



**Parent-led or Baby-led? Associations between complementary feeding practices and health-related behaviours in a survey of New Zealand families**

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5 **Title: Parent-led or Baby-led? Associations between complementary**  
6 **feeding practices and health-related behaviours in a survey of New**  
7 **Zealand families.**  
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## 30 ABSTRACT

**Objective:** To determine feeding practices and selected health-related behaviours in New Zealand families following a “baby-led” or more traditional “parent-led” method for introducing complementary foods.

**Design, setting and participants:** 199 mothers completed an online survey about introducing complementary foods to their infant. Participants were classified into one of three groups: “adherent Baby-Led Weaning (BLW)”, the infant mostly or entirely fed themselves at 6-7 months; “self-identified BLW”, mothers reported following BLW at 6-7 months but were using spoon-feeding at least half the time; and “parent-led feeding”, the mother reported not having tried BLW.

**Results:** 8% were following “adherent BLW” and 21% “self-identified BLW”. Compared to “self-identified BLW” and “parent-led feeding”, a higher proportion of the “adherent BLW” met the WHO recommendations to exclusively breastfeed for 6 months and introduce complementary foods at 6 months. The “adherent BLW” group was more likely to have family foods ( $p=0.018$ ), and less likely ( $p=0.002$ ) to have commercially prepared baby food. Both BLW groups were more likely to share meals with the family compared to “parent-led feeding”. In contrast to “self-identified BLW” and “parent-led feeding”, the “adherent BLW” group did not offer iron-fortified cereal as a first food.

**Conclusion:** This study suggests that although many parents consider they follow BLW, very few are following it strictly. The extent to which BLW was followed was associated with potential benefits (e.g., sharing family meals) and risks (e.g., low iron first foods) highlighting the importance for health professionals and researchers of accurately describing the extent of adherence to BLW.

## ARTICLE SUMMARY

### 60 Article focus

- Baby-Led Weaning (BLW) is becoming increasingly popular amongst parents of young infants.
  - There are a number of proposed benefits associated with BLW including a healthier BMI, and a number of possible risks, including poorer iron intakes.
- 65• However, very little is known about how BLW is practised in the community and how strictly it is followed by parents.

### Key messages

- The extent to which BLW is practised varies.
- 70• The association of BLW with potential benefits and possible risks may differ depending on the extent to which the method is adhered to.
- Most parents use traditional spoon-feeding for introducing complementary foods, but many would be willing to try BLW if they had another infant.

### 75 Strengths and limitations of this study

- This is the first study to investigate BLW in the general population.
- The survey was advertised in main urban centres of New Zealand and may not be representative of rural families.
- As the sample size is small results should be interpreted with caution.

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## INTRODUCTION

Baby-Led Weaning (BLW) is an alternative method for introducing complementary foods to infants in which the infant feeds themselves hand-held foods instead of being spoon-fed by an adult [1].

The small body of existing research suggests that BLW is feasible for most 6-month old infants from a motor development point of view. [2 3] It also suggests that BLW is associated with potential benefits including lower levels of maternal anxiety, restriction, pressure to eat and monitoring during the complementary feeding period; [4] and perhaps healthier eating patterns and BMI. [5] However, none of the studies to date have drawn their BLW cases and parent-led controls from the same population. Given the paucity of current research, and the lack of randomized controlled trials, healthcare professionals [6] and health governing bodies [7] are unwilling to support BLW as a population recommendation. Anecdotal reports suggest that the use of BLW is increasing in New Zealand and other countries including the United Kingdom.

Baby-Led Weaning in its strictest form requires that the infant has complete control over their own eating from the beginning of the complementary feeding period. [1] In theory, BLW is therefore a distinctly different method of infant feeding compared to the traditional method of spoon-feeding purées. [1] However, essential questions, such as how parents actually follow BLW in practice, and the extent to which BLW is associated with health-related behaviours in the general population, remain unanswered.

The aim of this survey was to determine feeding practices and selected health-related behaviours in New Zealand families following “baby-led” or more traditional “parent-led” methods for introducing complementary foods.

## METHODS

### Participants

Two hundred and thirty parents who had an infant aged 6-12 months old were recruited from four main urban centres in New Zealand (Auckland, Wellington, Christchurch, Dunedin) by newspaper advertisement. Inclusion criteria were that participants had a healthy child aged 6-12 months who was born full term and was currently living in New Zealand, with no diagnosed neurological or developmental condition. Recruitment for the study stated that we were interested in when and how complementary foods were introduced to babies. To reduce selection bias, BLW was not mentioned. Advertisements for the study provided a web link to the online questionnaire. The study was approved by the Human Ethics Committee of the University of Otago, Dunedin, New Zealand.

### Data collection

The population-based, cross-sectional survey was administered from May 2010 to August 2010 (three months in total). Participants could only complete the survey once for one child. Consent and eligibility were established using check boxes that had to be completed before the participant was allowed entry to the survey.

### The survey

The current survey questions were based on a web-based infant feeding survey previously administered in the United Kingdom [8], current infant nutrition literature, and consultation with a paediatrician, a paediatric dietitian, and health researchers. The survey was designed and hosted using [www.SurveyMonkey.com](http://www.SurveyMonkey.com) (Survey Monkey Copyright © 1999 - 2009 SurveyMonkey.com). A pretest was electronically administered to 15 parents with young children aged 1-10 years to verify survey functionality and understandability and the survey was modified based on the pretesting results. The modifications included deleting a repeated question and rephrasing some questions to improve clarity.

