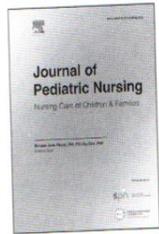




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The effect of baby-led weaning and traditional complementary feeding trainings on baby development

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ABSTRACT

Purpose: The aim of this study was to evaluate the risks of self-feeding, transition to early solid food and family meals, choking risk, anemia risk and obesity risk in 6–12-month-old infants who were introduced to complementary feeding using the traditional complementary feeding (TCF) and baby-led weaning (BLW) methods/training.

Design and methods: Mothers of infants who had not yet transitioned to complementary feeding were included in this randomized study. The mothers of 62 infants included in the study were randomized into the intervention groups as TCF and BLW, classified according to the number of children and education level. The research was carried out according to the CONSORT-2010 guidelines after randomization and was concluded with 52 infants and their mothers.

Results: It was found in the study that self-feeding and transition to solid foods in infants fed with the BLW method was higher than the infants fed with the TCF method ($p < 0.05$). A significant increase was observed in the hemoglobin level of infants fed with the BLW method over time ($p < 0.001$).

Conclusions: It was concluded that the BLW method did not lead to risks of obesity, anemia and iron deficiency in transition to complementary feeding. Secondary results indicated that feeding with the BLW method promoted self-feeding and early transition to solid foods and did not lead to the risk of choking.

Practice implications: Complementary feeding with the BLW method can be safely used by both mothers, healthcare professionals and researchers.

Trial Registration: register.clinicaltrials.gov; Identifier: NCT05771324

Introduction

The Baby-Led Weaning (BLW) method is defined as an alternative approach to feeding that encourages baby and mother to feed and allows the baby to enjoy feeding time, unlike traditional complementary feeding (Kurtuncu et al., 2018; World Health Organization, 2009). BLW is a baby-friendly feeding method in which babies feed themselves with pieces of food, preferably from home meals, instead of spooned foods prepared in the form of puree by the parents during the transition to complementary feeding (World Health Organization, 2009; Kurtuncu et al., 2018; Köksal et al., 2015). However, the risks of choking, iron deficiency, and inadequate energy intake are the potential disadvantages mentioned by health professionals and parents regarding complementary feeding with the BLW method (World Health Organization, 2009; Kurtuncu et al., 2018; Brown & Lee, 2011; Cameron et al., 2012;

Moore et al., 2014; Cameron et al., 2015).

Despite its potential disadvantages reported, complementary feeding with the BLW method is becoming preferable thanks to its advantages such as low obesity risk, better food quality, positive attitudes of families on eating behavior, and being a method that supports infant development (Kurtuncu et al., 2018; Brown & Lee, 2011; Cameron et al., 2012; Cameron et al., 2015; Addesi et al., 2015).

The consistency of the food, when and how much they will consume is determined by the parents of infants who are introduced to complementary feeding with the traditional spoon feeding. At the same time, since the foods are prepared in the form of puree or baby cereals with the traditional method, feeding is provided without the need for babies to chew (Addesi et al., 2015; Cameron et al., 2015; Köksal et al., 2015). This suppresses the infants' capacity to adjust the amount eaten according to their physiological needs and their ability to self-feeding

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(Cameron et al., 2012; Cameron et al., 2015; Addesi et al., 2015; Williams Erickson et al., 2018; Köksal et al., 2015; Brown & Lee, 2015). In the BLW method, the baby can end the feeding when he is full by using the capacity to adjust the amount eaten according to his physiological needs (Cameron et al., 2012; Taylor et al., 2021; Williams Erickson et al., 2018).

Therefore, infants can be fed by providing their own self-regulation in feeding. With the BLW feeding method, the food intake of infants according to their satiety and the increase in their self-regulation of energy skills reduce the risk of obesity in infants (Cameron et al., 2012; Cameron et al., 2015; Addesi et al., 2015; Williams Erickson et al., 2018; Taylor et al., 2021).

Despite the increasing interest in feeding with the BLW method, there are very few studies evaluating the months of transition to solid foods and home meals, the risks of choking, anemia, and obesity in infants with the BLW method (Cameron et al., 2015; Daniels et al., 2015; Dogan et al., 2018; Morison et al., 2016; Pearce & Langley-Evans, 2022; Williams Erickson et al., 2018). The fact that this study was planned in a randomized controlled trial using internationally accepted guidelines for both feeding methods are important for the study's evidence. With its evidence-based results, it is predicted that this study can guide not only parents but also health professionals and politicians.

Objective

The aim of this study was to evaluate the risks of self-feeding, transition to early solid food and family meals, choking risk, anemia risk and obesity risk in 6–12-month-old infants who were introduced to complementary feeding using the traditional complementary feeding (TCF) and baby-led weaning (BLW) methods/training.

Methods

Research design

This research is a prospective, triple-blinded, randomized controlled experimental and analytical study with the highest level of research evidence.

Place and time of the research

This research was conducted in the Gynecology and Pediatrics Hospital in Zonguldak between January 18–December 31, 2021.

