Standard versus baby-led complementary feeding: a comparison of food and nutrient intake in 6-12 month old infants in the UK

Article

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ABSTRACT

Objective: To compare food and nutrient intake of infants aged 6-12 months following a baby-led complementary feeding (BLCF) approach to infants who followed a standard weaning (SW) approach.

Design: Participants completed an online questionnaire consisting of socio-demographic questions, a 28-day food frequency questionnaire (FFQ) and a sample of participants completed a 24-hour dietary recall.

Setting: UK.

Participants: 134 infants aged 6-12 months (*n*=88, BLCF; *n*=46, SW).

Results: There was no difference between weaning method and food groups for "fruits", "vegetables", "all fish", "meat and fish", "sugary" or "starchy" foods. The SW group were offered "fortified infant cereal" ($p<.001$), "salty snacks" at 6-8 months ($p=.03$), "dairy and dairy based desserts" at 9-12 months ($p=.04$) and pre-prepared infant food at all ages ($p<.001$) more often that the BLCF group. The SW group were offered "oily fish" at all ages ($p<.001$) and 6-8 months ($p=.01$), and "processed meats" at all ages (p<.001), 6-8 months ($p=.003$), and 9-12 months ($p<.001$) less often than the BLCF group. In the BLCF group there was a significantly greater intake of sodium ($p=.028$) and fat from food ($p=.035$), and a significantly lower intake of iron from milk ($p=.012$) and free sugar in the 6-8 month subgroup ($p=.03$) compared to the SW group. Iron intake was below the RNI for both groups and sodium was above the RNI in the BLCF group.

Conclusion: Compared to the SW group the BLCF group were offered foods higher in sodium and lower in iron, however the foods offered contained less free sugar.

Keywords: baby led weaning, infants, nutrition, complementary feeding

INTRODUCTION

Optimal nutrition in infancy is crucial for growth and development, and for establishing good eating habits for long-term health [(1)]. At around six months of age, infants should be introduced to complementary foods in addition to breast or formula milk, as infant milk alone will not satisfy an infant's energy and nutrient needs [(2)]. Iron and zinc stores in breast milk are almost depleted by six months, so complementary foods that provide these micronutrients are of particular importance to the breast fed infant [(2; 3)].

The UK Department of Health guidelines on infant feeding recommend breastfeeding exclusively for the first six months, after which a variety of complementary foods can be introduced alongside continued breastfeeding (and/or formula milk), but cow's milk should not be offered as a main drink until after twelve months. Vitamin A, C and D supplements are recommended from six months unless the child is formula fed, and foods should contain no added salt or sugar [(4)]. Traditionally, infants in the UK have been spoon-fed pureed foods and infant cereals as 'first foods', but over the past ten to fifteen years an alternative method of complementary feeding (CF), known commonly as 'Baby-Led Weaning' (BLW) has increased in popularity in countries such as the UK, Canada and New Zealand [(5)]. In essence, baby-led complementary feeding[1] (BLCF) involves finger foods being offered to the infant from the age of six months, in addition to continued breastfeeding. The infant is encouraged to join in with family meal times and to self-feed as much or as little as their appetite allows at each meal [(6)].

It has been suggested that BLCF could be considered a continuation of breastfeeding on demand, which promotes self-regulation of milk volume by the infant [(7)]. Proponents of this method assert that because the infant, rather than the adult, is responsible for their own feeding, it enables the infant to self-regulate their appetite, potentially lowering the risk of obesity later in life [(6; 8)], whilst encouraging the development of chewing and fine motor skills [(9)]. It has also been suggested that this method introduces infants to a wider variety of foods and textures and may lead to less fussy eating as the child matures [(6; 10)].

[1] The term baby-led complementary feeding will be used throughout this manuscript as babies who are still being breastfed, are not yet weaned, but they have been introduced to complementary feeding.

Books and websites on BLCF abound, but due to the lack of research into the nutritional and safety aspects of this method, health professionals are reluctant to recommend BLCF, and the main sources of information for parents are BLCF websites and parenting forums [10]. BLCF primarily involves the consumption of finger foods, the main concerns of health professionals are that finger foods could increase the risk of choking, and that the energy and iron intake of infants might be too low. The advice given by the NHS since 2010 [11] recommends the introduction of soft finger foods from six months. Fortified infant cereals such as baby rice are a popular first food for spoon-fed infants, but make impractical finger foods. Therefore, another concern is that BLCF infants would lack micronutrients such as zinc and iron, which fortified cereals contain [12]. In contrast, parents who are successful in using BLCF report benefits such as it being a less stressful method of feeding than standard weaning [12; 13].