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3 The online survey was divided into four main sections (Table 1):  
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- 5 1. Starting complementary foods
- 6 2. Baby-Led Weaning
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- 8 3. Attitudes towards, and experiences of, feeding the infant
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- 10 4. Demographic information
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**Table 1. Overview of data collected in the survey**

Survey section	Data collected
Section 1: Starting complementary foods	<p data-bbox="651 397 1060 430"><b>Timing and type of complementary food</b></p> <p data-bbox="651 430 1785 511">Participants were asked: Age (months) when infant first had complementary food, main reason(s) for starting food at this age, the type of food given, form the food was in (puréed, mashed, whole), whether the food was home made or commercially prepared.</p> <p data-bbox="651 527 976 560"><b>Mealtimes and eating patterns*</b></p> <p data-bbox="651 560 1785 641">Participants were asked: Frequency with which they ate with the infant (could have been different foods but baby ate at the same time), frequency infant ate family foods (could have been at a different time but they ate the same food that the rest of the family ate).</p> <p data-bbox="651 657 871 690"><b>Gagging and choking</b></p> <p data-bbox="651 690 1785 738">Many parents confuse gagging with choking or find it hard to differentiate between the two [9]. We provided a written description before asking about gagging and choking.</p> <p data-bbox="651 738 1785 803">Participants were asked: If child had ever gagged or choked and if so, how often, the form (purée, mashed, whole) of food that was involved, child’s age when choked.</p>
Section 2: Baby-Led Weaning	<p data-bbox="651 820 1785 868">Participants were asked: had they tried BLW, the extent to which they had followed BLW, whether they would recommend the method to other parents.</p> <p data-bbox="651 868 1785 982">Participants who reported not having tried BLW were directed to questions asking their opinion of BLW based on a brief description (table 2) and short ‘introduction to BLW’ video, which was embedded in the survey. They were asked whether they would try BLW if they had another child and to provide reasons why they would or would not try it.</p>
Section 3: Attitudes towards, and experiences of, feeding the infant	<p data-bbox="651 998 1785 1079">Participants were asked: about their satisfaction with their choice of infant feeding method for the current infant, whether they would consider changing feeding methods if they had another child, reasons for liking or disliking the method of feeding used.</p>
Section 4: Demographic information	<p data-bbox="651 1104 1785 1161">Participants were asked: age, sex, ethnicity, education, household, number of other children, employment status, region of New Zealand they lived in.</p>

\* To obtain data for all infants at 6 to 7 months of age, parents were asked to answer questions relating to current age and also when the child was 6 to 7 months of age. Parents whose child was currently 6 to 7 months of age only completed this section once and then skipped to the following section.



**Table 2. Description of Baby-Led Weaning included in the Survey**

Traditional infant feeding involves offering the baby puréed foods first, then gradually increasing the texture from purée to mash, to lumpy and then to family foods. Baby Led Weaning is different and involves the infant feeding themselves right from the start. You offer your baby pieces of soft food of a size and shape that the baby can handle (for example steamed broccoli or carrots). The baby is allowed to explore the food at their own pace and they decide how much they will eat. Rather than preparing separate meals for your baby, they are offered foods similar to what the rest of the family is eating.

**Data analysis**

To compare those who considered themselves to be following BLW with those who met stricter criteria for BLW at 6-7 months of age we defined two BLW groups. Figure 1 shows the questions that determined which of the three methods parents were considered to have used for introducing complementary foods.

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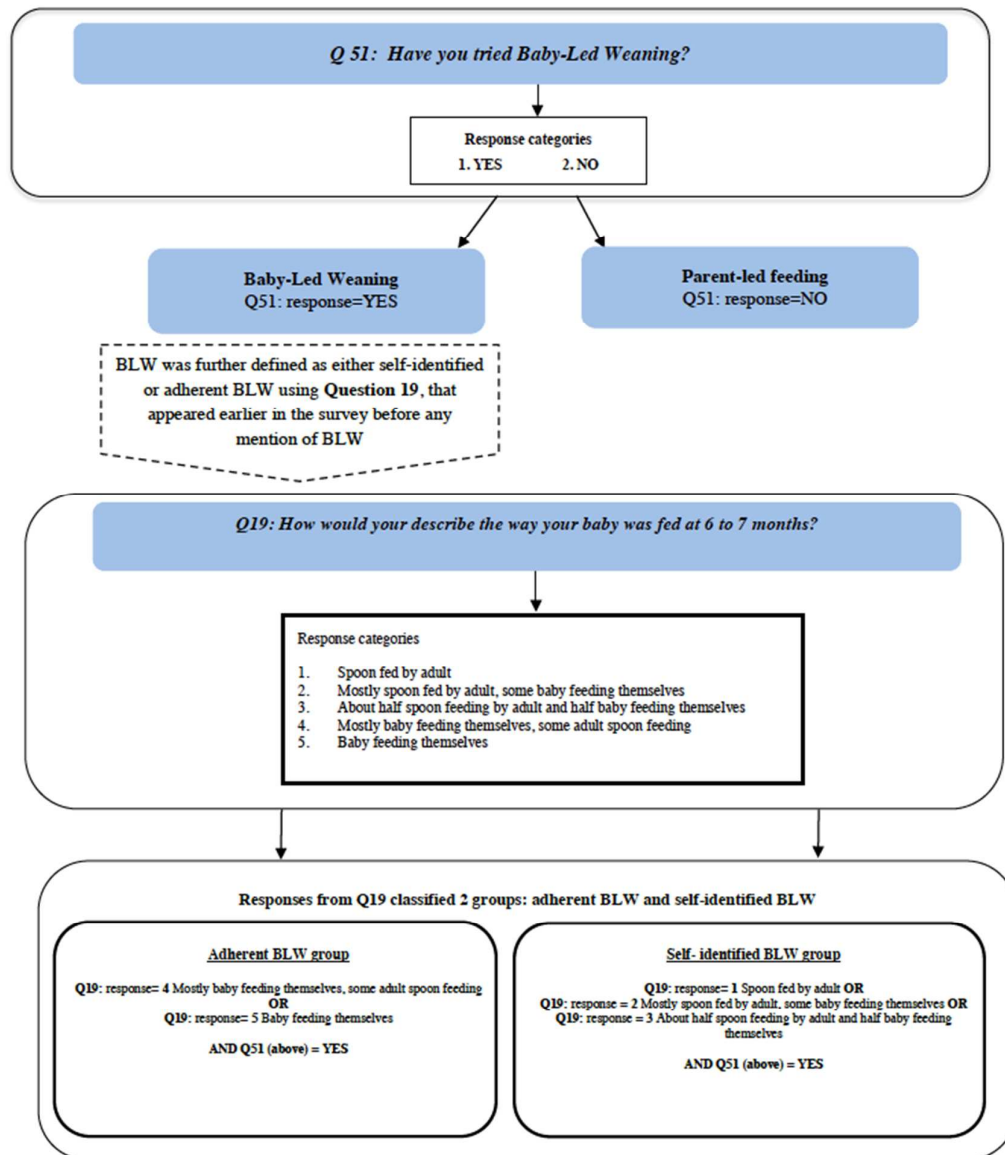