The sample of the study

The population of the study consisted of a total of 73 infants aged 4, 5, and 6 months. In the calculation of the sample, a power analysis was performed with an effect width of 0.30 and a margin of error of 5%. Accordingly, the total number of individuals was determined as 62 (31 infants in each group) at a power level of 81.23% for two repeated measurements. Blocked and stratified randomization methods were used to select the experimental groups. According to the power analysis made after the study was completed, for each group, it was determined that there was a minimum of 19 subjects when the effect width value was 0.70 at a 5% margin of error and 82.26% power level. According to the power analysis made after both analyses, it is seen that the sample size in the groups is sufficient.

Selection of experimental groups and randomization

Face-to-face interviews were conducted with the mothers of the infants included in the sample, and the mothers were informed about the purpose of the research and how the research would be conducted. Before randomization, a literature review was performed on infant feeding variables. When the literature was examined, studies showed the

effects of mothers' education level and previous complementary food experiences on the transition to complementary feeding formed the basis of randomization (Addesi et al., 2021; Cameron et al., 2015; Daniels et al., 2015; Morison et al., 2018; Taylor et al., 2021; Williams Erickson et al., 2018). Therefore, randomization was based on mothers' educational level and previous experience with complementary foods. Blocked and stratified randomization methods were used in randomization. Moreover, the blocked randomization method was used for stratified sample selection. Experimental groups with two individuals in each block were formed homogeneously according to the education level of the mothers and the number of children.

The bias of the research

An effort was made to prevent bias at all stages of the research. Randomization was used to avoid bias in assignments. To prevent bias in sample selection, all infants followed in a single center and meeting the inclusion criteria were examined. While the researcher who intervened was not involved in the evaluation of the post-intervention outcomes, the researcher who performed the developmental assessments did not have information about which intervention was applied to the groups, which groups the infants belonged to, and the type of intervention. In addition, the statistical evaluator who analyzed the studies analyzed the study without knowing which group was the treatment group. On the other hand, the volunteers in the study did not have information about the intervention groups. In this way, the triple blinding method, the most reliable method to avoid bias, was used in this study. There was no bias at any stage of this study using randomization and the triple-blinding method. The international standard CONSORT 2010 diagram was used in structuring the study. A diagram of the CONSORT 2010 flow chart is given in Fig. 1.

Inclusion criteria

Inclusion criteria in the study were evaluated separately for mothers and infants. The inclusion criteria for mothers were as follows:

- The arrival of mothers at the center where the research would be conducted for routine baby follow-up and vaccination follow-up
- Volunteering of mothers to participate in the research
- Having no communication problems
- Being at least 19 years old
- Having no physical or mental disability

The inclusion criteria for infants were as follows:

- Babies 6 months old
- Not having been introduced to complementary feeding
- Being fed only with breast milk
- Not being born before 38 weeks of gestation
- Not having a congenital anomaly
- Having no digestive and neurological system disease that might affect feeding

Exclusion criteria

Regardless of the baby's age in months, all infants and their families who began complementary feeding and did not meet the inclusion criteria were excluded from the study.

Data collection tools

Introductory Information Form for Mothers and Babies and Laboratory Findings Evaluation Form were used to collect data.

Introductory Information Form for Mothers and Babies: The form prepared by the researchers consisted of the sociodemographic

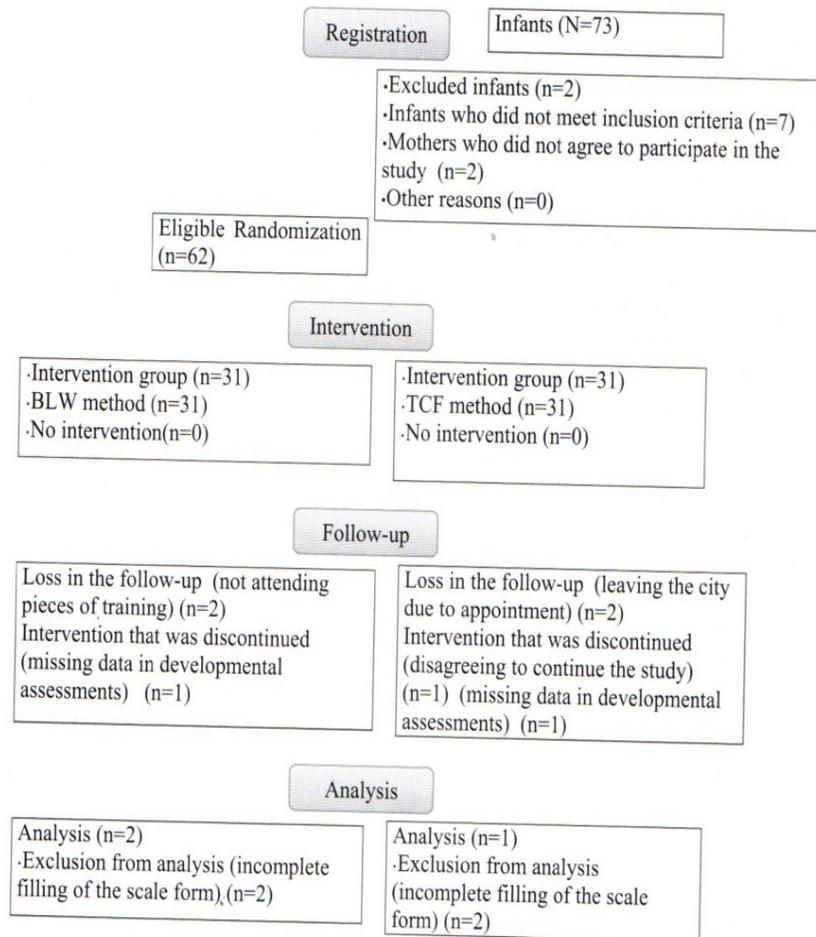


Fig. 1. CONSORT 2010 Flow Chart.

characteristics of the infants and parents, the mothers' experience of complementary food intake, and breastfeeding.

