JAMA Pediatrics | Original Investigation

Effect of a Baby-Led Approach to Complementary Feeding on Infant Growth and Overweight
A Randomized Clinical Trial

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IMPORTANCE Baby-led approaches to complementary feeding, which promote self-feeding of all nonliquid foods are proposed to improve energy self-regulation and lower obesity risk. However, to date, no randomized clinical trials have studied this proposition.

OBJECTIVE To determine whether a baby-led approach to complementary feeding results in a lower body mass index (BMI) than traditional spoon-feeding.

DESIGN, SETTING, AND PARTICIPANTS The 2-year Baby-Led Introduction to Solids (BLISS) randomized clinical trial recruited 206 women (168 [81.6%] of European ancestry; 85 [41.3%] primiparous) in late pregnancy from December 19, 2012, through March 17, 2014, as part of a community intervention in Dunedin, New Zealand. Women were randomized to a control condition (n = 101) or the BLISS intervention (n = 105) after stratification for parity and education. All outcomes were collected by staff blinded to group randomization, and no participants withdrew because of an adverse event. Data were analyzed based on intention to treat.

INTERVENTIONS Mothers in the BLISS group received lactation consultant support (≥5 contacts) to extend exclusive breastfeeding and delay introduction of complementary foods until 6 months of age and 3 personalized face-to-face contacts (at 5.5, 7.0, and 9.0 months).

MAIN OUTCOMES AND MEASURES The primary outcome was BMI *z* score (at 12 and 24 months). Secondary outcomes included energy self-regulation and eating behaviors assessed with questionnaires at 6, 12, and 24 months and energy intake assessed with 3-day weighed diet records at 7, 12, and 24 months.

RESULTS Among the 206 participants (mean [SD] age, 31.3 [5.6] years), 166 were available for analysis at 24 months (retention, 80.5%). The mean (SD) BMI *z* score was not significantly different at 12 months (control group, 0.20 [0.89]; BLISS group, 0.44 [1.13]; adjusted difference, 0.21; 95% CI, −0.07 to 0.48) or at 24 months (control group, 0.24 [1.01]; BLISS group, 0.39 [1.04]; adjusted difference, 0.16; 95% CI, −0.13 to 0.45). At 24 months, 5 of 78 infants (6.4%) were overweight (BMI≥95th percentile) in the control group compared with 9 of 87 (10.3%) in the BLISS group (relative risk, 1.8; 95% CI, 0.6-5.7). Lower satiety responsiveness was observed in BLISS infants at 24 months (adjusted difference, −0.24; 95% CI, −0.41 to −0.07). Parents also reported less food fussiness (adjusted difference, −0.33; 95% CI, −0.51 to −0.14) and greater enjoyment of food (adjusted difference, 0.25; 95% CI, 0.07 to 0.43) at 12 months in BLISS infants. Estimated differences in energy intake were 55 kJ (95% CI, −284 to 395 kJ) at 12 months and 143 kJ (95% CI, −241 to 526 kJ) at 24 months.

CONCLUSIONS AND RELEVANCE A baby-led approach to complementary feeding did not result in more appropriate BMI than traditional spoon-feeding, although children were reported to have less food fussiness. Further research should determine whether these findings apply to individuals using unmodified baby-led weaning.

TRIAL REGISTRATION http://anzctr.org.au Identifier: ACTRN12612001133820

JAMA Pediatr. 2017;171(9):838-846. doi:10.1001/jamapediatrics.2017.1284
Published online July 10, 2017.

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Supplemental content

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Puréed foods are typically used as first foods for infants, with gradual exposure to more varied textures over time. Finger foods may be consumed but do not usually represent a large proportion of the diet until later in the complementary feeding period.[1-3] Baby-led weaning (BLW) is an alternative approach to introducing solid foods in which infants feed themselves all their food from the start of complementary feeding (approximately 6 months of age).[4,5] Proposed advantages include improved energy self-regulation (ability to respond appropriately to appetite and satiety cues),[6] leading to improved body weight[7] and reduced food fussiness.[4] However, concerns have been raised that children may not eat enough, particularly if self-feeding skills are poor.[8-10]

Despite considerable interest in BLW,[11] little research has directly examined these questions. Only 1 study has investigated energy self-regulation, reporting higher satiety responsiveness and less food fussiness in young children who had been weaned using BLW compared with traditional spoon-feeding.[12] Two studies have reported a lower risk for overweight in BLW infants,[12,13] but both studies used parental reports of child weight, which can be inaccurate in younger children.[14] Only 1 study has assessed energy intake, reporting similar intakes in BLW and spoon-fed infants.[15] These existing observational data are further limited because growth patterns in self-selected individuals may be biased by differences in demographic variables. In particular, mothers who follow BLW tend to be more highly educated, to breastfeed longer, and to return to work later,[16] factors that also affect child growth.[17,18]

The aim of this randomized clinical trial was to determine whether allowing infants to control their own food intake by feeding themselves solid foods using a baby-led approach to complementary feeding results in differences in body mass index (BMI) *z* scores (primary outcome) and in secondary outcomes of energy self-regulation, eating behaviors, and energy intake at 12 and 24 months of age compared with traditional spoon-feeding.

