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Original Research Article

Demand Feeding versus Scheduled Feeding during early life: Influence of feeding practice on obesity at early childhood: a systematic review of published evidence

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Abstract: There is an interest in the degree to which feeding practices contribute to early childhood obesity. We undertook a systematic review to investigate the effect of demand feeding versus scheduled feeding on obesity in early childhood. A systematic search of electronic databases identified studies relating feeding during early life mainly infancy to episodes of early childhood obesity. Included studies were assessed for quality based on study methodology, validity of dietary assessment, success of follow-up, standardised assessment of obesity. Data from ten cohorts involving 5535 subjects were included. Studies had follow-up of more than 60 %, adjusted statistically for three or more confounders and used standard criteria to determine end points. About half the studies used a validated FFQ, administered the FFQ more than once or had follow-up of one year. Fewer than half the studies involved subjects' representative of the general population. This systematic review points out the presence of heterogeneity in the results from studies reviewing feeding practices and risk of obesity. This could be due to the fact that studies are too varied in methods of feeding assessment and anthropometric measurements, time scale and the method of evaluating the nature of the association.
Keywords: Demand, scheduled, feeding, infant, childhood, obesity

INTRODUCTION

During the first years of life, infants and toddlers are dependent on the mothers or caregivers to provide appropriate and sufficient nutrition. Accordingly, the potential impacts of feeding practices on over-nutrition and the development of overweight during this time are intuitive. A prolong disparity of mother responsiveness to infant feeding signals is argued to have an impact on the development of obesity [1]. The disparity influences infant's response to internal signs of satiation and hunger, for example, feeding when the infant is satiated. Antecedently, the focus of nutrition in during life was on satisfying nutritional requirements [1-3]. Recent meta-analysis papers and reviews point out that approximately all available research indicate that accelerated weight gain during childhood rises the opportunity of obesity during adulthood [2]. However, most research and reviews have studied what infant/child is consuming, and there is a limited knowledge on when and how this consumption occurs [3-4]. The risk of childhood obesity is on average two to three times higher for rapid weight gain infants than those on normal weight gain pattern [5-6]. For this reason, this field is a significant public health issue. This topic has been frequently discussed on the societies, with two extremities of debate to support each practice. However, most discussions depend on anecdotal evidence; and there is remarkably limited descriptive and experimental knowledge about the underlying arguments [7].

This gap in knowledge makes this topic worthwhile area to explore and review. Moreover, even though this concept of disparity has long been recognised in literature since 1950s, there is a lacking of systematic assessment of the feeding practices related evidence [8]. This systematic review has attempted to analyse the hypothesized association between feeding practices during infancy and overweight during infancy as well as toddlerhood. A systematic approach applied to obtain research papers from five leading databases. The quality of evidence collected was assessed according to the reporting of the study methodology, statistical methods and analysis, the duration and success of follow-up, the content and validation of the feeding assessment procedure. The systematic search

produced only ten original researches, which met the inclusion and exclusion criteria. However, many studies were not original studies, different samples' ages or other reasons will be discussed within the methodology section. The object of this review is to examine the different impacts between demand feeding and scheduled feeding during early life on child obesity during early childhood.

MATERIALS AND METHODS:

A systematic search of electronic databases resulted in research papers related to feeding on demand or schedule to Body Mass Index (BMI). The Data from ten origin studies involving 5535 subjects were extracted. However, it was not possible to aggregate the results in Meta-analysis, due to differences in age groups, time scale and protocols of the studies. The problem of paediatric overweight is evident before the preschool years [8]. Data collected in the National Health and Survey 2007–2008 indicated that more than 10% of infants and toddlers were obese [9]. These figures increase concerns because obese infants are at higher risk of overweight in adulthood. For example, Analysis of data from Nutrition Surveillance System concluded that overweight infants were 2.9–4.3 times at risk to be overweight at the ages of 1to 4 years than non-overweight infants [10]. For this reason, establishment energy self-regulation by infants may facilitate the development of capacity for energy regulation throughout infancy and into childhood. To this notion, Wright and others [11-12] have concluded that suitable responses to infant feeding cues are significant items for infant self-regulation and control of energy consumption. This claim is supported by experimental research, which has shown that infants at age of six weeks of age may adjust the volume and energy content of formula intake and maintain a certain level of daily energy intake [13–15]. Another cohort study has also concluded the same evidence, including data from 6 to 24 month old children. The result showed an inverse association between the number of daily feeds and child weight. [16].