Laboratory Findings Evaluation Form: The form consisted of 11 assessment parameters and two assessment times (at the 6th and 12th months).

Data collection

The data were collected online due to the COVID-19 pandemic. The flow chart of the data in the research is given in Table 1.

The study applied traditional complementary feeding and baby-led weaning methods to six-month-old infants who had not transitioned to complementary feeding.

Table 1

Study flow chart by months.

	4-5 months	6 months	6-7 month	9 months	12 months
Contact with families	+				
Data collection tools					+
Developmental assessment		+			+
Performing laboratory examinations		+			+
Complementary feeding training Module 1		+			
TCF training Module 2/A		+			
BLW training Module 2/B		+			
TCF training Module 3/A				+	
BLW training Module 3/B				+	

Complementary feeding training

Complementary feeding training was planned according to the age of the infant in months. Guide booklets were prepared for each training module and given to parents before the training. Complementary feeding features specific to the age period of infants formed the educational content in each module. The only difference between groups A and B training modules was the information regarding feeding with the BLW method. Participant/participants who could not attend any session in each training module were included in the next training session. Thus, the participation of every mother was ensured in all training modules. The training by month were given in Table 2.

Data analysis

In evaluating data obtained in the study, the SPSS 22.0 Statistics package program was used for statistical analysis. While frequency, percentage, mean, and standard deviation were used for descriptive statistical methods, Kolmogorov - Smirnov distribution test was used to examine the normal distribution. Independent samples *t*-test was used to compare quantitative data between two groups. Mann-Whitney *U* test and Kruskal-Wallis *H* test, which were nonparametric tests, were used to evaluate data that did not show normal distribution. Statistical significance was evaluated at the $p < 0.05$ level.

Ethics of the study

To conduct the study, permission numbered 2019/173-16/10 from the Clinical Research Ethics Committee and written institutional permissions from the Zonguldak Provincial Health Directorate were obtained. The individuals in the sample were informed about the study and their consent was obtained with a voluntary consent form.

Table 2
Complementary feeding training by months.

Baby age (month)	Training	Guide Used in Training	Number of training	Guide Training Booklet
4, 5, and 6 months	Module 1	Successful complementary feeding guide for mothers	4 times in total in groups of 15	Module1 guide booklet
6–8 months	Module 2/A	Guide for 6–8 month-old babies (TCF)	3 times in total in groups of 10	2/A guide booklet
	Module 2/B	Guide for 6–8 month-old babies (BLW)	3 times in total in groups of 10	2/B guide booklet
9–12 months	Module 3/A	Guide for 9–12 month-old babies (TCF)	3 times in total in groups of 10	3/A guide booklet
	Module 3/B	Guide for 9–12 month-old babies (BLW)	3 times in total in groups of 10	3/B guide booklet
Zoom Training Links, ID and Training Access Codes		XXX Is Inviting You To A Scheduled Zoom Meeting. Topic: XXX's Personal Meeting Room Join Zoom Meeting https://Us04web.zoom.us/j/5147794535?pwd=U3Nsd0FrRUVia0wrU1FaeWRKd0doQT09 Meeting ID: 5147794535 Passcode: X.XXX		

Results

The mean age of the mothers in the group of TCF was 29.42 ± 3.78 and 31.27 ± 4.23 in the group of BLW. There was no significant difference between the groups regarding the number of children and complementary feeding experience of mothers ($p > 0.05$). In Table 3, the groups gave the demographic characteristics of the mothers, as well as the distribution of variables such as pregnancy period, transition to complementary feeding, and the state of the infant's breastfeeding. Examining the table, it was seen that there was a homogeneous distribution between the groups in terms of sociodemographic information and other variables.

Comparing the variables relating to the feeding state of the infants at 12 months, it was found that infants fed with the BLW method were more likely to self-feed ($p = 0.005$) and solid food transitions by 6–8 months of age ($p < 0.001$) than those fed with the TCF method. In addition, infants' transition to home meals fed with the TCF method ($p = 0.016$) was determined to be earlier than those fed with the BLW method (Table 4).

When Table 5 was examined, there was no significant difference between the pre-test and post-test scores of groups in terms of retching and choking risk ($p > 0.05$). Infants fed with the TCF method significantly decreased retching scores over time ($p = 0.008$). The iron intake score of the infants at 6 and 12 months fed with the BLW method was higher than those fed with the TCF method ($p < 0.05$). In addition, the

Table 3
Characteristics of variables regarding mothers.