In the UK there have been several large studies investigating the relationship between CF style and behavior by Brown and Lee [10; 14; 15], but research into the nutritional adequacy of different feeding methods is scant. One pilot study for a randomized controlled trial has been undertaken in New Zealand to compare nutrient intake and safety concerns of BLCF and traditionally spoon-fed infants [16]. This trial concluded that energy intake was similar across both groups, but vitamin A and selenium intake was lower and sodium intake higher in the modified BLCF group [16]. Another small study from New Zealand by Morison *et al.* [17] compared nutrient intakes and choking risk of BLCF and traditionally spoon fed infants, and concluded that, although energy intake was similar in both groups, the BLCF group had higher intakes of fat and saturated fat, and lower intakes of iron, zinc and vitamin B12. A further set of studies recently published from the Baby-Led Introduction to Solids (BLISS) trial in New Zealand found that compared to a control group, BLISS infants consumed more sodium and fat at 7 months, and less saturated fat at 12 months [18]. They also found no differences in zinc intake [19] but a larger variety of foods offered compared to a control group [20]. However this intervention was designed to resolve many of the issues believed to be associated with BLCF and provided guidance and education on the types of foods that could be used to improve the nutritional adequacy of the infants diet with particular emphasis on iron.

Due to the paucity of UK studies comparing food and nutrient intake of BLCF infants, health professionals and parents have little evidence to recommend this method of CF. The first aim was to investigate the demographic characteristics of parents in the SW and BLCF groups. The second aim of this study was to compare whether there are any differences in the foods offered to BLCF and SW infants using data from a validated food frequency questionnaire. The third aim was to compare the energy and nutrient intake of infants in each food group (protein, carbohydrate, free sugar, fat, saturated fat, sodium, iron, zinc) using 24-hour dietary recall data.

MATERIALS AND METHODS

***Study design*:** This UK population-based study of infants aged six to twelve months used data collected from parents completing an online questionnaire, consisting of pretested demographic questions, questions on feeding style, a food frequency questionnaire (FFQ) and a 24-hour dietary recall.

Participants: Following obtaining ethical approval from X University research ethics committee, 320 parents with a child aged 6-12 months were recruited via online parenting websites and posters in nurseries and pre-schools within 10km of X University. The poster and information about the study was advertised in a research thread on the websites for 'Mumsnet' and the National Childbirth Trust (NCT). Participants were directed to a link to the questionnaire and were invited to complete the questionnaire online or using a paper copy between 31st May and 10th July 2017.

Exclusion criteria: Parents had to be 18 years of age or over with an infant aged six to twelve months on completion of the questionnaire. They were excluded if their infant was born before 37 weeks gestation (premature infants can sometimes be slower to reach milestones such as sitting up or self-feeding [(21)]), or had a physical or developmental condition or disability likely to affect their feeding or growth.

Questionnaire: The questionnaire was formatted using Qualtrics software (Qualtrics©, 2017 Provo, UT, USA) and consisted of three main blocks of questions, which took approximately 45 minutes to complete. The first block consisted of socio-demographic questions about age, ethnicity, academic background and employment status. The questions were devised by the researchers based on similar previous studies [(22; 23)].

The second block of questions pertained to the infant, including their age, sex, weight at birth, current weight, gestation when born, breastfeeding practices and CF methods. The questions regarding CF methods used percentage scales, such as those used by Brown and Lee [(14)]: 0%, 10%, 25%, 50%, 75%, 90% and 100%. Parents who reported using spoon-feeding for 10% or less of the time at the infant's current age were assigned to the BLCF group, whereas those who reported using spoon feeding more than 10% of the time were assigned to the SW group.

The third block of questions consisted of a food frequency questionnaire, validated by previous researchers [24; 25]. Permission was granted by Dr Sahota for use in this study. The FFQ addressed the frequency of consumption of food types and the approximate amount of each food consumed in the past 28 days. A subgroup of participants also completed a 24-hour dietary recall, which required participants to recall the foods and drinks their child had consumed in the previous 24 hours, excluding foods which were offered, but not eaten.

Analysis of FFQ: Foods offered per day, week or month were converted into food frequency per day, similar to that calculated by Bingham *et al*. [26] in the EPIC study. Foods were assigned to the following groups for analysis of data: all fruits; all vegetables; starchy foods (porridge, breakfast cereal, bread, crackers, breadsticks, chapattis, pita bread, potato, sweet potato, rice, pasta); fortified infant cereal; dairy and dairy based desserts (cheese, savoury white sauce, yoghurt/fromage frais, ice cream, custard, milk pudding); all fish; oily fish; all meat/fish; processed meats (ham, sausage, bacon, sausage rolls); sugary foods (cakes, biscuits, buns, pastries, sweets); salty snacks (including crisps); pre-prepared baby food (dried food excluding baby rice, jars, tins, pots or pouches), and sugary drinks (including baby juice, fruit juice, squash and fizzy drinks). Groups were broken down into age and CF method, because six to eight-month old infants will usually be obtaining a higher proportion of energy from milk than foods and are likely to consume less finger foods than nine to twelve-month old infants.