Literature-search strategy

A systematic literature review of feeding practices was performed using five principal databases MEDLINE, EMBASE, CINAHL, COCHRANE and, CENTRAL, International libraries and citation index (Web of Science) were searched for related research papers. Language restriction was applied with searching in studies with English abstracts. Reference lists of selected papers were searched for other potentially relevant research. These databases were searched for articles listed from the database's inception to mid February 2017. Database limits were used to restrict search to research in full term healthy human infants (from birth up to 4 years). The main criteria of included studies, that they should include comparison between demand feeding and scheduled feeding and their impacts on body weight, irrespective of milk type wether bottle or breast milk. A list of 20 search terms was generated to identify Article titles and their abstracts were briefly skimmed and reviewed using the inclusion/ exclusion criteria. Articles which met or questionably met the selection criteria were then thoroughly reviewed for eligibility. The included studies are original research published in English, up to mid-February 2017, involving healthy full-term infants who aged zero month up to four years of child ag,. Moreover, they should include infant feeding/eating practice as exposure and infant weight/growth as outcome, and focusing on child weight gain, overweight and/or obesity. Exclusion criteria included research that focused on growth faltering (organic or non-organic) or preterm infant. Although including growth faltering and malnutrition studies would increase the quantity of articles, they would not have added to the content of this review as demand and/or scheduled feeding in these studies are investigated in relation to a different set of outcomes, including promotion of energy intake.

Quality assessments:

The assessment of available evidence has considered the reporting of the study design, the sampling (e.g. Response rate), as well as follow-up success and duration. Application of standardised procedures to measure body weight and validation of the feeding practices assessment method was used to check the study's internal validity. Whether the records were reviewed by a blind researcher, adjustment for confounding factors and number and suitability of statistical analysis are elements used to qualify the bias and confounding of the study.

Data abstraction:

The data abstraction of the systematic review is presented in Figure 1. The search of five databases with 20 keywords provided 883 hits. It was not possible to deliver a unique group of hits, because databases subscribe to the same indexes or journals. After elimination of redundant abstracts, 126 unique abstracts were deemed appropriate for full-abstract review based on the brief review of article titles and abstracts. These abstracts were then thoroughly reviewed based on the inclusion/exclusion criteria. First, 16 articles were excluded because they were not original research. 24 articles were excluded

because performing research in a population other than 0 month – four years. 17 research was performed with regard to malnutrition/growth were excluded (Figure 2). The 69 remaining articles were assessed to determine whether feeding practices and infant/child weight was directly measured. A total of 59 articles were excluded because some aspects of infant overweight/obesity or infant feeding practices were not directly measured. In most of these excluded cases, feeding observations or measurements were not used to investigate the feeding practices wether demand or scheduled feeding.

Data synthesis and analysis

Qualitative data from each study including design, participant characteristics, methodology, results and statistical analysis were extracted and tabulated for comparative analysis. No assessment of publication bias was undertaken owing to the small number of included studies, as well as due to the difficulty in combining multiple publications from the same cohort and mixed associations between specific feeding practice and obesity development.

Summary of included studies

The studies included in this systematic review are summarised and alphabetically listed in Table 1[17-26].