Key Points

Question Does a baby-led approach to complementary feeding reduce the risk for overweight?

Findings In the randomized clinical trial Baby-Led Introduction to Solids with 206 participating mothers, the mean body mass index z score of infants who followed a modified version of baby-led weaning was not different at 12 (0.44) or 24 (0.39) months of age compared with infants who followed traditional spoon-feeding (0.20 and 0.24, respectively). No evidence suggested a difference in the prevalence of overweight.

Meaning A baby-led approach to complementary feeding does not appear to result in healthier growth or a reduced risk for overweight compared with traditional feeding practices.

Methods

The Baby-Led Introduction to Solids (BLISS) study adheres to the principles of BLW (the infant feeds himself or herself family foods with the family, ideally while breastfeeding on demand) but was modified in response to concerns regarding potential growth faltering, iron deficiency, and choking.[19] Because the protocol[20] and pilot study[21] have been published, only relevant information is included herein. The trial protocol is found in Supplement 1. The study was approved by the Lower South Regional Ethics Committee of New Zealand, and written informed consent was obtained from all adult participants before randomization.

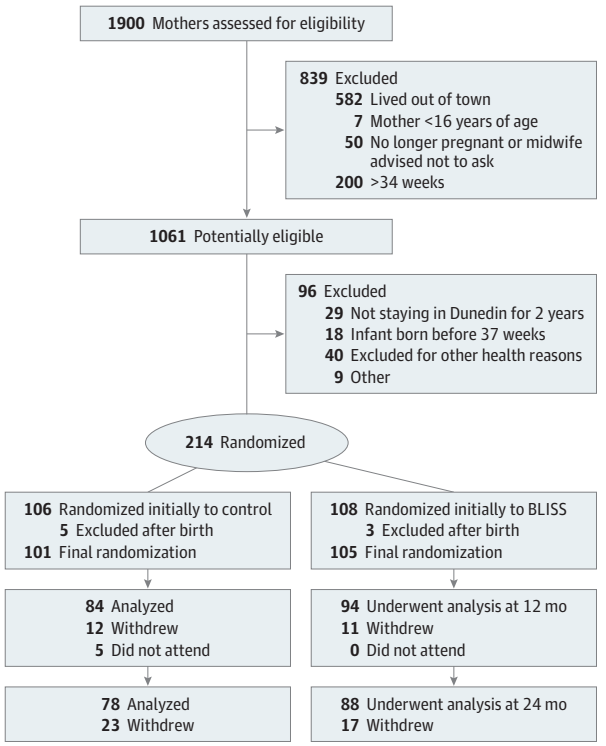
Women were recruited in late pregnancy from sequential bookings (December 19, 2012, through March 17, 2014) at the only maternity hospital in Dunedin, New Zealand. Exclusion criteria consisted of not living locally, mother younger than 16 years, booking after 34 weeks gestation, prematurity, or congenital abnormality likely to affect feeding or growth. Two hundred and six of 879 women approached (response rate, 23.4%) were randomized by the study biostatistician (S.M.W.) to the control (n = 101) or BLISS (n = 105) group using random-length blocks (maximum of 7) after stratification for parity (first child and subsequent child) and maternal educational attainment (nontertiary and tertiary) (**Figure 1**). Allocation was concealed using opaque presealed envelopes, and the biostatistician used uninformative group codes until primary analyses were completed.

All families had access to government-funded routine midwifery and well-child care.[22,23] The BLISS group received 8 additional contacts from pregnancy to 9 months of age. Five contacts (3 face-to-face and 2 telephone; 10-60 minutes each) were by an international board-certified lactation consultant (R.S.D.) antenatally and at 1 and 3 to 4 weeks and 3 to 4 and 5 months. These contacts provided education and support for prolonging milk feeding (ideally exclusive breastfeeding), in keeping with BLW, and delaying the introduction of complementary foods until 6 months, at which time infants were considered to be developmentally ready to self-feed.[20] Additional support could be requested. Three additional contacts (face-to-face; 30-60 minutes each) by a trained researcher (E.A.F. and J.M.) when the infant was 5.5, 7.0, and 9.0 months of age provided individualized advice and support to (1) wait until 6 months before introducing solid foods; (2) use responsive feeding practices, paying attention to hunger and satiety cues; (3) provide high-iron and high-energy foods at each meal and avoid foods posing a choking risk; and (4) offer foods easy to pick up and eat and more frequent milk feeds during illness and recovery. Extensive pretested BLISS resources[21] for use between study contacts detailed feeding in a baby-led manner, food ideas and recipe books suitable for each age, and safety information, particularly regarding choking.[20]

Adherence to a baby-led approach was measured by questionnaire at 6, 7, 8, 9, 12, and 24 months (eg, "How has your baby been fed their solids in the past week?"). Adherence was defined as the infants feeding themselves most or all their food in the previous week.[20]

Hospital records provided information on infant birth weight and sex, maternal parity, and level of household deprivation.[24] The baseline questionnaire, completed before

Figure 1. Study Flowchart



BLISS indicates Baby-Led Introduction to Solids.

randomization in late pregnancy, assessed maternal educational attainment, employment status, and ethnicity (New Zealand Census questions; http://www.stats.govt.nz), self-reported prepregnancy height and weight, and how mothers intended to introduce solid foods.