Analysis of 24-hour recall: 50 participants completed the 24-hour dietary recall (BLCF: *n*=29, SW *n*=21). All diet records were manually entered into Nutritics® dietary analysis software (Nutritics.com 2016, v4.315 Education, Dublin, Ireland). Foods, baby formula and supplements not listed in Nutritics were defined using supermarket website nutritional information for products per 100g (Tesco, Asda, Sainsburys and Waitrose). Values for breast milk composition were obtained from McCance and Widdowson's The Composition of Foods [27]. To assess the volume of breast-milk consumed, the method of Mills and Taylor was applied as described in Lanigan *et al*. [28] and Cribb *et al.* [29]: 135g breast milk for infants aged 6–7 months and 100 g for those aged 8–12 months was calculated for each feed of at least ten minutes duration. Energy and nutrient intake were calculated and SACN 2015/COMA reports generated in Nutritics®. The proportions of food energy from fat, protein and carbohydrate was calculated using 17kJ per gram of protein and carbohydrate, and 37.7kJ per gram of fat.

Statistical Analysis:

Data were analysed using IBM SPSS Statistics version 23 (SPSS Inc., Chicago, IL, USA). A *p*-value of <.05 was considered to indicate statistical significance.

Demographic data*:* Chi-squared tests were conducted to test differences between the SW group and BLCF group where the variables were not a continuous measure (parents' education, ethnicity, working status, infant sex and breastfeeding status). Independent sample *t*-tests were carried out to examine differences between feeding methods on the continuous variables (parents' age and BMI, no of children, infant gestational age at birth, infant age at the onset of CF, current age, infant birth weight and current weight). Independent samples *t*-tests were used for all parametric data. Man-Whitney U tests were conducted where data were not parametric. Weight for age centiles were calculated using the WHO Growth Standard for 0-24 months and significant differences was checked using Mann-Whitney U tests.

FFQ: Independent sample *t*-tests for parametric data and Mann-Whitney U tests for non-parametric data were used to determine differences between CF groups and the mean number of times infants were offered a food group. A chi-squared test was used to test for differences in vitamin supplement use between groups.

24 hour recall: Independent sample *t*-tests for parametric data and Mann-Whitney U tests for non-parametric data were used to determine differences between CF groups and the mean macro-nutrient and micro-nutrient intake for total intake (food and infant milk), for infant milk only, and for food only.

RESULTS

The questionnaire was attempted by 320 participants (319 online, 1 paper copy by post). After removing partially completed questionnaires (*n*=173), those in which the infant was born at less than 37 weeks gestation (*n*=6) or was older than 12 months (*n*=2) or had allergies or medical conditions which affected feeding (*n*=5), 134 remained. A very limited number of participants indicated the portion size offered at each occasion, so this section of the FFQ had to be discounted. Groups were: SW all (*n*=46), BLCF all (*n*=88); SW 6-8 months (*n*=27), BLCF 6-8 months (*n*=37); SW 9-12 months (*n*=19), BLCF 9-12 months (*n*=51).

Fifty participants gave sufficient detail relating to food, quantity and breast-feeding duration, in the 24 hour recall: SW all (*n*=21), BLCF all (*n*=29); SW 6-8 months (*n*=13), BLCF 6-8 months (*n*=12); SW 9-12 months (*n*=8), BLCF 9-12 months (*n*=17).

Demographics: There was no significant association between groups and parent age, educational level, work status or ethnicity (Table 1). There was no significant association between CF method and initial breast feeding, gestation, age of child at time of filling in questionnaire, infant sex, birth order, birth weight, current weight or centiles for weight and height (Table 2). Infants who followed BLCF commenced weaning significantly later than SW (p<.001) and significantly more BLCF infants were breastfed exclusively for six months (p<.001). At the time of the study in the BLCF group 52% were consuming breast milk only, 24% formula only and 24% were combination feeding (formula and breast milk) whereas in the SW group 43% were being breast fed, 43% formula fed, 14% mixed.