Demographic characteristics	TCF		BLW		Test	p	
	n	%	n	%			
The number of children	1	18	69.2	20	76.9	0.391	0.532 ¹
	2 and more	8	30.8	6	23.1		
Mother's level of education	Secondary	5	19.2	3	11.5	1.926	0.165 ¹
	High school	10	38.5	7	26.9		
	University and †	11	42.3	16	61.5		
Mother's employment	Employed	9	34.6	8	30.8	0.087	0.768 ¹
	Unemployed	17	65.4	18	69.2		
Mother's profession	Housewife	14	53.8	12	46.2	2.029	0.566 ¹
	Private sector	2	7.7	4	15.4		
	Employee	3	11.5	3	11.5		
	Civil servant	7	26.9	7	26.9		
Paying attention to food intake during pregnancy	Yes	17	65.4	18	69.2	0.362	0.834 ¹
	No	2	7.7	1	3.8		
	Sometimes	7	26.9	7	26.9		
Vitamin supplements during pregnancy	Never	8	30.8	9	34.6	0.368	0.947 ¹
	Folic acid	3	11.5	4	15.4		
	Vitamin	2	7.7	2	7.7		
	Iron	13	50.0	11	42.3		
Mode of birth	Normal delivery	2	7.7	6	23.1	2.364	0.248 ¹
	Cesarean section	24	92.3	20	76.9		
The presence of a helper for baby care	Yes	11	42.3	6	23.1	2.185	0.139 ¹
	No	15	57.7	20	76.9		
Constant helper for baby care	Yes	0	0.0	1	3.8	1.020	1.000 ¹
	No	26	100.0	25	96.2		
Complementary feeding experience	Yes	12	46.2	10	38.5	0.315	0.575 ¹
	No	14	53.8	16	61.5		
The state of the complementary feeding experience	Traditional	11	42.3	10	38.5	1.048	0.592 ¹
	BLW	0	0.0	1	3.8		
	None	15	57.7	15	57.7		
Receiving help in complementary feeding	Yes	9	34.6	8	30.8	0.087	0.768 ¹
	No	17	65.4	18	69.2		
Need for constant help in complementary feeding	Yes	3	11.5	5	19.2	0.591	0.703 ¹
	No	23	88.5	21	80.8		
State of feeding with breast milk in the first 6 months	Only breast milk	4	15.4	4	15.4	0.155	0.985 ¹
	Breast milk and water	4	15.4	5	19.2		
	Breast milk and formula	12	46.2	11	42.3		
	Only breast milk in the first 4 months	6	23.1	6	23.1		
Age of mother	Mean ± sd	Mean	Mean ± sd	Mean	1.844	0.065 ²	
	29.42 ± 3.78	(Min-max)	31.27 ± 4.23	(Min-max)			
		29.0 (25–43)		30.0 (23–41)			

¹: Chi-square test; ²: Independent sample t-test; *: $p < 0.05$.

Table 4
Variables related to feeding characteristics of infants at 12 months and the relationship between the groups.

Feeding characteristics	TCF		BLW		Test	p	
	n	%	n	%			
Self-feeding	Yes	17	65.4	25	96.2	7.924	0.005** ¹
	No	9	34.6	1	3.8		
Using a spoon and fork	Yes	15	57.7	19	73.1	1.359	0.244 ¹
	No	11	42.3	7	26.9		
Consistency of food	Usually grainy foods	11	42.3	5	19.2	3.341	0.188 ¹
	Usually solid foods	10	38.5	15	57.7		
	In every texture	5	19.2	6	23.1		
Time for the transition to solid foods	6–8 months	2	7.7	24	92.3	37.231	< 0.001**** ¹
	9–12 months	24	92.3	2	7.7		
Transition to home meals	Yes	22	84.6	14	53.8	5.778	0.016* ¹
	No	4	15.4	12	46.2		

¹: Chi-square test; *: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$.

iron intake score of infants fed with both feeding methods ($p = 0.042$) increased significantly over time.

While there was no significant difference in the hemoglobin and ferritin levels of the infants at 6 and 12 months ($p > 0.05$), there was a significant increase in the hemoglobin level of infants fed with the BLW method over time ($p = 0.008$).

There was no significant difference between the groups in terms of weight for height, height for age, and weight for age in infants at 6 and 12 months ($p > 0.05$). When the changes in infants in terms of height and weight over time were examined, both height and weight gain increased significantly in both groups ($p < 0.001$) (Table 6).

Table 5
The relationship of the pretest-posttest scores belonging to variables of retching, iron intake, risks of choking, and anemia with the groups and times.