All outcome assessments were collected by researchers blinded to group allocation (L.J.F., L.D., B.M., and L.W.E.) (July 31, 2013, through April 26, 2016). Infant weight was measured on an electronic scale (model 334; Seca), and length was measured on a 100-cm board (Rollameter; Harlow Healthcare) in duplicate in accordance with World Health Organization protocols.[25] Length was obtained at 6, 12, and 24 months and weight at 6, 7, 8, 9, 12, and 24 months. We calculated BMI (weight in kilograms divided by height in meters squared) at 12 and 24 months; *z* scores (primary outcome) were created using World Health Organization reference data.[26] Overweight was defined as a BMI at or above the 95th percentile for age and sex.[26]

Secondary outcomes were assessed by questionnaire at 12 and 24 months. For energy self-regulation, parents indicated the extent to which they agreed with 8 statements about their child's ability to know when they were full[27] (Cronbach α, .81-.85). They also completed the Children's Eating Behavior Questionnaire (CEBQ),[28] which measures satiety responsiveness (eating appropriately in response to appetite) and food responsiveness (eating in response to environmental food cues rather than hunger) (Cronbach α, .67-.78). Eating behavior was assessed as enjoyment of food (having a positive attitude to food) and food fussiness (rejection of new and familiar foods)[28] from the CEBQ (Cronbach α, .85-.90). The person who made mealtime decisions, level of caregiver distress, and whether the child was a picky eater were determined from the Toddler-Parent Mealtime Behavior Questionnaire[29] (TMBQ; 12 months only; Cronbach α, .54-.83).

Energy intake at 7, 12, and 24 months of age was determined from 3-day weighed diet records collected on randomly assigned days (1 weekend day and 2 weekdays) during 3 weeks. Estimated total daily volumes were used for breast milk (750 g/d at 7 months,[30] 448 g/d at 12 months,[30] and 59 g/breastfeed at 24 months[31]). For infants with mixed feeding, the reported volume of formula was subtracted from 750 g at 7 months or 448 g at 12 months, with the remainder entered as breast milk (no child consumed formula at 24 months). Participants received written and oral instructions for completing the records, including careful recording of leftovers. Diet records were analyzed using the Kai-culator program (version 1.13s; University of Otago), which uses the New Zealand Food Composition Database (FOODfiles 2010), nutrient data for commonly consumed recipes from national nutrition survey data, and nutrient data for commercial infant foods collated by the research team.[20]

Brief feeding questionnaires were administered at 2, 4, 6, 7, 8, 9, 12, and 24 months of age. The following data were determined prospectively: weeks of exclusive breastfeeding (no other liquids or solids since birth), age when complementary foods were first introduced, age when the infant was feeding himself or herself regularly, and age when the infant was feeding himself or herself all his or her food.[20]

Data on adverse events (untoward medical occurrence that did not necessarily have a causal association with the intervention[32]) were collected actively (growth faltering, choking, or iron deficiency[19]) and passively (participant concerns as they were reported to us). A study pediatrician (B.J.W.) blinded to group allocation was consulted if any of 5 growth triggers were met (eTable in Supplement 2), and appropriate follow-up was initiated. Growth faltering was defined as a decrease in the weight *z* score of more than 1.34.[20] Data on choking[33] and iron deficiency[34] have been reported elsewhere.

Statistical Analysis

Based on a mean (SD) BMI of 17.3 (1.4) and a correlation between repeated measures (BMI at 6-12 months) of 0.78,[35] our study had 80% power to detect a difference in BMI of 0.40 with 85 infants in each group (equivalent to a BMI *z* score of 0.29) with a type I error rate of 0.05. Data were analyzed according to intention to treat according to CONSORT guidelines,[36] based on those who had at least 1 follow-up BMI measure, using STATA software (version 13; StataCorp). Linear mixed-effects models with participant-level random intercepts were used to estimate the difference in BMI *z* score (primary outcome) and BMI (secondary outcome) between the BLISS and control groups, and logistic regression (because the prevalence was low) was used to estimate the relative risks (RRs) and 95% CIs for being overweight. Chained equations were used to estimate missing values with a model that included age, weight,

length, and BMI and terms for sex, parity, maternal educational attainment, household deprivation, marital status, and weeks of exclusive breastfeeding. For this imputation, 50 data sets were generated using 1000 burn-ins for each set. Estimates for BMI *z* score and BMI were obtained from the imputed data sets and the original data set, and the residuals were checked for normality.