Food Frequency: There was no significant difference between weaning method and food groups for fruits, vegetables, fish, meat and fish, sugary foods or starchy foods (Table 3). The SW group (all ages) were offered significantly more fortified infant cereal (p<.001), salty snacks at 6-8 months (p=.03), dairy and dairy based desserts at 9-12 months (p=.04) and pre-prepared baby food at all ages compared to the BLCF group (p<.001). Conversely, the BLCF group were offered significantly more oily fish at all ages (p<.001 and 6-8 months p=.01), and processed meats at all ages and 9-12 months (p=.001) and 6-8 months (p=.003) than the SW group.

24-hour recall: There was no significant difference between weaning method and nutrient intake for energy, carbohydrate, protein, saturated fat or zinc (Table 4). There was a significantly greater intake of free sugar in the 6-8 month SW group (p=.030), iron in infant milk in the SW group (p=.012), fat in food in the BLCF group (p=.035), and sodium in the BLCF group for food (p=.028). Data were also compared to RNI data for 7-12 month old infants (Table 5) [(30)]. Whilst mean zinc intake met the RNI for both groups, 50% of BLCF infants fell below the RNI of 5mg. Iron intake were lower than the RNI in both groups but considerably so in the BLCF group.

Proportion of food energy from macronutrients: The BLCF group obtained a greater percentage of energy from fat (34%) than the SW group (26%), and less from carbohydrate (50%) than the SW group (57%). The proportion of energy from protein was similar in both groups (BLCF 16%, SW 17%). Free sugars in the SW group accounted for 9% of energy intake, considerably higher than the BLCF figure of 1%.

Supplements: Seventy percent of BLCF infants were given multivitamin or vitamin D supplements, compared to 48% of SW infants, which showed a trend towards statistical significance (p=.05).

Salt: The proportion of parents who reported never adding salt during the preparation of infants' food was similar for the SW group (84%) and the BLCF group (85%).

DISCUSSION

Our findings indicate some differences in food and nutrient intake between BLCF and SW infants. This discussion will first consider the demographic data of the population and their feeding styles, then any differences in macronutrients and micronutrients and food sources between the groups, before examining the limitations of the study.

The questionnaire tended to attract parents with a preference towards BLCF, with 66% of participants following a BLCF approach, despite CF methods not being mentioned on the recruitment poster. Whilst the demographic in this study was well matched for age, education, work status, ethnicity and sex of infant, it is not representative of the UK population as a whole. Comparing Office for National Statistics [31] figures from the 2011 census with results from our study, 94.8% of the participants were white, compared to the national average of 86%, and 83.7% had held a University degree compared to 27% nationally. There is evidence that parents who choose BLCF in the UK have more years of education [14].

In our study, and in previous research [10; 14; 17; 32], BLCF was associated with a longer duration of breastfeeding and a later introduction of complementary foods, both of which are considered beneficial to infant health [14]. Sixty-four percent of BLCF infants were breast fed exclusively for the first six months, compared to 32 % of SW infants and only 1% in the 2010 Infant Feeding Survey [33]. BLCF infants were first introduced to complementary foods at an average of 5.8 months, which was later than the SW group (5.5 months) but in line with the recommended age of around six months. However in 2010 in the UK, 75% infants had been introduced to CF by the age of five months [33]. Seventy percent of BLCF parents reported giving their infants vitamin supplements as recommended for all breast-fed infants compared to only 48% of SW parents, although some parents noted that they did not remember to do this every day.

The study indicated that there were no differences between BLCF and SW in terms of energy intake, but the proportion of energy in food from macronutrients and the types of foods offered was different. BLCF infants were offered significantly more fat in food than SW infants which agrees with the findings of Morison *et al*. [17]. From the age of two onwards, fat as a percentage of energy intake should be no more than 35% [30]. Both BLCF and SW infants met this guidance: BLCF infants (all ages) derived 34% food energy from fat, compared to 26% SW infants. Although these are just estimates of the dietary intake, 26% of energy from fat in the diet is relatively low as studies have shown that infants on a low fat diet (25% or less energy from fat) commonly fail to thrive [34; 35].

The SACN 2015 report [36] states that from the age of two years, free sugars should amount to no more than 5% of total energy (there is no guidance for children under two years). Free sugars accounted for only 1% total energy in the BLW group, however this was 9% in the SW group. Commercially prepared baby foods were offered 11.6 times a week for SW infants compared to only 3.4 times a week for BLCF infants, potentially providing less free sugar. Crawley and Westland [37] criticized manufacturers of commercially prepared baby foods in the UK for adding fruit to provide sweet flavours to vegetable-based purees resulting in a high concentration of sugar. The authors also commented that these foods are unlikely to replicate the taste and texture of homemade food and may have a negative influence on dental health if sucked directly from a baby food pouch. Studies by Coulthard *et al.* [38; 39] showed that introducing homemade foods with ‘lumps’ and varied textures before nine months increased both the range of foods, and the quantity of fruit and vegetables that a child will consume at seven years compared to infants fed solely on pureed foods. In contrast, Smithers *et al*. [40] used data from the Avon Longitudinal Study to show that six to eight month old infants who consumed more ready-prepared baby foods had lower sodium and higher iron intake than infants consuming breast milk and homemade food.