Figure 1. Survey questions used to classify infant feeding method

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5 The **adherent BLW group** consisted of those who reported having tried BLW,  
6 and whose infant mostly or always self-fed at 6 to 7 months (Figure 1). A broader  
7 definition of BLW was used to assign parents to the **self-identified BLW** group.  
8 These participants reported having tried BLW, but spoon-fed their infant at least  
9 half the time. All other participants reported not having tried BLW. These  
10 participants were classified as **parent-led feeding**.  
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17 Information on ethnicity was collected using the 2006 NZ Census of Populations  
18 and Dwellings question as recommended by Statistics NZ. [10] Participants who  
19 nominated two or more ethnic groups were assigned to a single group using the  
20 prioritization system recommended by Statistics NZ, with the order of priority  
21 being (from highest to lowest): Māori, Pacific, Asian, Other, NZ European. [10]  
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### 27 **Statistical analysis**

28 All analyses were conducted using Stata™ version 12 (STATA Corporation,  
29 College Station, Texas, USA). Descriptive statistics were tabulated and Chi-square  
30 tests and Fishers Exact test (when cell counts were less than 10) were performed  
31 to examine differences in proportions. A p-value < 0.05 was considered to  
32 indicate statistical significance. Characteristics, and feeding and health-related  
33 practices were compared across three groups: 1) “adherent BLW”, 2) “self-  
34 identified BLW”, and 3) “parent-led feeding”.  
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## RESULTS

A total of 199 participants completed the online survey (20 of the 230 people recruited did not meet the eligibility criteria and eleven did not complete the entire survey). Most (n=140, 70%) of the sample were classified as “parent-led feeding”, 42 (21%) as “self-identified BLW” and 17 (9%) as “adherent BLW”. Table 3 presents the participant characteristics. All participants who answered the survey were mothers. The mean age of the infants was 8.6 months. Approximately half of the mothers in the sample were 30 to 39 years of age, 66% had a tertiary qualification, and 55% had more than one child. Maternal age (p=0.047; a greater proportion of mothers aged 20-29 followed “self-identified BLW”) and residing region (p=0.001; “adherent BLW” was greater among those living in Christchurch and least likely among those living in Auckland) were significantly associated with feeding method. There were no other significant differences in participant characteristics between feeding methods (p≥0.05).

**Table 3 Characteristics of participants**

		All (n=199)	Parent-led feeding (n= 140) n (%)	Self-identified BLW (n= 42) n (%)	Adherent BLW (n=17) n (%)	p-value
Maternal age at child's birth (years)	<20	13	11 (8.2)	1 (2.4)	1 (6.25)	<b>0.005</b>
	20-29	49	28 (20.0)	17 (40.5)	4 (23.5)	
	30-39	103	71 (50.7)	24 (57.1)	8 (47.1)	
	40-49	28	24 (17.1)	0	4 (23.5)	
	Missing	6	6	0	0	
Infant age (months)	6-7	52	36 (25.7)	13 (30.9)	3 (17.6)	0.194
	7-8	23	18 (12.9)	2 (4.8)	3 (17.6)	
	8-9	34	27 (19.3)	5 (11.9)	2 (11.8)	
	9-10	31	18 (12.9)	12 (28.6)	1 (5.9)	
	10-11	29	19 (13.6)	5 (11.9)	5 (29.4)	
	11-12	30	22 (15.7)	5 (11.9)	3 (17.6)	
	Missing	0	0	0	0	
Maternal education	Year 11 or below**	6	3 (2.1)	3 (7.1)	0	0.572
	Year 12 or 13†	55	39 (27.9)	11 (26.2)	5 (29.4)	
	Post-secondary school	34	27 (19.3)	5 (11.9)	2 (11.8)	
	University degree or higher	98	65 (46.4)	23 (54.8)	10 (58.8)	
	Missing	6	6	0	0	
Ethnicity	NZ European	121	78 (55.7)	32 (76.2)	11 (64.7)	0.966
	NZ Māori	12	8 (5.7)	4 (9.5)	0	
	Samoan	2	2 (1.4)	0	0	
	Indian	4	4 (3.8)	0	0	
	Chinese	1	1 (2.9)	0	1 (5.9)	
	English	9	6 (5.7)	2 (4.8)	0	
	Other	9	6 (5.7)	3 (7.1)	1 (5.9)	
	Missing	41	35	1	4	
Parity	Primiparous	89	66 (47.1)	14 (33.3)	9 (52.9)	0.240
	Multiparous	110	74 (52.9)	28 (66.7)	8 (47.1)	
	Missing	0	0	0	0	
Household composition	Mother and father	160	115 (82.1)	30 (71.4)	15 (88.2)	0.271
	Single parent	23	17 (12.1)	6 (14.3)	0	
	Missing	16	8	6	2	
Residing region	Auckland	78	61 (43.6)	17 (43.6)	0	<b>0.001</b>
	Wellington	42	28 (20.0)	12 (28.6)	2 (11.8)	
	Christchurch	29	17 (12.1)	4 (9.5)	8 (47.1)	
	Dunedin	31	21 (15.0)	5 (11.9)	5 (29.4)	
	Other	8	7 (5.0)	1 (2.4)	0	
	Missing	11	6	3	2	
Maternal employment status	Currently in paid employment	44	25 (18.7)	15 (35.7)	4 (23.5)	0.119
	Not in paid employment	89	62 (46.3)	21 (50.0)	6 (35.3)	
	On parental leave, returning to paid employment	40	32 (23.9)	5 (11.9)	3 (17.6)	
	On parental leave, not returning to paid employment	18	15 (11.2)	1 (2.4)	2 (11.8)	
	Missing	8	6	0	2	