We used Kaplan-Meier curves to illustrate the age at which infants started feeding themselves and compared the groups using a log-rank test. Analyses of differences between groups for adherence to a baby-led approach to feeding were limited to those who were eating solids and are presented as RRs (95% CI). Regression analysis was used to compare the groups for energy self-regulation and eating behaviors, adjusting for birth weight, infant age and sex, and the stratification variables (first vs subsequent child and tertiary vs nontertiary maternal educational attainment). Energy intake was analyzed similarly using quantile (median) regression.

Results

Among the 206 mothers randomized (mean [SD] age, 31.3 [5.6] years), 168 (81.6%) were of European ancestry and 85 (41.3%) were primiparous. Before randomization, most mothers planned to follow traditional spoon-feeding, with few expecting their infant to feed themselves (45 [21.8%]) or to use solely finger foods (39 [18.9%]) (**Table 1**). Women who participated were less likely to be from deprived households (44 of 206 [21.4%] vs the national average [30.0%]; $P = .007$) but reported similar ethnicity (81.6% vs 584 of 751 [77.8%] European; $P = .12$) and parity (41.3% vs 319 of 751 [42.5%] first child; $P = .82$) to nonparticipants. A total of 166 mothers were available for the 24-month analysis (retention, 80.5%) (Figure 1).

We found no significant differences between the BLISS and control groups for BMI *z* score at 12 (adjusted difference, 0.21; 95% CI, −0.07 to 0.48) or 24 (adjusted difference, 0.16; 95% CI, −0.13 to 0.45) months using the imputed data (**Table 2**). The RR for being overweight in the BLISS compared with control groups was 2.5 (95% CI, 0.9-6.9) at 12 months and 1.8 (95% CI, 0.6-5.7) at 24 months. When the analysis was restricted to the complete cases, we found no significant adjusted differences in BMI *z* score at 12 (0.23; 95% CI, −0.06 to 0.52) or 24 (0.15; 95% CI, −0.12 to 0.45) months, and the RRs for overweight were 2.9 (95% CI, 1.0 to 8.6) at 12 months and 1.6 (95% CI, 0.5 to 5.3) at 24 months.

The results for energy self-regulation and eating behaviors are presented in Table 2. Parents indicated that BLISS infants were less satiety responsive than control infants at 24 months (adjusted difference, −0.24; 95% CI, −0.41 to −0.07). Mothers of BLISS infants rated their infants as significantly less fussy or picky about food, whether measured by the CEBQ (adjusted difference, −0.33; 95% CI, −0.51 to −0.14) or TMBQ (adjusted difference, −0.22; 95% CI, −0.41 to −0.04) at 12 months of age, although not at 24 months. Mothers of BLISS infants were also more likely to report a positive attitude to food (enjoyment of food) at 12 (adjusted difference, 0.25; 95% CI, 0.07-0.43) and 24 (adjusted differ-

Table 1. Participant Characteristics

Characteristic	Study Group[a] Control (n = 101)	BLISS (n = 105)
Maternal		
Age, mean (SD), y	31.3 (6.2)	31.3 (5.0)
Prepregnancy BMI, mean (SD)	25.6 (5.6)	25.9 (6.3)
Prepregnancy weight status		
Normal (BMI<25)	56 (58.3)	60 (57.7)
Overweight (BMI 25 to <30)	21 (21.9)	22 (21.1)
Obese (BMI≥30)	19 (19.8)	22 (21.1)
Educational attainment		
School only	29 (28.7)	34 (32.4)
Postsecondary	19 (18.8)	24 (22.9)
University	53 (52.5)	47 (44.8)
Employment		
Not employed	33 (32.7)	20 (19.0)
Part-time	27 (26.7)	36 (34.3)
Full-time	41 (40.6)	49 (46.7)
Parity		
First child	42 (41.6)	43 (41.0)
2 Children	32 (31.7)	43 (41.0)
≥3 Children	27 (26.7)	19 (18.1)
Ethnicity		
New Zealand European or other	85 (84.2)	83 (79.0)
Māori or Pacific	10 (9.9)	15 (14.3)
Asian	6 (5.9)	7 (6.7)
Household deprivation decile[b]		
1-3	29 (28.7)	31 (29.5)
4-7	49 (48.5)	53 (50.5)
8-10	23 (22.8)	21 (20.0)
Texture of food parent intends to use to introduce solid foods[c]		
Purées or purées and finger food	80 (79.2)	83 (82.2)
Mostly or all finger food	21 (20.8)	18 (17.8)
How parent intends to introduce solid foods[c]		
Parent fed or parent and infant fed	59 (58.4)	64 (61.0)
Mostly or all infant fed	25 (24.8)	20 (19.0)
Do not know	17 (16.8)	21 (20.0)
Infant		
Birth weight, mean (SD), g	3531 (486)	3509 (451)
Sex		
Male	53 (53.0)	43 (41.0)
Female	47 (47.0)	62 (59.0)

Abbreviations: BLISS, Baby-Led Introduction to Solids; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).