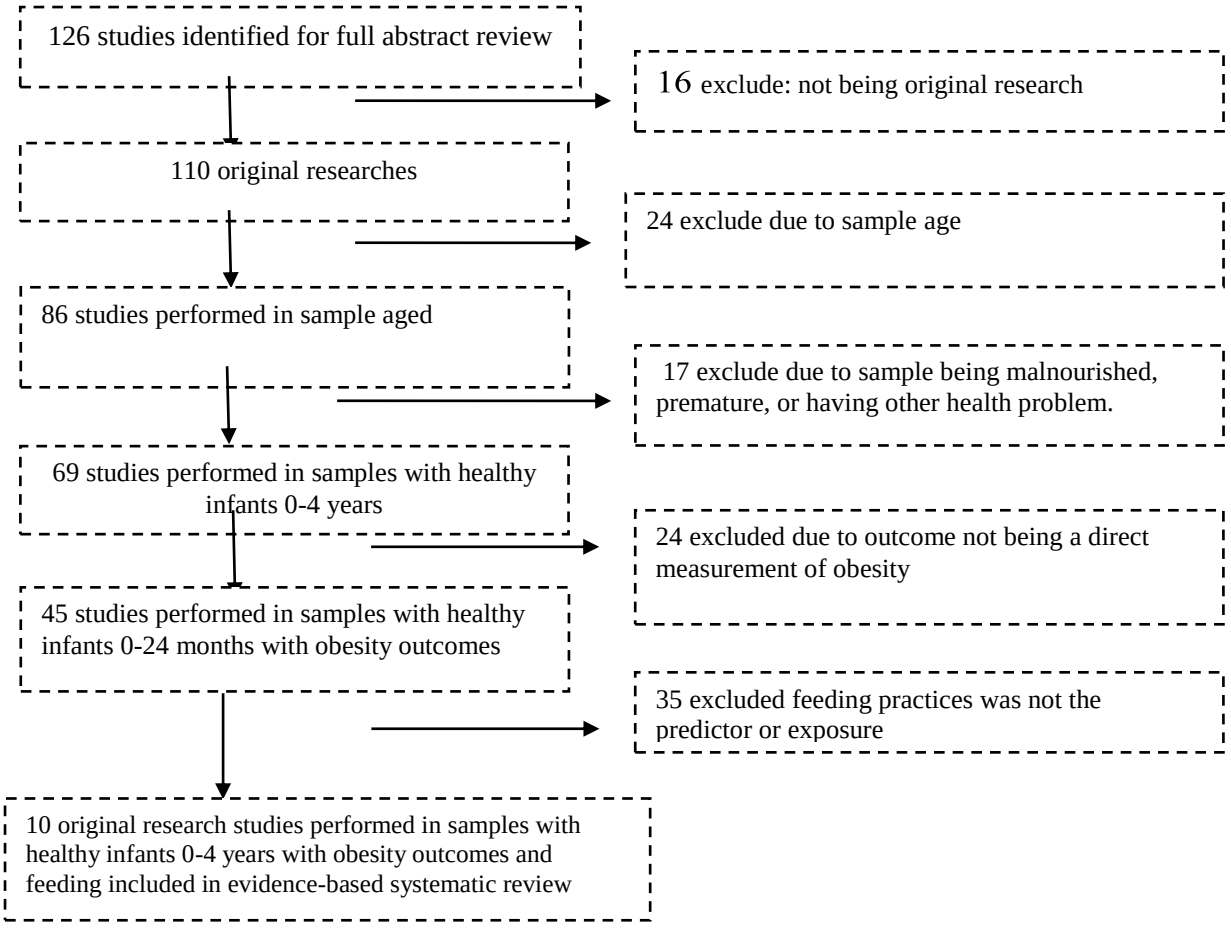

Fig 1: Flow diagram of articles extraction

Participant characteristics

The included studies involved 5535 infants with study sizes ranging between 48 [25] and 2834 [17]. Most studies involved subjects with an age range between 1months and four years. Four of the ten studies included infant with pre-existing under/ overweight [20, 22, 25, 26], whereas six studies included participants regardless of weight history and adjusted for this in the statistical analysis [17, 19, 20-26]. The presence of pre-existing overweight at entry was not reported in one study [20] and another excluded subjects with pre-existing overweight only if they had changed their eating habits as a result of their disease [24].

Assessment of dairy food intake

Intake of dairy food (diet assessment) was measured with a validated FFQ in five studies [18, 20, 22, 24-26], a weighed food record in one study [21] and a 1-week food-frequency recall in another [23]. The tool for assessing diet was poorly defined in two studies [24, 25] and was not described in one study [18].

Of the ten included studies, two measured feeding practices as an exposure and obesity as an outcome [27], seven measured feeding frequency and duration [36,41] and three measured intervals [34,44]. There remaining six studies reported various combinations of feeding practices against BMI end points; [39, 40, 43]. The majority of studies separated subjects into group based on bottle or breast feeding, or frequency of feeding demanding or scheduling [34-39, 41, 44].

Assessment of outcome measures

All of the included studies identified weight using standard criteria from the International Classification for weight index [28-30] or the WHO classification criteria [31].

