for infant feeding has been highlighted in previous research.[71] There is a need to consider the likelihood that current ways of promoting breastfeeding fail to take account of the socio-economic and cultural features associated with some groups of women.[71] For instance, Hoddinott et al.[70] found that goals for women to breastfeed for the first 6 months were unrealistic and led to inconsistency in health professional advice and parents who were not always honest if they were not following the guidelines. Hennessy and colleagues[69] found that although health professionals promoted breastfeeding, if there were concerns about weight loss, especially during the early postnatal period, they rapidly suggested infants were offered formula. These challenges highlight the need for health professionals to be enabled to provide realistic advice and support for caregivers around responsive breast and formula feeding.

Support from family and friends was found to be an enabler in this review, which is unsurprising as a previous evidence synthesis highlighted the importance of support and advice from friends and family, above that provided by healthcare professionals.[18] However, one study found that maternal responsiveness during feeding was adversely effected by father absence, non-technology related, and father distractions.[42] Clearly, caregivers may be influenced negatively by family and friends as highlighted by Hennessy et al.[69] who described negative relationships between women, who were trying to breastfeed, and their mothers particularly where these women themselves have their own breastfeeding goals. Interestingly, planning and evaluation around infant feeding were identified as both a barrier and an enabler in this review. For example, having goals for a child's food intake was not conducive to responsive feeding, whereas plans to undertake baby-led weaning were enabling.[57,61] Goal setting is a useful behaviour change technique that has been employed in dietary behaviour change in adult populations[72] and weight-related behaviour change in children.[73] As such, it was expected that planning and goal setting would be beneficial for promoting responsive feeding. However, our findings indicate the importance of recognizing potential adverse consequences of caregiver goal setting around infant feeding.

Caregiver emotions and needs can also impact their ability to engage in responsive feeding. Both maternal depression[28,38,44] and parental feelings of negativity if their child did not eat were identified as barriers, whereas maternal hostility[48] and negative emotion[60] were associated with pressurised feeding. However, mothers who were more mind-minded were more feeding sensitive.[59] A recent conceptual model of early maternal–child pathways to childhood obesity risk shows that maternal mental health during infancy influences the establishment of parent–child feeding interactions during infancy.[74] Impaired maternal mental health and negative emotional responses may impact on responsive feeding through reduced capacity to interact and engage with the infant emotionally and interpersonally. Clearly, the emotional responses of both caregiver and infant need to be carefully considered in the development of a responsive feeding intervention.

We did not identify any studies with data that could be mapped to the COM-B component of physical capability. Although we excluded infants with major sensory and physical disabilities (e.g., blindness and deafness), there will be caregivers who are unable to recognise and acknowledge their infant's cues, such as those who are visually impaired. Furthermore, some caregivers may have physical disabilities that make face-to-face infant feeding difficult. Although there are support services for mothers with visual impairments (https://blindmotherhood.com/vision-aware-bottle-feeding-baby/) and disabilities (https://www.bestbeginnings.org.uk/parents-with-disabilities), we did not identify any literature exploring responsive feeding for these groups of caregivers. Any future intervention will need to include these groups of caregivers in the developmental phase to ensure the information is appropriate and accessible.

This review was undertaken to inform development of a targeted intervention to improve caregiver responsive feeding practices. Our findings indicate that such an intervention needs to address both individual caregiver factors and wider socio-ecological influences on infant feeding practices. Existing evidence and models for tailoring interventions around infant feeding[75] indicate the importance of stakeholder engagement to inform intervention development and implementation.

4.1 | Study strengths and limitations

The strengths of this review were the use of quantitative and qualitative data to ensure robust and comprehensive approach to identifying barriers and enablers. The use of the COM-B model as a framework for analysis facilitated synthesis of barriers and facilitators and how they relate to each other, which is an important step in exploring how to improve caregiver feeding behaviours. A further strength is the additional complementary thematic analysis of qualitative data to ensure no barriers and enablers were missed. The multidisciplinary team was involved in all stages of the review, with several rounds of checking and consensus. This activity ensures confidence in decisions made and increases the robustness of the review findings. We included studies with quantitative and qualitative designs in the review and assessed their methodological quality using the MMAT, which is considered a reliable and efficient checklist for this purpose.[76] The MMAT uses nominal criteria (yes/no/can't tell) to score an item, and therefore, it is not possible to provide an overall rating of the quality of the studies included in the review, nor to be able to weigh the evidence from particular papers. Other potential limitations are our application of the MMAT tool. We only looked at the included papers although we are aware that for the intervention studies there will be protocols and additional papers that provide some of the information needed for a higher rating. The focus on OECD countries will mean that we have not included barriers and enablers from non-OECD countries. However, given that our main focus was to identify the barriers and enablers to inform an intervention that will initially be developed and tested in the United Kingdom and Ireland, this is appropriate.

5 | CONCLUSION

This review provides the first comprehensive evidence base of the barriers and enablers to caregiver responsive feeding from the extant literature. Barriers such as recognition of cues, knowledge, understanding, beliefs, and attitudes toward feeding could potentially be addressed with anticipatory guidance prenatally or during the first few weeks of an infant's life. It is important to target these critical windows to better support caregivers as they learn to recognise infant feeding cues. There is also a need to address social and structural barriers to caregivers obtaining sufficient, consistent information about responsive infant feeding. Observed inequity in information provision to formula feeding caregivers also needs to be addressed both in intervention development and service delivery. In summary, future responsive feeding interventions must address individual and population level influences on infant feeding practices. Engagement with caregivers and broader stakeholders such as health care professionals, commissioners, and service planners is essential to further develop and implement such interventions.

CONFLICT OF INTEREST

No conflict of interest statement.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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