In this study, BLCF infants consumed a mean intake of 529.11mg sodium (or 1.3g salt) which is one third above the daily recommended maximum of 400mg. Results from the FFQ showed that BLCF infants were offered more processed meats a known source of sodium and nitrates in the diet [41] than SW infants. In the short term, sodium intake above 400mg per day in infants may cause harm to developing kidneys, and in the long-term a preference for salty foods may result in problems such as high blood pressure in adulthood [42]. Sodium intake ranged from 154mg to 1102mg in the BLCF group, with two infants consuming almost three times the recommended intake of sodium in 24 hours (1102mg and 1082mg). In this case, the majority of the sodium was contained in baked beans, ham, crumpets and cheese. Added sodium is rarely present in commercially pureed baby foods, which represented a greater proportion of dietary intake in the SW group than the BLCF group, but could be present in family food unmodified for BLCF infants. Cribb *et al*. [29] calculated intake of sodium and iron from three-day dietary records of family foods offered to eight month old infants (*n*=1178) and 70% consumed more than the daily maximum of 400mg. However, 85% of BLCF parents in the current study reported that they never added salt to food, although the BLCF group was offered processed meats on average just over three times per week. The mean sodium intake for SW, 375mg, was in line with the RNI.

Iron is required for the development of red blood cells, immune function and cognitive development [43]. Iron deficiency anaemia, caused by insufficient dietary iron, can lead to delays in the development of cognitive function, which can be irreversible [44]. The UK has no screening policy for iron deficiency, which makes it difficult to estimate the prevalence in the population [45], but in the 2011 Diet and Nutrition Survey of Infants and Children, iron intake was 10-14% below the Lower Reference Nutrient Intake [46]. In our study, iron intake was below the RNI for both groups: the SW group were 20% below the RNI and the BLCF group were 38% below the RNI. The lower iron intake in the infant milk portion of the BLCF group could be explained in part by a greater consumption of breast milk, which has a lower concentration of iron than formula milk (approximately 0.07mg per 100ml compared to 0.80mg per 100ml in formula milk [47]) and lower intake of commercially prepared baby foods and fortified infant cereals. This suggests that BLCF infants may need foods with a greater iron content, especially if breast milk is still a large part of overall energy intake. The FFQ showed significantly more fortified infant cereal (baby rice) offered to the SW group, which is a good source of iron, but is difficult for BLCF infants to consume when self-feeding. Compared to the RNI for 7-12 month old infants average zinc intake met the RNI for both groups, but 50% of BLCF infants fell below the RNI of 5mg. Red meat, such as beef and lamb, is a good source of iron and zinc, but it can prove difficult to chew and parents may worry about infants choking if it is in finger food form.

Data for this study was self-reported and could be open subject to error (e.g. people misreporting or estimating body weight). The participants for this study were also self-selected and the choice of weaning style was also selected by the participants. Whilst internet recruitment is efficient, it may be biased towards participants who have a higher level of education [48]. Although 320 surveys were attempted, only 134 were fully completed. The length of the questionnaire was a limitation and many participants completed the demographic questions, but did not progress further to the FFQ. The 50 participants who completed the entire survey including the 24-hour dietary recall were those that were more motivated to do so, and this may have biased the results. The FFQ has not been validated for online use and as such the decision was taken to focus solely on the types of foods consumed from this data. The nutrients contained in breast milk are very difficult to standardize since the composition of breast milk changes between each feed, and the fat content of milk varies as the breast is emptied of milk [47; 49]. Assessing the accuracy of duration and volume of breast milk is difficult. It is likely that some participants overestimated the duration of feeds, or the time the infant was actively sucking. However, energy from milk and food was similar for both BLCF and SW infants, which suggests the method was consistent with volumes calculated for formula milk. The 24-hour recall data was dependent on participants recording the quantity of food actually ingested, which is problematic with infants, so the quantities stated can only be estimates. The habitual intake of foods consumed is difficult to estimate in a 24-hour food recall, and a longer (2 day) weighed food diary would be a more accurate indicator of quantity ingested, but would require many more resources than were available in this study. The questionnaire was undertaken at any time between when the child was 6-12 months and it is known that babies will transition from a being spoon fed (SW) to self-feeding (BLCF) during this time [50]. Future studies should assess food intake at the point of weaning.