	TCF		BLW		Test / p (intergroup p-value)
	mean ± sd	n / %	mean ± sd	n / %	
Retching (6. months)	1.38 ± 0.50	10 (38.5)	1.15 ± 0.36	4 (15.4)	-1.858
(12. months)	1.11 ± 0.32	3 (11.5)	1.00 ± 0.00	0 (0)	0.06
Test / p (pre-posttest)	-2.646 / 0.008* ²		-2.00 / 0.05 ²		-1.767
Risk of choking (6. months)	1.15 ± 0.36	4 (15.4)	1.04 ± 0.2	1 (3.8)	0.07
(12. months)	1.04 ± 0.2	1(3.8)	1.0 0.00	0 (0)	-1.398
Test / p (pre-posttest)	-1.732 / 0.08 ²		-1.00 / 0.317 ²		0.16
Risk of anemia	mean ± sd	Mean (min-max)	mean ± sd	Mean (min-max)	Test / p
Hemoglobin (6. months)	11.55 ± 0.77	11.7 (9.8–13.3)	11.67 ± 0.68	11.5 (10.8–13.2)	-0.572
(12. months)	11.88 ± 0.78	11.9 (10.2–13.3)	12.10 ± 0.75	12.3 (10.5–13.4)	0.570 ¹
Test / p (pre-posttest)	-1.986 / 0.058 ³		-2.863 / 0.008* ³		-1.030
Normal value: 11–15 g / dl					0.308 ¹
Ferritin level (6. months)	25.13 ± 8.78	24 (12.4–46)	33.15 ± 24.64	26.1 (10–132.2)	-1.327
(12. months)	25.96 ± 10.52	25 (10.5–48.3)	31.50 ± 20.00	29 (8.1–110)	0.184 ²
Test / p (pre-posttest)	-1.195 / 0.232 ⁴		-0.394 / 0.694 ⁴		-1.346
Normal value: 15–150 µg / L					0.178 ²
Iron intake level (6. months)	48.01 ± 17.55	50 (16.9–103)	59.16 ± 17.49	61.4 (25–93.4)	-2.296
(12 months)	57.09 ± 20.99	58.7 (27–110.4)	69.71 ± 23.39	70 (22.9–113.1)	0.026* ¹
Test / p (pre-posttest)	-2.970 / 0.006* ³		-2.140 / 0.042* ³		-2.048
Normal value: 31–144 g / dL					0.046* ¹

¹: Mann Whitney U test; ²: Independent sample t-test; ³: Friedman test; *: $p < 0.05$.

Discussion

Studies showing the effect of mothers' education level and their previous complementary feeding experience on the transition to complementary feeding indicated that homogeneity be ensured between groups (Cameron et al., 2015; Daniels et al., 2015; Morison et al., 2018; Williams Erickson et al., 2018). There was no significant difference between the groups regarding education level, age, employment, profession, and number of children of the mothers included in the study (Table 3). Considering these results, the groups are homogeneous regarding the basic variables affecting the transition to complementary feeding and infant development in this study.

Self-feeding, early transition to solid foods and home meals

In the study, the mean scores of hand feeding/self-feeding and early transition to solid foods (6–8 months) were found to be higher in infants fed with the BLW method than in infants fed with the TCF method. In addition, the infants' transition time to home meals fed with the TCF method was found to be significant compared to those fed with the BLW method. In the study by Morison et al. (2018, in which they compared infants transitioned to complementary feeding with the BLW and TCF method, it was found that there was a difference between the groups in terms of the consistency of the foods at 7 months, but not at 12 months. The same study, it was also determined that the rate of feeding with solids and foods in any consistency was higher in infants fed with BLW at 12 months and 24 months. The study conducted by Daniels et al. (2015), reported that the transition from grainy foods to solids was earlier in infants fed with the BLW method than in those fed with the TCF method. Self-feeding scores of infants fed with the BLW method were also stated to be more significant. The study conducted by Cameron et al. (2015), determined that there was no difference between the groups in terms of the consistency of the foods and transition to solid foods. However, in the same study, the mean score of transition to solid foods was found to

Table 6
Comparison of Weight-For-Height, Length/height-For-Age, and Weight-For-Age scores between the groups.

		TCF				BLW			
		6 months old		12 months old		6 months old		12 months old	
		n	%	n	%	n	%	n	%
WLZ	Thin	2	7.7	0	0.0	2	7.7	1	3.8
	Average	20	76.9	23	88.5	24	92.3	18	69.2
	Overweight	4	15.4	3	11.5	0	0.0	6	23.1
	Obese	0	0.0	0	0.0	0	0.0	1	3.8
LAZ	Short	1	3.8	1	3.8	0	0.0	1	3.8
	Average	19	73.1	17	65.4	23	88.5	17	65.4
	Tall	6	23.1	5	19.2	2	7.7	8	30.8
	Very tall	0	0.0	3	11.5	1	3.8	0	0.0
WAZ	Thin	1	3.8	0	0.0	0	0.0	0	0.0
	Average	23	88.5	22	84.6	24	92.3	21	80.8
	Overweight	2	7.7	4	15.4	2	7.7	4	15.4
	Obese	0	0.0	0	0.0	0	0.0	1	3.8
Baby height (cm)	Mean ± sd			Mean ± sd		Mean ± sd		Mean ± sd	
	67.92 ± 2.23			76.77 ± 3.12		67.62 ± 2.80		75.35 ± 3.19	
Test/p (pre-posttest)	52.000 / < 0.001* ³					52.000 / < 0.001* ³			
	Test/p (Intergroup p-value at 6 months)					−0.535/0.593 ¹			
	Test/p (Intergroup p-value at 12 months)					−1.364/0.172 ²			
Baby weight (kg)	Mean ± sd			Mean ± sd		Mean ± sd		Mean ± sd	
	8.12 ± 0.92			10.11 ± 0.74		7.88 ± 0.6		9.99 ± 1.16	
Test/p (pre-posttest)	46.231 / < 0.001* ³					51.515 / < 0.001* ³			
	Test/p (Intergroup p-value at 6 months)					1.111/0.272 ²			
	Test/p (Intergroup p-value at 12 months)					0.441/0.661 ²			

WLZ: Weight-For-Height; LAZ: Length/Height-For-Age; WAZ: Weight-For-Age; ¹: Mann Whitney U test; ²: Independent sample t-test; ³: Friedman test; *, *p* < 0.05.

be higher in infants fed with BLW. In the study carried out by Williams Erickson et al. (2018), the scores of self-feeding and transition time to solid foods were determined to be higher in babies fed with the BLW method. Our study found that the transition to home meals was earlier in infants fed with the TCF method. When the literature was examined, our study results were similar to the studies in the literature.