\* p-value compares feeding methods

\*\* Year 11 is usually at age 15-16 years

† Years 12 &amp; 13 are usually at ages 16-18 years

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3 More than half (58%) of the sample surveyed exclusively breastfed their infant  
4 to five months of age, and only 4% reported never exclusively breastfeeding.  
5 However, 63% of infants received complementary food before the recommended  
6 age of six months. A greater number in the “adherent BLW” group (52.9%) met  
7 the WHO recommendation to exclusively breastfeed for 6 months [11] compared  
8 to the “self-identified” (27.5%) and “parent-led feeding” (21.4%) groups  
9 (p=0.026). Similarly, the number managing to meet the recommendation to  
10 introduce complementary foods at 6 months was significantly greater in the  
11 “adherent BLW” group. A total of 64.7% in the “adherent BLW” compared to the  
12 33.3 % in the “self-identified BLW” and 33.6% in the “parent-led feeding” group  
13 introduced complementary food at  $\geq 6$  months (p=0.044).  
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23 Table 4 summarizes a range of feeding practices and health-related behaviours.  
24 Compared to the “self-identified BLW” and “parent-led feeding” groups, the  
25 “adherent BLW” group were more likely to be having foods that the family ate  
26 (i.e. the same food but not necessarily at the same time as the rest of the family)  
27 (p=0.018), more likely to begin eating family foods when they started  
28 complementary foods or within the first month of starting (p<0.001), and were  
29 less likely to be offering their baby commercially prepared baby food (p=0.002).  
30 Both BLW groups were more likely to be sharing all or most of their meals with  
31 the family (i.e. having meals at the same time but not necessarily the same food)  
32 compared to “parent-led feeding” (p=0.040). In contrast to the “self-identified  
33 BLW” and “parent-led feeding” groups, “adherent BLW” children were not  
34 offered infant iron-fortified cereal as their first food.  
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**Table 4 Feeding practices and health-related behaviours by feeding method used to introduce complementary foods**

		All (n=199)	Parent-led feeding (n= 140) n (%)	Self-identified BLW (n= 42) n (%)	Adherent BLW (n=17) n (%)	p-value*
Baby eats family food ( <i>may be modified or eaten at a different time</i> )	Doesn't eat family foods	8	2 (1.4)	6 (14.3)	9 (52.9)	<b>0.018</b>
	Occasionally	150	113 (80.7)	28 (66.7)	8 (47.1)	
	Most of the time or all of the time	41	25 (17.8)	8 (19.0)	8 (47.1)	
	Missing	0	0	0	0	
Age baby started eating family food	When started CF or within 1 mo	20 (10.1)	7 (5.0)	4 (9.5)	9 (52.9)	<b>&lt;0.001</b>
	2-4mo after starting CF	68 (34.2)	50 (35.7)	13 (31.0)	5 (31.3)	
	Doesn't eat with family	111 (55.8)	83 (59.3)	25 (59.5)	3 (18.8)	
	Missing	0	0	0	0	
Baby shares their meal with the family ( <i>even if food is different</i> )	None of their meals	43	34 (24.2)	7 (16.7)	2 (11.5)	<b>0.040</b>
	Some of their meals	90	67 (47.8)	19 (45.2)	4 (23.5)	
	Most of their meals	48	28 (20.0)	12 (28.6)	8 (47.1)	
	All of their meals	16	9 (6.5)	4 (9.5)	3 (17.6)	
	Missing	2	2	0	0	
First food offered	Baby rice cereal	100	75 (53.6)	24 (57.1)	1 (5.9)	<b>0.001</b>
	Fruit	70	48 (34.3)	12 (28.6)	10 (58.8)	
	Vegetables	29	17 (12.1)	6 (14.3)	6 (35.3)	
	Meat	0	0	0	0	
	Missing	0	0	0	0	
Amount of commercially prepared baby food	All of it	14	11(7.9)	3 (7.1)	0	<b>0.002</b>
	Most of it	34	21 (15.0)	11 (26.2)	2 (11.8)	
	Half of it	47	38 (27.0)	8 (19.0)	1 (5.9)	
	Hardly any of it	78	58 (41.4)	15 (35.7)	5 (29.4)	
	None of it	26	12 (8.6)	5 (11.9)	9 (52.9)	
Missing	0	0	0	0		
Reported a choking episode	No	130 (67.3)	95 (69.3)	24 (60.0)	11 (68.8)	0.567
	Yes	63 (32.6)	42 (30.7)	16 (40.0)	5 (31.3)	
	Missing	7	3	2	2	
Reported a gagging episode	No	51 (26.2)	39 (27.9)	7 (16.6)	5 (29.4)	0.286
	Yes	143 (73.7)	99 (70.7)	34 (81.0)	10 (58.8)	
	Missing	5	2	1	2	

\* p-value compares feeding methods

CF Complementary foods

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5 Across the whole sample, 32.6% of participants reported at least one choking  
6 episode, and most (71.4%) of these participants reported that choking had  
7 occurred with whole food. There was no difference between groups for the  
8 proportion reporting at least one choking episode, the form (puréed, mashed or  
9 whole) that the food was in, or the method of feeding (spoon-feeding or self-  
10 feeding) when the choking episode occurred ( $p>0.05$ ). There was also no group  
11 difference in the proportion reporting at least one gagging episode ( $p>0.05$ ).  
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18 Thirty-eight per cent of all participants had not heard of BLW, 7.6% reported  
19 knowing a lot about it, and the remaining 54.1% reported knowing a moderate  
20 or small amount. A large proportion of the “parent-led feeding” group had never  
21 heard of BLW (64.4%). Participants reported hearing about BLW through a  
22 friend or family member rather than from a healthcare professional.  
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28 All families who had followed BLW reported that they would recommend the  
29 method, but interestingly more than half (59.6%) would recommend that BLW  
30 be used in combination with spoon-feeding. Forty-six per cent of those who had  
31 followed “parent-led feeding” would be willing to try BLW if they had another  
32 child. The main reasons reported for not wanting to try BLW were fear of their  
33 infant choking (55.3%), concern about the infant’s ability to eat enough (44.2%),  
34 reservation that the infant would not have the necessary motor skills to self-feed  
35 (27.6%), or considering that “parent-led feeding” had worked fine, so there was  
36 no need to change (27.1%).  
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## DISCUSSION

This is the first study to describe BLW and parent-led feeding in a sample from the general population. In contrast, previous studies have recruited participants separately from BLW specific groups or websites, with controls coming from other sources such as patient lists [5], and nurseries and community centres [4 8 12]. We found that the association between infant feeding method and health-related behaviours differed depending on the extent to which families followed BLW. Compared to the “self-identified BLW” and “parent-led feeding” group, the “adherent BLW” were more likely to meet the WHO recommendations to exclusively breastfeed for 6 months, and to begin complementary foods at 6 months of age. [11] The “adherent BLW” group were also more likely to be having foods that the family ate, and were less likely to be offering their baby commercially prepared baby food. Both BLW groups were more likely to be sharing all or most of their meals with the family compared to the “parent-led feeding” group. In contrast to the “self-identified BLW” and “parent-led feeding”, children, “adherent BLW” children were not offered infant iron-fortified cereal as their first food.