As an area in which research is limited, and the first study of this type in the UK, this study supplements the published evidence currently available on nutrient intake of infants following BLCF or SW approaches to CF. The survey was comprehensive, which meant a broad range of data could be collected. The sample size was larger than for similar studies, such as that of Morison *et al*. [17], which gives the study more statistical power. Finally, all demographic data was consistent between groups for parents, and age, sex and weight of infants was consistent between groups.

CONCLUSION

Doctors, midwives and health visitors are reliant on evidence-based research to inform their advice to parents. This study adds to the small pool of knowledge relating to food and nutrient intake and CF methods. This study suggests that BLCF can have both positive and negative implications for the diets of infants. Parents need to be made more aware of the types of food they should or should not be offering their infant to ensure that sodium intake is not too high and that iron intake is sufficient. In the current study the BLCF group were less likely to be offered commercially prepared baby foods and less free sugar than the SW in this study. Parents using BLCF should be informed of the benefits and limitations and given advice to ensure optimal nutritional intake during this important time such as has been achieved during the BLISS studies [16].

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Table 1. Demographic characteristics of parents following standard weaning (SW) and baby led complementary feeding (BLCF)

Parental characteristics	**SW (n=46)**	**BLCF (n=88)**	***P* value**
Parent Age in years [mean (SD)] *	31.7 (4.8)	34.0 (4.0)	.07
<19	0 (0.0)	0 (0.0)	
20-24	0 (0.0)	6 (7.0)	
25-29	7 (15.2)	23 (26.7)	
30-34	17 (37.0)	36 (41.9)	
>35	22 (47.8)	21 (24.4)	
Education [n (%)]			.70
No formal education	0 (0.0)	1 (1.1)	
School GCSEs[a]	3 (6.5)	5 (5.7)	
School A levels[b]	1 (2.2)	7 (8.0)	
College[c]	2 (4.3)	3 (3.4)	
University[d]	40 (87.0)	72 (81.8)	
Ethnicity [n (%)]			.34
White	43 (93.5)	84 (95.5)	
Asian/Asian British	1 (2.2)	0 (0.0)	
Black/Black African/Black British/Black Caribbean	0 (0.0)	1 (1.1)	
Mixed	1 (2.2)	3 (3.4)	
Other	1 (2.2)	0 (0.0)	
BMI [(kg/m^2] (SD)	26.1 (5.7)	26.5 (4.8)	.35
<18.5	1 (2.2)	1 (1.1)	
18.5-24.9	20 (43.5)	36 (41.4)	
25.0-29.9	16 (34.8)	32 (36.8)	
30.0-34.9	6 (13.0)	12 (13.8)	
>35.0	3 (6.5)	6 (6.9)	
Number of children [n (%)]			.364
1	22 (47.8)	60 (68.2)	
2	21 (45.7)	19 (21.6)	
3	2 (4.3)	5 (5.7)	
>3	1 (2.2)	4 (4.5)	
Work status [n (%)]			.25
Full time	16 (34.8)	33 (37.5)	
Part-time	26 (56.5)	39 (44.3)	
Not in work	4 (8.7)	16 (18.2)	

*data from two participants was excluded due to incorrect data entry

[a] qualification generally taken by school students in the UK aged 14–16 years

[b] School leaving qualification in the UK that can be used for University entrance

[c] Further education generally undertaken between 16-19 years that may or may not involve A level qualifications

Table 2. Infant characteristics of those following standard weaning (SW) and baby led complementary feeding (BLCF)

Infant characteristics	**SW (n=46)**	**BLCF (n=88)**	***P* value**
Age [months (SD)]	8.5 (2.0)	9.1 (1.8)	.07
6-8 [n (%)]	27 (58.7)	37 (42.0)	
9-12 [n (%)]	19 (41.3)	51 (58.0)	
Sex			.47
Male [n (%)]	21 (45.7)	47 (53.4)	
Female [n (%)]	25 (54.3)	42 (47.7)	
Gestation [weeks (SD)]	39.5 (1.4)	40.0 (1.4)	.06
Weight for age centile at birth [mean (SD)]	60.6 (26.7)[a]	67.0 (27.2)[a]	.14
Weight for age centile at current age [mean (SD)]	58.2 (28.7)[b]	57.5 (33.0)[b]	.96
Initial breastfeeding [n (%)]	40 (87.0)	82 (93.2)	.23
Exclusively breast fed for 6 months [n (%)]	15 (32.6)	56 (64.4)[c]	**<.001** [e]
Age of introduction of CF [months (SD)]	5.5 (0.5)	5.8 (0.4)[d]	**<.001** [e]