Table 1: Summary of the studies

Article	Design	Sample	Measurements	Summary of results	Statistical methods	Study quality
Jessica *et al.;* [17]	Prospective cohort. Dutch Duration: 4 years 2000-2004	2834 mothers Gender:51.2% M; Mean B.wt: 3506 g 80.2 % on breast feeding Response rate: 66%.	Milk type: breast, bottle breast feeding, feeding duration. Scheduled, demand or both. Weight: Parents reports	Strong association between feeding pattern and breastfeeding duration (Pearson Chi ^{2}= 334.6, p <0.001). No association between feeding pattern and BMI	Linear and logistic regression. Adjustment for Some confounding factors	Follow-up %: not reported. No adjustment for many confounding. Exclusion of those on mixed feeding Depending on parents' report Feeding assessed only at 3 months.
De Carvalho *et al.;* [18]	USA; Quasi-experimental Duration: 35 days 1982	Control: scheduled Experimental: demand. Response rate: Control: 27.9% Experimental: 17.9%	All depend on mothers' report. Frequency, duration session, infant weight gain and amount of milk intake were reported. Weight record: 3 times	Feeding frequency is higher in experimental group P< 0.001 when duration is more among control group. Weight gain: experimental group gained more weight P< 0.02	Chi ^{2} test. No information about any considered confounding factors or any adjustment.	Different methods to inform both groups about procedure. Depending on mother measures. Small sample size. elimination of >50% at some stages
Casiday *et al.;* [19]	Prospective cohort study Setting: urban UK community. Duration: 13	502Mothers. Response rate: 54% Children age first 13 months of life.	Feeding method, duration, frequency recorded by	Breast infants had more frequent feeding. Bottle or mixed-feeding associated with SES & negatively	ANOVA, linear regression, logistic regression,	Only half of the cohort completed diaries & with no validation

	months;2003		mothers during first 6 weeks. Infant weight at 12 days, 6 week and 13 months. Duplicate of the weight data from the child health record.	with maternal education. Age was +ve correlated with bottle volume, feeding rate. Higher infant Wt among demand breast fed ones. Mixed feeding	Adjustment for confounding factors included: SES, maternal education, mother's parity and age.	of the of diary entries. Self-selection bias: mothers feeding very frequently or having difficulty in feeding may not have completed and returned diaries. No adjustment for confounding.
Agras *et al.;* [20]	Prospective cohort USA 2 years;1986-87	61 of 99 Infant , M 51.1% F 48.9% Response:61.6 %	SES, feeding and growth at: week 2 & 4. 12 and 24 months: growth & feeding duration. Solid food consumption. Infant B.wt, Ht. Feeding number, interval and duration were recorded at home.	No significant differences in SES, feeding. Parental education associated with adiposity. Demand feeding negatively associated with adiposity. Bottle-fed were ↑adipose at 6 months. Less feeds/day associated with ↑obesity.	Multiple linear regressions. Considered confounders are: B.Wt, age, gender, parental education, parental wt & introduction of solid foods.	Only 8 subjects were bottle feeding ((no representative of population) No check for confounding by breast feeding and other possible confounding factors. Small sample size.
Li et *et al.;* [21]	Prospective cohort US2000	N: 1187. Response rate: 62.6% Infants: 41.5 % M 53%fF. 34.5% of mother college degree.	10 questionnaires Over a1-year postpartum. Wt length by doctor at 3, 5, 7, and 12 month. Age at measurement. average number of feedings/ 7 day (mother report)	↓breast feeding duration → ↑weight OR 2.11 (1.24–3.60). Scheduled feeding →↑weight OR 1.28 (0.80–2.03).	Bivariate association, multiple regressions. Confounders age, sex, SES, maternal health &age, gestational age, solid food, & education, ethnicity, pre-pregnancy BMI. mothers smoking	No representative of population. Weight reported by the mothers. The sample was national and relatively large.