In this study, adherent BLW was defined as the baby feeding themselves all or most of the time at 6 to 7 months of age (i.e. little or no parent spoon-feeding). Previous studies [4 8] have defined BLW according to the extent of spoon-feeding and/or purées consumed. As our previous work [6] had suggested that purées could be offered to the self-feeding infant (for instance puréed mince on toast) the definition used here related only to the method of feeding (self-feeding vs. spoon-feeding) and not the form of food (purée, mashed, or whole). In practice only a small number of families (8% of this sample) were classified as following adherent BLW. A large proportion (21%) of families who reported using BLW were instead following a more flexible approach that included a combination of self-feeding and spoon-feeding. This agrees with our earlier qualitative study [6], in which families following BLW also reported using some spoon-feeding. Generally this occurred at times when their infant appeared unable to feed themselves (e.g., during illness) or specifically to ensure

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3 appropriate iron intake (parents spoon-fed iron-fortified baby cereal at  
4 breakfast). This suggests that BLW and spoon-feeding are not viewed as  
5 dichotomous methods within the community but instead as styles of infant  
6 feeding that can be combined to suit the needs of the child and the family in each  
7 feeding situation.  
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13 A concern that is commonly expressed about BLW [6] is the potential increased  
14 risk of choking when infants self-feed whole foods. When infants transition from  
15 milk to solid foods they are at increased risk of choking because they may not  
16 have developed the coordination of chewing, breathing and swallowing needed  
17 to eat food safely. [13 14] Choking is when the airway is obstructed and  
18 respiration is interrupted [15] and food related choking can be fatal. [14 16]  
19 Prevalence data on choking are limited, and no data exist on the rates of choking  
20 when complementary foods are being introduced, whether using a traditional or  
21 a BLW method. The most relevant data available show that in New Zealand in the  
22 period from 2002 to 2009, nine deaths occurred in children under six years of  
23 age as a result of the inhalation of food, specifically meat, sausage, peanuts, apple  
24 and grapes [16]. In contrast, gagging, which is very common among all infants, is  
25 less serious. [17] The gag reflex very effectively keeps large pieces of food well to  
26 the front of the mouth, only allowing well masticated food to reach the back of  
27 the mouth for swallowing. [1 18-20]. In this survey we found no difference  
28 between the groups in the proportion reporting at least one gagging or choking  
29 episode. However, more than 30% of the total sample reported at least one  
30 choking episode, and this mostly commonly involved whole foods. Since choking  
31 can be very serious it would be of concern if these reports reflect actual choking  
32 rates. Parents often find it difficult to distinguish between choking and gagging  
33 and therefore, although we included a definition of both choking and gagging in  
34 our survey, it is likely that parents have incorrectly identified choking, in  
35 particular mistaking gagging for choking.  
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53 We found a number of important associations between feeding method and the  
54 likelihood of achieving the nutrition recommendations for infants as outlined by  
55 the New Zealand Ministry of Health and WHO [11 21]. The “adherent BLW”  
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3 group were more likely to meet both the recommendation to exclusively  
4 breastfed to six months, and to introduce complementary foods at six months.  
5 Two possible explanations for this finding are that the desire to follow BLW  
6 results in parents waiting until six months, which is the age when it is considered  
7 that most healthy infants are developmentally ready to self-feed, [2 22 23] or  
8 that parents who choose BLW are more aware of and adhere to health  
9 recommendations. However, it is also feasible that parents who follow a parent-  
10 led method are able to encourage their infant to begin complementary foods  
11 earlier by feeding purées or infant cereal by spoon, which requires little input  
12 from the infant and therefore is not reliant on their developmental ability to  
13 actively participate in feeding. The results from the current study are consistent  
14 with a cross-sectional study from the United Kingdom where BLW (defined as  
15 less than 10% spoon-feeding or less than 10% purée use for total food intake)  
16 was associated with later introduction of complementary foods. [8] Furthermore  
17 a United Kingdom based survey examining the knowledge of infant feeding  
18 guidelines and the influence of healthcare professionals identified BLW as the  
19 strongest predictor for introducing complementary foods at the recommended  
20 age. [24]