[a] error in data entry final participant numbers are: *n*=45 SW, *n*=87 BLCF; [b] error in data entry: *n*=45 SW, *n*=86 BLCF; [c] no data for one participant: *n*=87 BLCF; [d] error in data entry for one participant: *n*=87 BLCF; [e] P-values <.05 are highlighted in bold and indicate statistical significance

Table 3. Food Frequency Questionnaire results: number of times each food type was offered per day over all ages groups (total), 6-8 months and 9-12 months for those following standard weaning (SW) and baby led complementary feeding (BLCF).

	Total					6-8 Months					9-12 Months				
	SW (*n* = 21)		BLCF (*n* = 29)			SW (*n* = 13)		BLCF (*n* = 12)			SW (*n* = 8)		BLCF (*n* = 17)		
Nutrient	Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*
Fruits	2.77	0.35	2.37	0.15	.67	2.35	0.35	1.99	0.20	.49	3.36	0.66	2.65	0.21	.37
Vegetables	3.58	0.62	3.49	0.23	.11	3.22	0.37	3.15	0.56	.31	4.20	1.28	3.68	0.29	.33
Fortified infant cereal	0.26	0.58	0.032	0.18	**<.001**	0.19	0.06	<0.001	0.003	**<.001**	0.37	0.11	0.05	0.03	**<.001**
All fish	0.50	0.12	0.50	0.07	.09	0.36	0.11	0.43	0.12	.26	0.69	0.20	0.56	0.08	.46
Oily fish	0.19	0.05	0.23	0.03	**<.001**	0.13	0.05	0.22	0.06	**.01**	0.26	0.09	0.24	0.03	.12
All meat/fish	1.26	0.20	1.40	0.16	.33	0.80	0.21	0.91	0.15	.22	1.91	0.35	1.75	0.35	.44
Processed meats (ham/sausage/bacon)	0.15	0.05	0.45	0.08	**<.001**	0.10	0.04	0.21	0.04	**.003**	0.22	0.10	0.62	0.12	**<.001**
Sugary foods (cakes/biscuits/snacks)	0.20	0.08	0.22	0.07	.63	0.10	0.07	0.35	0.03	.54	0.33	0.15	0.35	0.12	.77
Salty snacks	0.19	0.05	0.13	0.03	.31	0.20	0.07	0.05	0.02	**.03**	0.18	0.07	`0.19	0.04	.96
Starchy foods	3.39	0.40	3.34	0.20	.28	2.72	0.40	2.42	0.21	.88	4.34	0.74	4.01	0.28	.46
Dairy and dairy based desserts	1.23	0.15	0.98	0.07	.36	0.89	0.16	0.76	0.08	.80	1.72	0.25	1.14	0.09	**.04**
Sugary drinks	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	.16
Pre-prepared baby food	1.65	0.23	0.49	0.13	**<.001**	1.20	0.23	0.34	0.14	**<.001**	2.29	0.43	0.60	0.20	**<.001**

*P-values <.05 are highlighted in bold and indicate statistical significance

Table 4. 24-hour dietary recall: nutrient intake over all ages groups (total), 6-8 months and 9-12 months for those following standard weaning (SW) and baby led complementary feeding (BLCF).