Fisher *et al.;* [22]	Prospective cohort USA1999 Duration6months	N: 51 infants out of 55 (24females+31males) Recruitment: birth record, invitation letter then follow up phone. B. wt: ≥2500g Response rate: 93%	SES. Dietary intake (2week days+ 1weekend) recorded by mothers. Wt, length, height, SFT were collected during monthly visits by trained staff. Food samples analysed by Nutrition Data System	86% breast feeding Energy intake: M 96% F 92 % from DA. ↑Energy intake→↑length, ↓ SFT, no Wt association. ↓demand +↑scheduled→↑energy intake β= -0.44. Low infant wt → more scheduled feeding. ↑ breast feeding duration →↓ scheduled feeding practices	Univariate statistical for all variables, correlation & regression models. Confounding variables: maternal education, gender, weight at 12-13 months & Ht at 18 months.	Small sample size not representative sample. Mother record of dietary intake may mistake. Although, 86 % were breast feeding infants there was no adjustment for breast feeding duration. No adjustments for solid food.
Illingworth *et al.;* [23]	UK; Quasi-experimental Duration: 1 month 1951	N: 131 babies on demand feeding and 106 on schedule feeding. However, there were many un-clear changes in experiment protocol. Scheduled group: 6 feeds/24hrs. Demand group: flexible on demand.	Weight measurement: B.Wt, day 3 & then on alternate days. On day 6 & 8 weight measurements before and after feeding sessions.	Wt gain associated with demand feeding. Scheduled group were breast-fed at the age of 1 month & 80.3% in demand group. This difference is statistically significant confounding: parity & hospitalisation duration	t test, incidence & correlation test. Significant at 5 % level.	There were many un-clear changes in experiment protocol. No adjustment for many possible confounders. Adjustment for hospitalisation. !! Why if they all spent same time.
Farrow *et al.;* [24]	UK; Prospective cohort .Duration: 6 months 2003	N: 69 out of 87 Mean gestation age 39.68 weeks.	Infants B.Wt ((hospital)) & Wt at 6, 12 months. Feeding recorded using unobtrusive video camera. Infant Characteristics Questionnaire (ICQ) to assesses	Infant B.wt was not associated with scheduled feeding. Scheduled feeding at 6 months was a significant predictor of later infant weight gain (6–12 months Confounding:: B.Wt, gestational age, gender, feeding duration infant age.	Descriptive statistics, independent sample *t* tests, Pearson's 2-tailed correlations, Pearson's and regression models	The study depends on only 1 observation of mother. Non-clinical sample; cannot be generalized to all of infants. Not all important confounding: factors were considered.
Saxon *et al.;* [25]	USA; Retrospective cohort ; Duration: 3 months 2000	N: 48 infants (28 male; 20 female). 21 on demand feedings 27 on scheduled feeding. Averaged of age 12.5 months.	SES and feeding practices. Measurements: Weight, body length, and head circumference from 2-, 4- and 6-months clinic records and calculation	demand fed infants ate significantly more meals Compared to their schedule fed counterparts,, t (45) 2.26. $p < 0.05$. No other differences were found between feeding groups. Considered confounding: birth	Regression	No confounding adjustment. Maternal report. Retrospective limitations No clear report of the result

			by researchers blind to mothers' feeding. Meals number,	weight and length.		
Mihrshai *et al.;* [26]	AUS; Retrospective cohort ; Duration: 5 months 2009	612 out of 698 first time mothers and their infants. Healthy infants >35 weeks gestation. 2-7 months of age	B.Wt from hospital records. infant and mother weight and length/height, and self-completed questionnaire for mothers	Feeding categories: Confounders: gender, maternal age, education and smoking. The only factors that showed a significant association with positive weight change were lower maternal BMI & scheduled feeding. Formula fed infants were more likely to be fed on schedule	Chi squared tests; logistic regression model was used to evaluate the association between feeding style and weight gain.	It may be that study h started too late (2 months), after feeding and eating patterns have been established. So, it is difficult to follow up. Only first-time mothers.
M: male, m: months, B.Wt: body weight, BMI: body mass index, SES: socio-economic status, USA: United States of America, ↑: increase, ↓: Decrease →: associated with, hrs; hours, UK: United Kingdom. SFT; Skin fold thickness. DA; daily allowance						

DISCUSSION:

There is no consistency of the included studies' findings to support that either demand feeding or scheduled feeding during infancy is associated with a higher risk of over-weight and obesity during early childhood. While there is no doubt that feeding practice during early life contribute to later weight gain [17], and infant weight has evidently been associated with a higher occurrence of obesity during later life [18], the evidence abstracted from these reviewed articles does not consistently establish a direct association between the infant feeding pattern and early childhood body mass index (BMI). The risk for development of obesity extends between 1.5:1 and 4:1, depending on child age at assessment, duration of follow-up and used measurements [19]. The current recommendations by governments and health authorities to focus on infant weight are supported by the evidence published in 2008 Australian National Health Survey (NHS) (9), and National Children's Nutrition and Physical Activity Survey of Australia (the Children's Survey); [20] as these were the only surveys that review this issue. Ethical and practical issues make this area under researched. First study; Jessica *et al.;* [17]; which is a large prospective study, reported no significant relationship between feeding method and BMI. This was the same finding of Saxon *et al.;* [25]. However, Jessica *et al.;* [17] found a strong association between demand feeding and breast feeding duration; Pearson Chi^2 334.6 $P<0.001$. Also, infants who breast-fed for less than three months were mostly on scheduled feeding [17]. Nevertheless, this association may have resulted from assessment of feeding practices through asking parents at age of three months. Further explanation, at this stage, mothers and infants, are still learning about feeding practices. Consequently, the feeding intervals indicate the milk type and the infant digestion rate of previous feeded milk [23]. Moreover, breast- feeding could be a confounding factor for the association, especially with the fact that, more than 80 % of study subjects were on breast feeding. Further point, the study has not adjusted for many significant confounding factors such as an introduction of solid food, social and economic status, birth interval and order, current mother age and weight. Moreover, although the data from the large observational study examining multiple feeding practices and its appropriate statistical methods provide significant view into the relationship between feeding mechanism and weight gain [24 -25]; owning to the fact that follow-up is not clear, exclusion of those on mixed feeding practices, and those which lack clear justification about the reason for selecting the second recruiting group from this source, may weaken the finding of this study. This is not surprising as the research reflect national data are unable to approach the confounding impacts of life style and *socio-economic* variables [26]. Feeding practices are influenced by different cultural factors and lifestyle patterns between countries, as well as within a same country according to educational and socio-economic variables [27-29]. Since, adjustment for socio-economic factors is critical; findings from studies which had not adjusted for several variables could be subjected to bias. Casiday *et al.;* [19], Agres *et al.;* [20], Fisher *et al.;* [22], Illingrowth *et al.;* [23], Farrow [24], and Saxon *et al.;* [25], all had drawbacks in adjustment for

confounding factors. Further point, even they mentioned that there were available records of anthropometric measurements; they depended on parents' report of weight without any double check of records. This may lead to bias within the result because mothers always tend to underestimate her infant's weight [27] as the case with Decarvola *et al.;* [18]. Further limitation of this study, is the unclear reporting of results in some aspects, such as the mother BMI which is not clear whether this is the current, pregnant or pre-pregnant BMI.

In addition, some of the small sample studies included in this review may not have the statistical power to detect the feeding practice effects on weight gain, even if it exists [32]. Another issue may affect the external validity "generalisability" of the findings that most of the reviewed studies were small samples size and unable to address the changed mechanism of feeding practices over time. Of the ten studies included in this review, three [18, 20, 25] were set-up during or before the 1985 when breast was almost the common feeding source of milk. However, none of those studies reports any adjustment for breast-feeding. Moreover, the varying time of studies which extended between 1951–2009 may also contribute to the different impacts of feeding practices on weight gain. Furthermore, most, reviewed studies depended on mother reports of feeding practices and anthropometric measurements. Dubois and Girad [27] state that there is always misreporting in mother's child body measurements. They add in children, a higher BMI associated with misreporting in the lower values. Furthermore, social and economic factors also affect misreporting. This is an essential element as a child of lower socioeconomic class is more likely to be overweight, and his mother is more likely to misreport it than higher class.

This review includes two quasi-experimental [18, 23]; Carvalho *et al.;* [18] found that infant in the experimental group "demand feeding" gain more weight than those on scheduled feeding $P < 0.02$. However, this study has several limitations such as the small sample size. Small sample size was a clear limitation within several studies [18-20, 22-24] in this review. This may lead to negative consequences in generalisation and external validity. Also, it may a reason of inconsistency of the finding of these studies. For example, Decarvola *et al.;* [18] eliminated more than 50% of the participants at some stages of the study, and accordingly, the follow up rate was not clear. This issue was the same with Jessica *et al.;* [19]. Second quasi-experimental is Illingworth *et al.;* [23]; it is one of oldest studies in this area. It has many un- clear changes within the study protocol. Weight gain was greater among demand feeding group than scheduled babies; t value 1.47 α 5. This may result from two reasons, the more emptying of the breast by infants on demand feeding in this study and lower incidence of the nipples soreness of demand feeding mothers. However, it could be argued that mothers are less likely to be worried about infant's cries for food when he is fed according to his demand. For this reason, worrying less lead to more milk production and so infant gains more and faster weight [32].