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36 The feeding method used by families was associated with many other potentially  
37 health-related behaviours. Those in the “adherent BLW” group were most likely  
38 to offer fruits and vegetables as first complementary foods rather than iron-  
39 fortified cereal. It is of concern that for the “adherent BLW group” the first foods  
40 reported in this survey were poor sources of iron, as this increases the infant’s  
41 risk of suboptimal iron status [21 25-28]. Although fruits and vegetables are  
42 nutrient rich foods, they do not provide all the nutrients necessary for six-  
43 month-old children. [21] In particular, infants should receive iron-rich  
44 complementary foods such as meat, meat alternatives, or iron-fortified foods  
45 immediately when starting complementary foods to supply necessary iron. [21  
46 25-28] We are unable to determine how long only fruit and vegetables were  
47 offered, and at what age iron-rich foods, such as meat, were introduced.  
48 However, spoon-feeding iron-fortified baby rice cereal is a popular way for  
49 parents to increase their infant’s iron intake, [21] and the semi-liquid form of  
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3 infant cereals makes them a difficult food for infants to feed themselves at six  
4 months. In this survey none of the “adherent BLW” group offered infant cereal as  
5 a first food. In contrast, some of the “self-identified BLW” group did - presumably  
6 by spoon. Conversely, because the infant following BLW is eating family foods  
7 there may be greater potential for a wider variety of iron-rich foods such as  
8 pieces of cooked red meat to be offered. The bioavailability of iron from these  
9 foods is also much higher (15.5%) than from infant cereals (3%) [29]. However  
10 the results of the current study suggest that parents following BLW may need to  
11 be encouraged to offer these sources of iron immediately at 6 months.  
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20 Family meals have been linked to healthier eating patterns including greater  
21 intake of fruits and vegetables and lower intake of unhealthy foods. [30-32]  
22 However this relationship has only been examined in older children (two years  
23 and over) and the benefits of family meals for younger children (i.e., 6 to 12  
24 months) is yet to be determined. Furthermore, no longitudinal studies have  
25 investigated whether the health benefits associated with sharing family meals  
26 track into later life. Aside from the potential nutritional benefits associated with  
27 sharing family meals, there are other important reasons why infants should eat  
28 with the family, such as mealtimes providing an opportunity to communicate,  
29 learn, and develop family rituals. [33] Our results showed the “adherent BLW”  
30 parents were sharing a greater number of meals with their infant, and were  
31 likely to be doing this within one month of the initiation of complementary  
32 feeding. Brown and Lee [12] reported similar results in their qualitative study.  
33 Results from the pilot study (n=10) of Rowan and Harris [34] also showed BLW  
34 families were sharing most meals (average of 3 out of the 3.5 meals per day)  
35 with their child by 9 months of age.  
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49 In addition to sharing family meals, exposure to family foods (the same foods  
50 eaten by other family members) may encourage healthier long-term eating  
51 patterns. [35-37] Results from a recent representative Scottish study showed  
52 that eating family foods was the most important aspect of family meals  
53 associated with a healthier diet at age five years (i.e., it is the food choice that has  
54 greater importance than the form and function of the meal). [38] Food  
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3 neophobia (the reluctance to eat, or avoidance of new food [39]) and ‘fussy or  
4 picky eating’ (children who consume an inadequate variety of food through  
5 rejection of unfamiliar food [40]) are most prevalent around two to three years  
6 of age. [41] However early repeated exposures to a variety of different food  
7 textures and tastes during the introduction to complementary foods has been  
8 shown to reduce the extent of the food refusal. [37 42 43] In this survey, the  
9 “adherent BLW” infants were having a greater amount of family foods, as well as  
10 less commercially purchased food, whereas, families who followed the “parent-  
11 led feeding” method reported a greater proportion of commercially prepared  
12 food. Whilst purchased baby food is nutritionally appropriate [21] and many  
13 parents choose it for this reason, it is typically bland and of a smooth  
14 consistency. Only a longitudinal study would be able to determine the effects of  
15 early exposure to family foods compared with commercially prepared baby food  
16 on the infant’s neophobia and fussy or picky eating in later infancy.  
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29 Most parents in the current study either supported BLW or would be willing to  
30 try it with a subsequent child. All families who had followed BLW reported that  
31 they would recommend the method, but interestingly more than half would  
32 recommend that BLW be used in combination with spoon-feeding. Although  
33 more than one-third of the sample had not heard of BLW, after watching a short  
34 video and reading the brief description of BLW embedded in the survey 46%  
35 reported being willing to try it with another child. Combining the parents who  
36 were willing to use BLW with those who reported already using it suggests that  
37 79% of this sample would be willing to adopt, at least aspects of, a baby-led  
38 approach, even though a large proportion had, prior to the survey, not heard of  
39 BLW. Those not willing to try BLW were concerned about choking, energy intake,  
40 and developmental readiness of the infant to self-feed at six months or  
41 considered that the “parent-led feeding” method had worked well for their  
42 family, precluding any need to change.  
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54 This study has a number of strengths and weaknesses. We attempted to improve  
55 the representativeness of our sample by advertising the study in public domains  
56 (particularly community distributed free newspapers). Recruiting participants  
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3 from the general population instead of specific groups improves the likelihood of  
4 a more representative sample. [44 45] We also avoided mentioning BLW in the  
5 advertisement to reduce the bias associated with recruiting only those familiar  
6 with BLW. However, as the survey was administered through the Internet it  
7 required participants to have access to the Internet and possess computer skills.  
8 Recent figures show that 86% of NZ families have personal internet access [46]  
9 suggesting a large proportion could access the current survey. However our  
10 newspaper advertising was restricted to urban areas and this may have affected  
11 our sample, as the demographics characteristics of the current sample do not  
12 reflect those of the general New Zealand population. In particular, the sample  
13 was highly educated with more mothers having a university degree (66%)  
14 compared to the general population (40%). [47] Therefore, as this study was  
15 relatively small (n=199) and may have comprised participants who were more  
16 computer literate, caution must be used when interpreting results.  
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29 In conclusion, the majority of our sample were using the parent-led method of  
30 spoon-feeding purées to introduce complementary foods to their child. Twenty-  
31 one percent of the sample reported using BLW but were not strictly limiting  
32 spoon-feeding, and a smaller number (8%) followed a strict BLW approach. We  
33 found several important associations between feeding method and health  
34 related behaviours, suggesting that greater adherence to the self-feeding tenet of  
35 BLW was associated with exclusively breastfeeding for 6 months, beginning  
36 complementary foods at 6 months, and eating the same foods as the rest of the  
37 family from the start of the complementary feeding period. However, it is  
38 concerning that these infants were not offered infant iron-fortified cereal as a  
39 first food. Both BLW groups were more likely to be sharing all or most of their  
40 meals with their family. The results of this study suggest that for many families  
41 the practice of BLW deviates substantially from the theory. It is therefore  
42 essential that health professionals, as well as researchers, do not rely on parental  
43 self-reports of BLW, but also quantify the extent of infant self-feeding.  
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57 this study. SC was funded by a University of Otago PhD Scholarship.  
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4 design of the study, the analysis and interpretation of the data and the writing  
5 and editing of this paper. SC designed and executed the online survey and was  
6 responsible for the analysis and interpretation of the data. SC wrote the first  
7 draft of the paper, and A-L H and RWT made important intellectual contributions  
8 to the content and approved the final version.  
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16

17  
18 **Competing interests** None.  
19

20 **Ethical approval** Ethical approval was obtained from the University of Otago  
21 Ethics Committee.  
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23 **Provenance and peer review** Not commissioned.  
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25 **Data sharing statement** No additional data are available.  
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cross-sectional studies

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	2 & 5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	11 & Table 1 & Figure 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	11 & Table 1
Bias	9	Describe any efforts to address potential sources of bias	16
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6 & 7
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	Treated as missing Table 3 & Table 4
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A

<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 & Table 3
		(b) Indicate number of participants with missing data for each variable of interest	Table 3 & 4
Outcome data	15*	Report numbers of outcome events or summary measures	12 -16
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	2 & 22
Generalisability	21	Discuss the generalisability (external validity) of the study results	22
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).