[a] Data are expressed as number (percentage) unless otherwise indicated. Percentages have been rounded and may not total 100. Data were missing for 1 participant for maternal age, 6 for prepregnancy BMI and weight, 4 for texture of food parent intends to use to introduce solid foods, 3 for birth weight, and 1 for infant sex.

[b] Determined using the New Zealand Index of Deprivation 2013.[24] The Index combines 9 variables from the 2013 New Zealand national census to provide a deprivation score for each meshblock (a geographical unit defined by Statistics New Zealand that contains approximately 81 people). The score reflects the extent of material and social deprivation and is used to construct deciles from 1 (low deprivation) to 10 (high deprivation).

[c] Data were collected before randomization.

Table 2. Anthropometric and Behavioral Outcomes

Variable	Age, mo	Control Group		BLISS Group		Adjusted Difference (95% CI)[a]
		No. of Participants	Mean (SD)	No. of Participants	Mean (SD)	
Primary outcome						
BMI *z* score	12	84	0.20 (0.89)	93[b]	0.44 (1.13)	0.21 (−0.07 to 0.48)[c]
	24	78	0.24 (1.01)	88	0.39 (1.04)	0.16 (−0.13 to 0.45)[c]
Secondary outcomes						
BMI	12	84	16.9 (1.36)	93[b]	17.3 (1.69)	0.34 (−0.06 to 0.74)[c]
	24	78	16.2 (1.45)	88	16.4 (1.48)	0.24 (−0.18 to 0.66)[c]
Energy self-regulation[d]	12	81	4.14 (0.82)	92	4.17 (0.82)	0.00 (−0.24 to 0.25)[e]
	24	75	4.03 (0.74)	85	4.01 (0.82)	−0.04 (−0.29 to 0.21)[e]
Satiety responsiveness[f]	12	81	2.93 (0.61)	92	2.89 (0.57)	−0.07 (−0.24 to 0.10)[e]
	24	75	3.23 (0.55)	85	3.01 (0.53)	−0.24 (−0.41 to −0.07)[e]
Food responsiveness[f]	12	81	2.20 (0.71)	92	2.22 (0.72)	0.06 (−0.16 to 0.27)[e]
	24	75	2.41 (0.70)	85	2.51 (0.66)	0.12 (−0.09 to 0.34)[e]
Food fussiness[f]	12	81	2.25 (0.67)	92	1.94 (0.61)	−0.33 (−0.51 to −0.14)[e]
	24	75	2.61 (0.74)	85	2.43 (0.70)	−0.18 (−0.40 to 0.05)[e]
Enjoyment of food[f]	12	81	4.07 (0.67)	92	4.29 (0.55)	0.25 (0.07 to 0.43)[e]
	24	75	3.84 (0.68)	85	4.07 (0.55)	0.24 (0.05 to 0.43)[e]
Child makes mealtime decisions[g]	12	81	3.87 (0.54)	92	4.04 (0.44)	0.16 (0.01 to 0.31)[e]
Mother makes mealtime decisions[g]	12	81	3.22 (0.61)	92	3.00 (0.64)	−0.19 (−0.37 to −0.00)[e]
Caregiver distress score[g]	12	81	2.13 (0.75)	92	2.00 (0.65)	−0.13 (−0.33 to 0.08)[e]
Child is picky eater[g]	12	81	1.95 (0.66)	92	1.74 (0.58)	−0.22 (−0.41 to −0.04)[e]
Weighed diet records						
Energy intake, kJ	7	77	2862 (548)	85	2996 (613)	70 (−125 to 265)[h]
	12	68	3572 (776)	75	3623 (776)	55 (−284 to 395)[e]
	24	56	4084 (1042)	57	4026 (1029)	143 (−241 to 526)[h]

Abbreviations: BLISS, Baby-Led Introduction to Solids; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).

[a] Adjusted for infant age, infant sex, and stratification variables (parity [first child vs subsequent child] and maternal educational attainment [tertiary vs nontertiary]).

[b] Length was not obtained for 1 child at 12 months; thus, BMI could not be calculated. Differences were calculated using imputed values (101 participants for the control group and 105 participants for the BLISS group).

[c] Analyzed using mixed models, BLISS vs control groups.

[d] Determined as the extent to which parents agreed with 8 statements about their child's ability to know when they were full (range, 1-5, with greater scores indicating greater agreement).[27]

[e] Analyzed using linear regression, BLISS vs control groups.