Choking risk

When the feeding methods were examined in terms of disadvantages such as retching and choking risk, no significant difference was found between the groups. However, it was observed that the retching scores of infants fed with TCF decreased significantly over time. Pearce and Langley-Evans (2022) stated in their study that there was no difference between babies fed with the BLW and TCF methods regarding choking risk. Fangupo et al. (2016) stated in their study that there was no risk of choking in infants fed with both feeding methods. In the same study, it was reported that the signs of retching and choking during eating were significantly observed in 6-month-old babies fed with the BLW and 8-month-old babies fed with the TCF method, but this situation did not cause choking risk in both groups. Daniels et al. (2015), Dogan et al. (2018), Morison et al. (2018), Cameron et al. (2015), and Brown (2018) stated in their studies that there was no risk of choking in babies fed with the BLW method. In the study conducted by Cameron et al. (2015), 30% of mothers stated that they faced the risk of choking on their babies while eating raw fruit. The results of studies examining the BLW feeding method regarding choking risk were similar to the results of our study.

Iron intake and risk of anemia

T.R. The Ministry of Health provides iron supplements to infants as a routine practice in infant follow-ups. Our study, in addition to routine iron intake in infants in both groups, mothers were informed about iron intake with the training given. There are studies stating that health professionals have concerns about the risks such as iron deficiency, anemia, and growth retardation in complementary feeding with the BLW method (Agostoni et al., 2009; Brown et al., 2017; Carothers & Gribble, 2014; Cole et al., 2017; Hanindita et al., 2019; Rowan et al., 2022). Dogan et al. (2018) found in their study that there was no

significant difference in hemoglobin, hematocrit, iron, and ferritin levels between the groups in infants fed with BLW and TCF methods. It was also found that there was a higher increase in hemoglobin, hematocrit, iron, and ferritin levels in babies fed with the BLW method compared to those fed with the TCF. No risk of iron deficiency and anemia in infants fed with BLW was reported in the same study. In the study by Cameron et al. (2015), it was stated that iron intake was lower in infants fed with BLW than in infants fed with TCF, but no iron deficiency was observed in infants. Daniels et al. (2018) reported in their study that there was no difference in iron intake between groups and that there was no risk of anemia in infants fed BLW.

A study by Pearce and Langley-Evans (2022), reported that iron intake was higher in 6- and 8- month-old infants fed with traditional methods. Daniels et al. (2018) found in their study that there was no difference in iron intake and plasma ferritin levels in infants fed with BLW. In the same study, no difference was found between the groups regarding iron deficiency and anemia risk in babies by 12 months of age.

When the studies comparing nutrient, energy, and micronutrient intake according to the feeding methods were examined, it was seen that no studies were comparing the food and micronutrient intake after complementary feeding training. Iron levels in studies were found to differ in studies. Our study was a randomized in which complementary feeding training was provided to both groups.

Obesity risk

The height growth and weight gain of infants, as well as Z-scores of growth curves standardized by WHO (Weight For Height, Length/Height-For-Age, and Weight For Age) were examined in this study. Although there was no significant difference between the groups regarding height and weight gain of infants, the height and weight variables of infants fed with both methods increased over time. In the study by Dogan et al. (2018), which examined the effect of feeding with the BLW and the TCF methods on growth in infants, it was found that there was no difference between the groups in terms of height growth and weight gain. The rate of infants (98%) with average weight and fed with the BLW method was also found to be higher than the infants fed with the TCF method. In the study by Sazawal et al. (2014), in which they made home visits with home-based training for complementary

feeding, it was reported that the training provided affected the growth and development of infants. When studies on obesity risk were examined, Kahraman et al. (2020) reported in their study that there was a higher risk of obesity in babies fed with the TCF method and that there was no obesity risk in babies fed with the BLW method. In the study by Taylor et al. (2017), on the other hand, it was reported that there was no risk of growth retardation and obesity in both groups.

In the study by Zhang et al. (2013), comparing whether there was a difference between the training group that received complementary feeding training and the control group that was not trained in terms of growth and development of infants, it was determined that there was a significant increase in Weight-For-Age (WAZ), Height-For-Age (HAZ), and Weight-For-Length/Height (WHZ) values of 9- and 12-month-old infants in the training group. This study has revealed the effect of training for complementary feeding on growth. When the studies are examined, it is seen that both feeding methods have different results in terms of physical growth and obesity risk in infants. Therefore, more studies are needed to be conducted to evaluate the risk of obesity.