**Parent-led or Baby-led? Associations between complementary feeding practices and health-related behaviours in a survey of New Zealand families**

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Manuscripts

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5 **Title: Parent-led or Baby-led? Associations between complementary**  
6 **feeding practices and health-related behaviours in a survey of New**  
7 **Zealand families.**  
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**Key words** complementary feeding, baby-led weaning.**Word count** = 4442

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5 30 **ABSTRACT**6  
7 31 **Objective:** To determine feeding practices and selected health-related  
8 32 behaviours in New Zealand families following a “baby-led” or more traditional  
9 33 “parent-led” method for introducing complementary foods.10  
11 34 **Design, setting and participants:** 199 mothers completed an online survey  
12 35 about introducing complementary foods to their infant. Participants were  
13 36 classified into one of four groups: “adherent Baby-Led Weaning (BLW)”, the  
14 37 infant mostly or entirely fed themselves at 6-7 months; “self-identified BLW”,  
15 38 mothers reported following BLW at 6-7 months but were using spoon-feeding  
16 39 at least half the time; “parent-led feeding”, the mother reported not having  
17 40 tried BLW; and “unclassified method”, the mother reported they were not  
18 41 following BLW at 6-7 months but reported the infant mostly or entirely fed  
19 42 themselves at 6-7 months.20  
21 43 **Results:** 8% were following “adherent BLW”, 21% “self-identified BLW” and  
22 44 0% were following the “unclassified method”. Compared to “self-identified  
23 45 BLW” and “parent-led feeding”, a higher proportion of the “adherent BLW”  
24 46 met the WHO recommendations to exclusively breastfeed for 6 months and to  
25 47 introduce complementary foods at 6 months. The “adherent BLW” group was  
26 48 more likely to have family foods ( $p=0.018$ ), and less likely ( $p=0.002$ ) to have  
27 49 commercially prepared baby food. Both BLW groups were more likely to  
28 50 share meals with the family compared to “parent-led feeding”. In contrast to  
29 51 “self-identified BLW” and “parent-led feeding”, the “adherent BLW” group did  
30 52 not offer iron-fortified cereal as a first food.31  
32 53 **Conclusion:** This study suggests that although many parents consider they  
33 54 follow BLW, very few are following it strictly. The extent to which BLW was  
34 55 followed was associated with potential benefits (e.g., sharing family meals)  
35 56 and risks (e.g., low iron first foods) highlighting the importance for health  
36 57 professionals and researchers of accurately determining the extent of  
37 58 adherence to BLW.38  
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5 61 **ARTICLE SUMMARY**

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7 62 **Article focus**

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9 63• Baby-Led Weaning (BLW) is becoming increasingly popular amongst  
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11 64 parents of young infants.

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13 65• There are a number of proposed benefits associated with BLW  
14  
15 66 including a healthier BMI, and a number of possible risks, including poorer  
16  
17 67 iron intakes.

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19 68• However, very little is known about how BLW is practised in the  
20  
21 69 community and how strictly it is followed by parents.

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25 71 **Key messages**

26  
27 72• The extent to which BLW is practised varies.

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29 73• The association of BLW with potential benefits and possible risks may differ  
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31 74 depending on the extent to which the method is adhered to.

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33 75• Most parents use traditional spoon-feeding for introducing complementary  
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35 76 foods, but many would be willing to try BLW if they had another infant.

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39 78 **Strengths and limitations of this study**

40  
41 79• This is the first study to investigate BLW in the general population.

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43 80• The survey was advertised in main urban centres of New Zealand and may  
44  
45 81 not be representative of rural families.

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47 82• As the sample size is small results should be interpreted with caution.

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## 85 INTRODUCTION

86 Baby-Led Weaning (BLW) is an alternative method for introducing  
87 complementary foods to infants in which the infant feeds themselves hand-held  
88 foods instead of being spoon-fed by an adult [1]. Unlike the traditional method of  
89 infant feeding where infants may be given finger foods alongside spoon-feeding,  
90 and in many countries their introduction is delayed to 7 or 8 months of age ([2  
91 3]), BLW, in its purest form, does not include any spoon-feeding by the adult. The  
92 infant is only offered pieces of food, appropriately prepared, so that they can  
93 feed themselves.

94  
95 Although anecdotal evidence suggests that BLW is becoming popular with  
96 parents, scientific research is limited to eight publications [4-11]. The small body  
97 of existing research suggests that BLW is feasible for most 6-month old infants  
98 from a motor development point of view. [7 8] It also suggests that BLW is  
99 associated with potential benefits including lower levels of maternal anxiety,  
100 restriction, pressure to eat and monitoring during the complementary feeding  
101 period; [4] and perhaps healthier eating patterns and BMI. [9] However, none of  
102 the studies to date have drawn their BLW cases and parent-led controls from the  
103 same population. Given the paucity of current research, and the lack of  
104 randomized controlled trials, healthcare professionals [10] and health governing  
105 bodies [12] are unwilling to support BLW as a population recommendation.  
106 Anecdotal reports suggest that the use of BLW is increasing in New Zealand and  
107 other countries including the United Kingdom.

108  
109 Baby-Led Weaning in its strictest form requires that the infant has complete  
110 control over their own eating from the beginning of the complementary feeding  
111 period. [1] In theory, BLW is therefore a distinctly different method of infant  
112 feeding compared to the traditional method of spoon-feeding purées. [1]  
113 However, essential questions, such as how parents actually follow BLW in  
114 practice, and the extent to which BLW is associated with health-related  
115 behaviours in the general population, remain unanswered.