[f] Determined using the Children's Eating Behavior Questionnaire (range 1-5), with greater scores for satiety responsiveness and enjoyment of food indicating more favorable eating behavior and lower scores for food responsiveness and food fussiness indicating more favorable eating behavior.[28]

[g] Determined using the Toddler-Parent Mealtime Behavior Questionnaire (range 1-5), with greater scores for the mealtime decision scores indicating who is more in charge of the meal environment and greater scores for caregiver distress or picky eating indicating less favorable eating behavior.[29]

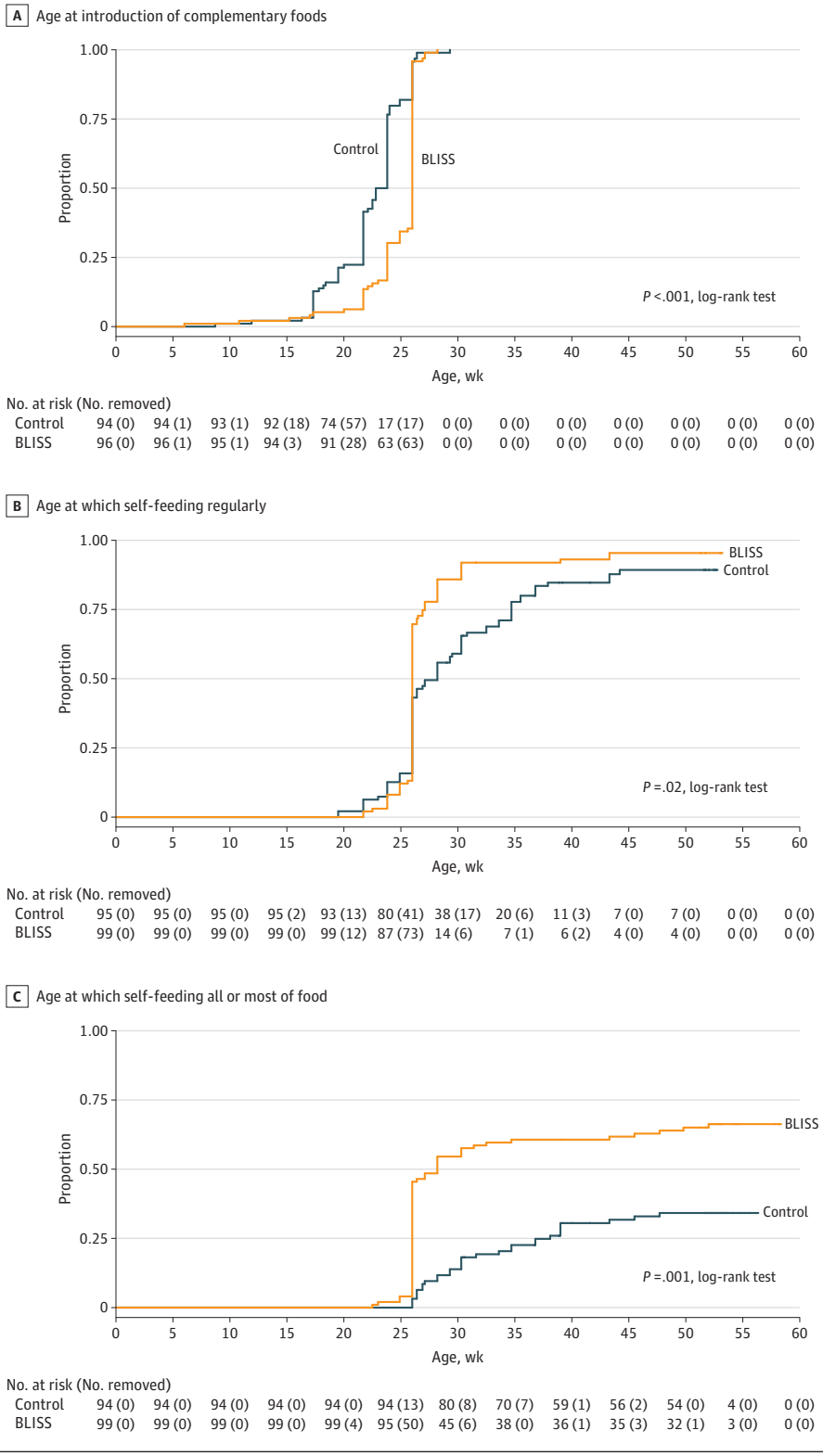
[h] Analyzed using quantile regression, BLISS vs control groups.

ence, 0.24; 95% CI, 0.05-0.43) months (CEBQ) and made significantly more mealtime decisions than control infants at 12 months (adjusted difference, 0.16; 95% CI, 0.01-0.31) (TMBQ). We observed no evidence of statistically significant differences in energy intake at any point. Prevalence of overweight did not differ significantly between the control and BLISS groups at 12 months (5 of 84 [6.0%] vs 14 of 93 [15.1%]; RR, 2.5; 95% CI, 0.9-6.9) or 24 months (5 of 78 [6.4%] vs 9 of 87 [10.3%]; RR, 1.8; 95% CI, 0.6-5.7). Differences were computed using imputed values for the control and BLISS groups and analyzed using Poisson regression.