		Total					**6-8 Months**					**9-12 Months**				
		SW (*n* = 46)		BLCF (*n* = 88)			SW (*n* = 27)		BLCF (*n* = 37)			SW (*n* = 19)		BLCF (*n* = 51)		
Nutrient		Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*
Energy (kJ)	Total	3847.8	1205.9	4143.1	935.0	.33	2368.3	924.7	237.7	899.0	.99	1479.5	9354.6	1770.4	850.3	.26
	Infant Milk	2368.3	924.7	2372.7	899.0	.99	2649.8	836.4	2654.8	960.3	.99	1910.8	925.83	2173.5	823.7	.48
	Food	1479.5	935.6	1770.4	850.3	.26	1132.0	872.8	1127.9	498.8	.99	2044.3	778.7	2223.9	752.4	.59
Carbohydrates(g)	Total	111.2	32.6	112.5	30.2	.88	108.8	31.4	96.5	22.4	.40	115.2	36.1	121.9	32.0	.66
	Infant Milk	62.1	20.8	60.2	23.1	.77	68.7	18.1	60.6	23.6	.30	51.3	21.4	55.5	22.0	.66
	Food	49.1	30.3	52.3	30.4	.72	40.1	30.3	32.4	16.9	.45	63.9	25.4	66.3	30.3	.85
Protein (g)	Total	25.9	9.9	27.5	8.5	.47	23.5	9.3	22.6	5.5	.77	29.8	10.2	31.1	8.8	.75
	Infant Milk	11.1	3.8	10.8	4.0	.79	12.3	3.3	12.0	4.3	.84	9.0	4.0	9.9	3.7	.61
	Food	14.8	9.5	16.8	9.3	.46	11.2	8.9	10.6	6.3	.86	20.7	7.5	21.2	8.6	.91
Fat (g)	Total	41.0	16.9	47.7	13.7	.12	41.7	14.5	46.1	11.9	.54	39.7	21.3	48.8	15.1	.23
	Infant Milk	30.7	15.0	31.8	12.6	.64	34.9	14.1	35.8	13.71	.94	24.0	14.5	29.0	11.3	.19
	Food	10.2	8.4	15.9	9.8	**.04***	6.8	6.2	10.2	5.1	.12	15.7	9.0	19.8	10.5	.55
Saturated Fat(g)	Total	16.7	7.6	19.8	6.9	.13	17.5	6.7	18.9	5.5	.57	15.2	9.3	20.5	7.9	.09
	Infant Milk	12.9	6.5	13.7	5.5	.56	14.6	6.2	15.6	5.9	.85	10.2	6.6	12.4	5.0	.22
	Food	3.7	3.4	6.1	5.3	.08	2.9	3.4	3.4	2.2	.41	5.1	3.1	8.0	6.1	.24
Free Sugar (g)	Total	5.2	7.5	3.6	5.1	.58	6.5	9.0	1.0	2.1	**.03**	3.0	3.4	5.5	5.8	.29
Iron (mg)	Total	6.2	4.9	4.8	2.6	.25	6.3	5.8	4.2	3.0	.57	6.0	3.2	5.3	2.2	.51
	Infant Milk	2.4	1.7	1.6	1.9	**.01**	2.1	1.5	1.8	2.1	.12	2.9	2.1	1.5	1.9	.08
	Food	3.8	4.5	3.2	2.2	.55	4.2	5.6	2.5	1.9	.85	3.1	2.0	3.7	2.3	.55
Zinc (mg)	Total	5.8	2.9	5.2	1.9	.40	6.0	3.3	5.0	2.1	.47	5.4	2.3	5.3	1.8	.95
	Infant Milk	5.4	2.3	5.3	1.8	.05	3.6	0.5	3.3	1.6	.66	2.9	0.9	2.8	1.5	.32
	Food	2.5	2.7	2.2	1.4	.52	2.5	3.3	1.7	1.4	.94	2.5	1.8	2.6	1.4	.92
Sodium (mg)	Total	375.5	219.4	529.1	224.8	**.01**	315.3	161.9	391.2	117.1	.10	473.4	273.7	626.5	233.9	.32

Infant Milk	134.6	42.3	129.9	55.6	.76	149.5	36.2	145.8	54.5	.84	110.3	50.1	118.8	55.2	.71
Food	240.9	218.0	399.1	237.0	**.03**	165.7	166.7	245.4	127.2	.23	363.0	246.3	507.6	238.7	.18

**P*-values <.05 are highlighted in bold and indicate statistical significance

Table 5. Comparison of total nutrient means from dietary recall and EAR/RNI for those following standard weaning (SW) and baby led complementary feeding (BLCF).

Nutrient	**SW 6-12** Mean (SD)	**BLCF 6-12** Mean (SD)	**RNI**
Energy (kJ)	3847.8 (1205.9)	4143.1 (935.0)	2853 [a]
Protein (g)	25.9 (9.9)	27.5 (8.6)	14.3 [b]
Iron (mg)	6.21 (4.9)	4.84 (2.6)	7.8
Zinc (mg)	5.8 (2.2)	5.2 (1.9)	5.0
Sodium (mg)	375.5 (219.4)	529.1 (228.8)	400
Calcium (mg)	588.9 (209.1)	579.9 (211.8)	525
Magnesium (mg)	80.9 (29.4)	90.7 (27.1)	75
Vitamin A(μg)	787.0 (327.5)	687.7 (192.1)	350
Vitamin B12 (μg)	1.43 (0.89)	1.47 (1.03)	0.4
Vitamin C (mg)	86.9 (36.9)	80.6 (30.3)	25

[a] Energy given as EAR (estimated average requirement). RNI (reference nutrient intake)

[b] Average of male and female requirements mixed feeding 7-12 months [(30)]