Strengths of study

The strength of this study is that it is a randomized controlled experimental study that evaluates self-feeding, early transition to solid foods and home meals, iron intake and anemia risk status, obesity, and choking risk in infants who switch to complementary feeding. In this study, the other strengths are that the training is given according to complementary feeding methods, and the results are evaluated according to both groups and time.

Limitations of study

The limitation of our study is that the data were collected online due to the pandemic. This situation caused 2 study participants to be unable to regularly participate in the training, and a total of 4 participants to complete the data.

Nursing implications or recommendations

The results of this study are evidence for parents and healthcare professionals on complementary feeding with the BLW method. In this way, nurses can easily use the developed modular training in primary and secondary healthcare institutions and present them to families. The active role of nurses and pediatricians in complementary feeding can contribute significantly to the growth and development of infants, and encourage families. The study results show that the BLW method is as effective as the TCF method and can be safely administered by families and healthcare professionals. This study presents evidence about the disadvantages of the BLW diet in the literature. Nurses and pediatricians can safely provide complementary nutrition education and support infant growth and development in clinical practice and primary health care during the complementary feeding period.

Conclusion

In this study, in which complementary feeding training was given with the TCF and BLW methods, it was concluded that the infants fed with the BLW method had an earlier transition to self-feeding and solids compared to the infants fed the TCF method. Still, the transition to home meals was earlier in the infants fed with the TCF method. In this study, contrary to the concerns in the literature, the risk of choking was not found to be significant in infants fed with both feeding methods. Still, mothers reported the risk of retching and choking at the beginning of the transition to complementary feeding in infants fed with the TCF method. In response to the concerns about iron intake and anemia risk, no risk of anemia was observed in infants fed with both feeding methods while hemoglobin levels were found to increase significantly in infants fed

with BLW method in this study. It was also found that iron intake was encouraged more in the BLW method than in the TCF method. In this study, which also evaluated the risk of obesity, it was determined that there was no risk of obesity in feeding with both nutrition methods. While these results revealed the effect of the training given, they also indicated that feeding with the BLW method encouraged self-feeding and higher iron intake. Thus, the risk of anemia was not observed in this study.

Authors' contributions

Study concept and design: M.K and N.A. Analysis and interpretation of data: N.A. Drafting of the manuscript: M.K, P.M.T and N.A. Critical revision of the manuscript for important intellectual content: M.K. Interpretation of Statistical analysis: M.K, P.M.T and N.A. Obtained funding: M.K and N.A. Study supervision: M.K.

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Consent to participate

The consent forms were obtained from the university's Ethics Committee (Approval number: 12.02.2019/506) and from the gynecology and pediatrics hospital and two Family Health Centers.

Consent to publish

The copyright of the article belongs to this journal.

Declaration of Competing Interest

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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References

- Addesi, E., Galloway, A. T., Wingrove, T., Brochu, H., Pierantozzi, A., Bellagamba, F., & Farrow, C. V. (2021). Baby-led weaning in Italy and potential implications for infant development. *Appetite*, 164, Article 105286.
- Agostoni, C., Braegger, C., Decsi, T., Kolacek, S., Koletzko, B., Michaelsen, K. F., ... ESPGHAN Committee on Nutrition. (2009). Breastfeeding: A commentary by the ESPGHAN Committee on Nutrition. *Journal of Pediatric Gastroenterology and Nutrition*, 49(1), 112–125.
- Brown, A. (2018). No difference in self-reported frequency of choking between infants introduced to solid foods using a baby-led weaning or traditional spoon-feeding approach. *Journal of Human Nutrition and Dietetics*, 31(4), 496–504.
- Brown, A., Jones, S. W., & Rowan, H. (2017). Baby-led weaning: The evidence to date. *Current Nutrition Reports*, 6, 148–156.
- Brown, A., & Lee, M. (2011). A descriptive study investigating the use and nature of baby-led weaning in a UK sample of mothers. *Maternal & Child Nutrition*, 7(1), 34–47.
- Brown, A., & Lee, M. D. (2015). Early influences on child satiety-responsiveness: The role of weaning style. *Pediatric Obesity*, 10(1), 57–66.
- Cameron, S. L., Heath, A. L. M., & Taylor, R. W. (2012). Healthcare professionals and mothers' knowledge of, attitudes to and experiences with, baby-led weaning: A content analysis study. *BMJ Open*, 2(6), Article e001542.
- Cameron, S. L., Taylor, R. W., & Heath, A. L. M. (2015). Development and pilot testing of baby-led introduction to SolidS version of baby-led weaning modified to address concerns about iron deficiency, growth faltering, and choking. *BMC Pediatrics*, 15(1), 1–11.
- Carothers, C., & Gribble, K. (2014). Infant and young child feeding in emergencies. *Journal of Human Lactation*, 30(3), 272–275.