BLISS infants were exclusively breastfed for longer (median, 21.7 weeks; 95% CI, 13.0-23.8 weeks) compared with control infants (median, 17.3 weeks; 95% CI, 6.0-21.7 weeks; $P = .002$), and 62 (64.6%) met the WHO guideline[37,38] for delaying solid foods until 6 months compared with 17 (18.1%) of control infants. Considerable differences were also observed in the age when infants first fed themselves (**Figure 2**). **Table 3** indicates that BLISS infants were more likely to feed themselves most or all of their food than control infants at every age.

Two serious adverse events[33] were reported (1 in the control group and 1 in the BLISS group); both resulted in hospital admissions owing to choking on milk, not related to the intervention. No infant met the criterion for growth faltering. Of the 32 infants who met at least 1 growth trigger (16 in the control and 16 in the BLISS groups) (eTable in the Supplement 2), 19 had further follow-up, but all showed improvements over time, indicating that any slowing of weight gain was transient. We found no significant group

Figure 2. Kaplan-Meier Survival Curves for Study Variables



The numbers below the graphs refer to the number of children not yet introduced to complementary foods at a particular time, with the number in parentheses referring to the number who started complementary feeding between this time point and the next (A); the number of children not yet feeding themselves regularly at a particular time, with the number in parentheses referring to the number who started feeding themselves regularly between this time point and the next (B); and the number of children not yet feeding themselves most or all of their food at a particular time, with the number in parentheses referring to the number who started feeding themselves most or all of their food between this time point and the next (C). BLISS indicates Baby-Led Introduction to Solids.

differences in the rates of choking[33] or iron deficiency anemia.[34] Parents passively reported 11 adverse events (all in the BLISS group), including concern about constipation (n = 4), choking (n = 3), sufficiency of milk intake (n = 2), growth (n = 1), and potential food allergy (n = 1). No participant withdrew owing to an adverse event.

Table 3. Adherence to a Baby-Led Approach to Complementary Feeding From 6 to 24 Months of Age

Age, mo	Study Group	Total No. of Participants	Method of Infant Feeding During Previous Week, No. (%)			RR (95% CI)[d]	*P* Value
			Infant Fed[a]	Parent Fed[b]	No Solids[c]		
6	Control	71	8 (11.3)	57 (80.3)	6 (8.5)	5.4 (2.8-10.7)	<.001
	BLISS	89	41 (46.1)	20 (22.5)	28 (31.5)		
7	Control	73	15 (20.5)	58 (79.4)	0	3.6 (2.3-5.8)	<.001
	BLISS	81	60 (74.1)	21 (25.9)	0		
8	Control	75	24 (32.0)	51 (68)	0	2.3 (1.6-3.3)	<.001
	BLISS	88	64 (72.7)	24 (27.3)	0		
9	Control	83	27 (32.5)	56 (67.5)	0	2.3 (1.7-3.3)	<.001
	BLISS	87	66 (75.9)	21 (24.1)	0		
12	Control	81	38 (46.9)	43 (53.1)	0	1.7 (1.3-2.1)	<.001
	BLISS	90	70 (77.8)	20 (22.2)	0		
24	Control	79	70 (88.6)	9 (11.4)	0	1.1 (1.0-1.2)	.008
	BLISS	80	79 (98.8)	1 (1.2)	0		

Abbreviations: BLISS, Baby-Led Introduction to Solids; RR, relative risk.

[a] Includes children who were feeding themselves most or all of their food.

[b] Includes children who were being fed most or all of their food by a parent or were approximately equally parent and infant fed.

[c] Indicates child did not consume solid foods in the previous week (subset of the 7 control and 30 BLISS infants who had never had complementary foods at 6 months of age).

[d] Compares the proportion of infants who were infant fed (compared with parent fed) in the BLISS group with the proportion who were infant fed (compared with parent fed) in the control group, adjusted for the stratification variables (first child vs subsequent child [parity] and tertiary vs nontertiary [maternal educational attainment]).

Discussion

Our randomized clinical trial suggests that allowing infants greater control over their eating by using a baby-led approach to complementary feeding does not result in more appropriate body weight up to 24 months of age than traditional spoon-feeding. In fact, mothers reported that BLISS infants appeared to be less, rather than more, responsive to appetite at 24 months of age than control infants (although this was seen for just 1 measure of energy self-regulation at 1 point, and no differences were observed in energy intake at any time). Our results also refute concerns that infants using a baby-led approach to complementary feeding may not eat enough food,[19] with no children showing growth faltering. Interestingly, Infants in the BLISS group showed less food fussiness and greater enjoyment of food than control infants.