Moving to the main findings of the other reviewed studies, Casiday *et al.;* [19] who studied feeding patterns during early infancy and it relation to weight gain and breast-feeding continuation. The main finding was that more frequent feeding and lower interval (demand) was associated with higher infant weight gain among breast fed infants only. However, owing to the fact that only 50 % of the cohort returned diaries, and there was no validation of the completeness of analysed entries; this association may not reflect reality. For instance, mothers having difficulty in feeding or those who feed remarkably frequently may not have finished and returned diaries. This increases the possibility of self-selection bias. On the other hand, Agras *et al.;* [20] who studied impacts of different feeding style during early life on development of adiposity; found that demand feeding was negatively associated with greater adiposity ($r = -0.25$, $P < 0.01$) [20]. However, it is unpractical to compare the results of Casiday and Agras; as the time scale covered is so dissimilar. In Li [21], scheduled feeding was associated with faster weight gain and overweight [OR 1.28 (0.80–2.03)]. Owning to the fact that mothers who often scheduled feeding were more among those whose infants seem lighter. It might be that mothers who observed that their infants were small for their age and not consuming adequate milk were more likely to use schedule feeding. This explanation could be supported by the result of one of the review study by Fisher and his colleagues [22]. Fisher *et al.;* found that the selection of scheduled feeding was associated with a prevalent of low weight infant with $\beta = 0.3$ model R2 0.15 $P < 0.05$. In addition, there is evidence that demand feeding infants empty the breast better than do those on scheduled feeding; and consequently less suffer from weight problem. On another hand, although this study [21] had a national and thus a relatively large sample, Black and Hispanic mothers were underrepresented in the study population. This under representation may affect the external validity and transferability of the study.

Although most of the reviewed studies depend on mother reporting, Li [21] minimized the reporting bias, by distributing a short-term retrospective remembrance for the previous week of every month postpartum. This validation may improve the internal validity and credibility of the research. Another study support the argument that scheduled feeding is positively associated with gaining more weight and high BMI value is Fisher *et al.;* [22] β= 0.56 0.2 P<0.01. Researchers of this study claim that maternal over control during infant feeding can exacerbate the current weight and feeding problem. In detail; forcing infants to eat has been at certain times associated with poor infant self-regulation of energy intake and subsequent overweight [22]. However, the small sample size "51 subjects" and restriction to non-Hispanic white mothers minimise the possibility generalization of the findings of Fisher [22]. Also, although, 86 % of infants were breast-feeding infants, there was no adjustment for breast feeding duration as well as other significant confounders, such as the introduction of solid foods.

Another study does not support the positive association between scheduled feeding and weight gain is Farrow [24]. They concluded that scheduled feeding during the age of 6 -12 months had a negative association with infant weight gain (β = - 0.402, P <0.001). Possible explanation that rigid schedule interferes with the infants normal weight gain during the infancy. The long impacts of that interference may disinherit eating and energy regulation by child [33]. However, the study depended on only one observation of maternal control over infant feeding. Accordingly, it may not reflective of the real feeding practices. Mihrshai *et al.;* [26] were also of those studies which support the positive association between scheduled feeding and weight gain OR 1.84 (1.04-3.27) P0.04.

Common issues that appeared within most of the studies are unclear follow up rate, ignorance of mention of odd ratio or other statistics, using small and unrepresentative samples. Another problem with many of the studies, including longitudinal studies; that they assessed the feedings and body measurements at time point(s). That provides only concurrent, rather than prospective, association to be detected [28]. Furthermore, many of the studies depend on univariate rather than multivariate analyses. Consequently, they have not controlled for the overlapping influences of several variables.

CONCLUSION

These systematic points out heterogeneity in the results from studies reviewing feeding practices and risk of obesity. That may due to studies are too varied in methods of feeding assessment and anthropometric measurements, time scale and methodology of evaluating the nature of the association. Changes in feeding patterns over time and failure to adjust for socio-economic variables may add complexity to the findings of the review and contribute to the findings dissimilarity. Critical requirements for future studies is to fully investigate the contribution of demand feeding and scheduled feeding on the risk of obesity experimentally and to determine the most significant confounders. Patterns of feeding have changed remarkably over the last few decades due to several social, economic and health factors, for this reason, the evidence related to feeding intake and breast/ bottle feeding needs to be re-evaluated in the context of the current health requirements.

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