- Cole, N. C., An, R., Lee, S. Y., & Donovan, S. M. (2017). Correlates of picky eating and food neophobia in young children: A systematic review and meta-analysis. *Nutrition Reviews*, 75(7), 516–532.
- Daniels, L., Heath, A. L. M., Williams, S. M., Cameron, S. L., Fleming, E. A., Taylor, B. J., ... Taylor, R. W. (2015). Baby-Led Introduction to Solids (BLISS) study: A randomized controlled trial of a baby-led approach to complementary feeding. *BMC Pediatrics*, 15(1), 1–15.
- Daniels, L., Taylor, R. W., Williams, S. M., Gibson, R. S., Fleming, E. A., Wheeler, B. J., ... Heath, A. L. M. (2018). Impact of a modified version of baby-led weaning on iron intake and status: A randomized controlled trial. *BMJ Open*, 8(6), Article e019036.
- Dogan, E., Yilmaz, G., Caylan, N., Turgut, M., Gokcay, G., & Oguz, M. M. (2018). Baby-led complementary feeding: Randomized controlled study. *Pediatrics International*, 60(12), 1073–1080.
- Fangupo, L. J., Heath, A. L., Williams, S. M., Somerville, M. R., Lawrence, J. A., Gray, A. R., ... Taylor, R. W. (2016). A baby-led approach to eating solids and risk of choking. *Pediatrics*, 138(4), Article e20160772.
- Hanindita, M. H., Widjaja, N. A., Irawan, R., & Hidajat, B. (2019). Comparison between baby-led weaning and traditional spoon-feeding on iron status and growth in breastfed infants. *Carpathian Journal of Food Science and Technology*, 5(11), 96–100.
- Kahraman, A., Gümüş, M., Binay Yaz, Ş., & Başbakkal, Z. (2020). Baby-led weaning versus traditional weaning: The assessment of nutritional status in early childhood and maternal feeding practices in Turkey. *Early Child Development and Care*, 190(5), 615–624.
- Köksal, E., Yalçın, S. S., Pekcan, G., Özbas, S., Tezel, B., & Köse, M. R. (2015). Complementary feeding practices of children aged 12–23 months in Turkey. *Central European Journal of Public Health*, 23(2), 149–154.
- Kurtuncu, M., Arslan, N., & Eyupoglu, N. D. (2018). *A baby friendly approach to complementary nutrition. Health sciences research in the globalizing world* (pp. 355–364). Bulgarian: St. Kliment Ohridski University Press.
- Moore, A. P., Milligan, P., & Goff, L. M. (2014). An online survey of knowledge of the weaning guidelines, advice from health visitors, and other factors that influence weaning timing in UK mothers. *Maternal & Child Nutrition*, 10(3), 410–421.
- Morison, B. J., Heath, A. M., Haszard, J. J., Hein, K., Fleming, E. A., Daniels, L., ... Taylor, R. W. (2018). Impact of a modified version of baby-led weaning on dietary variety and food preferences in infants. *Nutrients*, 10(8), 1092–1105.
- Morison, B. J., Taylor, R. W., Haszard, J. J., Schramm, C. J., Williams Erickson, L., Fangupo, L. J., ... Heath, A. L. (2016). How different are baby-led weaning and conventional complementary feeding? A cross-sectional study of infants aged 6–8 months. *BMJ Open*, 6(5), Article e010665.
- Pearce, J., & Langley-Evans, S. C. (2022). Comparison of food and nutrient intake in infants aged 6–12 months, following baby-led or traditional weaning: A cross-sectional study. *Journal of Human Nutrition and Dietetics*, 35(2), 310–324.
- Rowan, H., Lee, M., & Brown, A. (2022). Estimated energy and nutrient intake for infants following baby-led and traditional weaning approaches. *Journal of Human Nutrition and Dietetics*, 35(2), 325–336.
- Sazawal, S., Dhingra, P., Dhingra, U., Gupta, S., Iyengar, V., Menon, V. P., ... Black, R. E. (2014). Compliance with home-based fortification strategies for delivery of iron and zinc: Its effect on hematological and growth markers among 6–24 months old children in North India. *Journal of Health, Population, and Nutrition*, 32(2), 217–226.
- Taylor, R. W., Conlon, C. A., Beck, K. L., von Hurst, P. R., Te Morenga, L. A., Daniels, L., ... Heath, A. M. (2021). Nutritional implications of baby-led weaning and baby food pouches as novel methods of infant feeding: Protocol for an observational study. *JMIR Research Protocols*, 10(4), Article e29048.
- Taylor, R. W., Williams, S. M., Fangupo, L. J., Wheeler, B. J., Taylor, B. J., Daniels, L., ... Heath, A. M. (2017). Effect of a baby-led approach to complementary feeding on infant growth and overweight: A randomized clinical trial. *JAMA Pediatrics*, 171(9), 838–846.
- Williams Erickson, L., Taylor, R. W., Haszard, J. J., Fleming, E. A., Daniels, L., Morison, B. J., ... Heath, A. M. (2018). Impact of a modified version of baby-led weaning on infant food and nutrient intakes: The BLISS randomized controlled trial. *Nutrients*, 10(6), 740–756.
- World Health Organization. (2009). *Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals* (p. 2009). <https://apps.who.int/iris/handle/10665/44117>.
- Zhang, J., Shi, L., Chen, D. F., Wang, J., & Wang, Y. (2013). Effectiveness of an educational intervention to improve child feeding practices and growth in rural China: Updated results at 18 months of age. *Maternal & Child Nutrition*, 9(1), 118–129.