Despite marked interest in baby-led approaches,[11] minimal research has directly evaluated the advantages and disadvantages of this alternative approach to complementary feeding. Our results are in direct contrast with the only other study that has examined energy self-regulation,[12] in which higher satiety responsiveness was reported in young children using BLW. Moreover, whereas previous research has suggested that BLW infants are less likely to be overweight[12,13] and more likely to be underweight,[13] the 95% CI for our data does not exclude a potentially important increase in the risk for overweight. These discrepancies may have arisen because existing observational studies used infant weight reported by parents, which is known to be inaccurate,[14] whereas we measured weight. However, the most likely explanation is related to study design. Parents who choose to use BLW are known to differ demographically[16] and in the degree of maternal control over child eating[39] from parents using more traditional infant feeding practices, and these characteristics are related to growth[18] and eating behaviors.[40] By contrast, our randomized design should remove group differences in known and unknown confounders. Neither the present study nor the only existing study in infants examining energy intake in BLW[15] has demonstrated a statistically significant difference in energy intake between those using a baby-led approach to infant feeding and those using spoon-feeding. The difference in exclusive breastfeeding rates between the BLISS and control groups in the present study is unlikely to explain the findings given that existing literature generally supports breastfeeding being protective against obesity.[41] Therefore, energy intake, energy self-regulation, and body weight should be investigated in studies of infants using unmodified BLW, ideally alongside spoon-fed infants matched for key demographic variables.

Our results also suggest that use of a baby-led approach might change attitudes toward food, as has been indicated previously.[12] In our study, parents reported that BLISS infants had a better attitude toward food at 12 and 24 months and were less fussy about food (at 12 months) than control infants. Because of the strong genetic component to food fussiness,[42] the relatively large effect of this baby-led approach is of interest. The differences that we observed can be considered as a moderate effect and are likely to be important to parents because food fussiness can cause considerable stress.[43,44]

Strengths and Limitations

The main strengths of our study include the randomized clinical design, rigorous assessment of energy intake, high levels of adherence, and collection of growth data by trained assessors blinded to intervention status. We were careful to emphasize to participants the importance of measuring foods that were offered but not eaten (leftovers), and the energy intakes

reported in our sample reflect current estimated energy requirements for infants aged 12 months (3500 kJ for boys and 3200 kJ for girls[45]). Our repeated assessment of adherence provides confidence that the lack of intervention effect that we observed was not a result of poor adherence. Our data demonstrate that families randomized to a baby-led approach to feeding are able to adhere when provided with suitable guidance and support. The level of adherence among individuals using BLW without this support is less certain.

Our study also has some limitations. The sample was small, but we reported 95% CIs to show the range of plausible values for the differences. We were able to examine growth faltering only in descriptive terms because large studies would be required to detect differences in the prevalence of growth faltering.[46,47] However, our findings should provide reassurance to parents and health care professionals who have expressed concern regarding the capacity of young children to feed themselves sufficient amounts of food.[19,48] Because our BLISS approach included modifications to BLW specifically designed to reduce the likelihood of growth faltering,[20] unmodified BLW may not have the same effects. Although BMI data were missing for 40 participants (19.4%) at 24 months, imputation of growth data indicates that the missing data did not affect interpretation of the main outcomes. Finally, our sample was relatively socioeconomically advantaged; thus, the results may not apply to infants with a lower socioeconomic status.

Conclusions

A baby-led approach to complementary feeding does not appear to improve energy self-regulation or body weight when compared with more traditional feeding practices, although some benefits may accrue in attitudes to food, including reduced food fussiness. Additional research is required to determine the extent to which these findings apply to infants who are using a baby-led approach without the modifications and additional support provided by the BLISS intervention.

ARTICLE INFORMATION

Accepted for Publication: April 5, 2017.

Published Online: July 10, 2017. doi:10.1001/jamapediatrics.2017.1284

Author Contributions: Dr R. W. Taylor had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
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Obtained funding: R. W. Taylor, Heath.
Administrative, technical, or material support: Fangupo, Wheeler, Fleming, McArthur, Morison, Erickson, Davies, Cameron.
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Conflict of Interest Disclosures: None reported.

Funding/Support: This study was supported by Lottery Health Research, Meat & Livestock Australia, Karitane Products Society, Perpetual Trustees, New Zealand Federation of Women's Institutes, and the University of Otago, with in kind contributions from Heinz Watties, Ltd; by a fellowship from Karitane Products Society (Dr R. W. Taylor); by a doctoral scholarship from the University of Otago (Ms Daniels); and by a master's scholarship from the University of Otago (Ms Erickson).

Role of the Funder/Sponsor: The funding sources had no role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or the decision to submit the manuscript for publication.

Additional Contributions: We are grateful to all the families who participated in the the Baby-Led Introduction to Solids (BLISS) study, and to the BLISS research staff in the Departments of Medicine and Human Nutrition at the University of Otago, Dunedin, New Zealand.

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