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117 The aim of this survey was to determine feeding practices and selected health-

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3 118 related behaviours in New Zealand families following “baby-led” or more  
4 119 traditional “parent-led” methods for introducing complementary foods.  
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## 121 **METHODS**

### 122 **Participants**

123 Two hundred and thirty parents who had an infant aged 6-12 months were  
124 recruited from four main urban centres in New Zealand (Auckland, Wellington,  
125 Christchurch, Dunedin) by newspaper advertisement. Inclusion criteria were  
126 that participants had a healthy child aged 6-12 months who was born full term  
127 and was currently living in New Zealand, with no diagnosed neurological or  
128 developmental condition. Recruitment for the study stated that we were  
129 interested in when and how complementary foods were introduced to babies. To  
130 reduce selection bias, BLW was not mentioned. Advertisements for the study  
131 provided a web link to the online questionnaire. The study was approved by the  
132 Human Ethics Committee of the University of Otago, Dunedin, New Zealand.  
133

134

### 134 **Data collection**

135 The population-based, cross-sectional survey was administered from May 2010  
136 to August 2010 (three months in total). Participants could only complete the  
137 survey once for one child. Consent and eligibility were established using check  
138 boxes that had to be completed before the participant was allowed entry to the  
139 survey.  
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### 141 **The survey**

142 The current survey questions were based on a web-based infant feeding survey  
143 previously administered in the United Kingdom [5], current infant nutrition  
144 literature, and consultation with a paediatrician, a paediatric dietitian, and health  
145 researchers. The survey was designed and hosted using  
146 www.SurveyMonkey.com (Survey Monkey Copyright © 1999 - 2009  
147 SurveyMonkey.com). A pretest was electronically administered to 15 parents  
148 with young children aged 1-10 years to verify survey functionality and  
149 understandability and the survey was modified based on the pretesting results.  
150 The modifications included deleting a repeated question and rephrasing some

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3 151 questions to improve clarity.  
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6 153 The online survey was divided into four main sections (Table 1):  
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8 154 1. Starting complementary foods

9 155 2. Baby-Led Weaning

10 156 3. Attitudes towards, and experiences of, feeding the infant

11 157 4. Demographic information  
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**Table 1. Overview of data collected in the survey**

Survey section	Data collected
Section 1: Starting complementary foods	<p><b>Timing and type of complementary food</b> Participants were asked: Age (months) when infant first had complementary food, main reason(s) for starting food at this age, the type of food given, form the food was in (puréed, mashed, whole), whether the food was home made or commercially prepared.</p> <p><b>Mealtimes and eating patterns*</b> Participants were asked: Frequency with which they ate with the infant (could have been different foods but baby ate at the same time), frequency infant ate family foods (could have been at a different time but they ate the same food that the rest of the family ate).</p> <p><b>Gagging and choking</b> Many parents confuse gagging with choking or find it hard to differentiate between the two [13]. We provided a written description before asking about gagging and choking. Participants were asked: If child had ever gagged or choked and if so, how often, the form (purée, mashed, whole) of food that was involved, child’s age when choked.</p>
Section 2: Baby-Led Weaning	<p>Participants were asked: had they tried BLW, the extent to which they had followed BLW, whether they would recommend the method to other parents. Participants who reported not having tried BLW were directed to questions asking their opinion of BLW based on a brief description (table 2) and short ‘introduction to BLW’ video, which was embedded in the survey. They were asked whether they would try BLW if they had another child and to provide reasons why they would or would not try it.</p>
Section 3: Attitudes towards, and experiences of, feeding the infant	<p>Participants were asked: about their satisfaction with their choice of infant feeding method for the current infant, whether they would consider changing feeding methods if they had another child, reasons for liking or disliking the method of feeding used.</p>
Section 4: Demographic information	<p>Participants were asked: age, sex, ethnicity, education, household, number of other children, employment status, region of New Zealand they lived in.</p>

\* To obtain data for all infants at 6 to 7 months of age, parents were asked to answer questions relating to current age and also when the child was 6 to 7 months of age. Parents whose child was currently 6 to 7 months of age only completed this section once and then skipped to the following section.

**Table 2. Description of Baby-Led Weaning included in the Survey**

Traditional infant feeding involves offering the baby puréed foods first, then gradually increasing the texture from purée to mash, to lumpy and then to family foods. Baby Led Weaning is different and involves the infant feeding themselves right from the start. You offer your baby pieces of soft food of a size and shape that the baby can handle (for example steamed broccoli or carrots). The baby is allowed to explore the food at their own pace and they decide how much they will eat. Rather than preparing separate meals for your baby, they are offered foods similar to what the rest of the family is eating.

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4 158 **Data analysis**

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6 159 To compare those who considered themselves to be following BLW with those  
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8 160 who met stricter criteria for BLW at 6-7 months of age we defined two BLW  
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10 161 groups. Figure 1 shows the questions that determined which of the methods  
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12 162 parents were considered to have used for introducing complementary foods.  
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7 163 Figure 1. Survey questions used to classify infant feeding method  
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3 164 The **adherent BLW group** consisted of those who reported having tried BLW,  
4 165 and whose infant mostly or always self-fed at 6 to 7 months (Figure 1). A broader  
5 166 definition of BLW was used to assign parents to the **self-identified BLW** group.  
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8 167 These participants reported having tried BLW, but spoon-fed their infant at least  
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10 168 half the time. All other participants who reported not having tried BLW were  
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12 169 classified as either: i) **parent-led feeding** (if they reported spoon-feeding their  
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14 170 infant at least half the time), or ii) **unclassified method** (if they reported their  
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16 171 infant mostly or always self-fed at 6 to 7 months). This group was named  
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18 172 “unclassified” as they were allowing their infant to self-feed (a key premise of  
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20 173 BLW) but did not identify themselves as doing BLW.

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22 175 Information on ethnicity was collected using the 2006 NZ Census of Populations  
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24 176 and Dwellings question as recommended by Statistics NZ. [14] Participants who  
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26 177 nominated two or more ethnic groups were assigned to a single group using the  
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28 178 prioritization system recommended by Statistics NZ, with the order of priority  
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30 179 being (from highest to lowest): Māori, Pacific, Asian, Other, NZ European. [14]

### 31 32 181 **Statistical analysis**

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34 182 All analyses were conducted using Stata™ version 12 (STATA Corporation,  
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36 183 College Station, Texas, USA). Descriptive statistics were tabulated and Pearson’s  
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38 184 chi-squared tests and Fishers Exact test (when cell counts were less than 10)  
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40 185 were performed to examine differences in proportions. A p-value < 0.05 was  
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42 186 considered to indicate statistical significance. Characteristics, and feeding and  
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44 187 health-related practices were compared across three groups: 1) “adherent BLW”,  
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46 188 2) “self-identified BLW”, and 3) “parent-led feeding”.

## 47 48 49 191 **RESULTS**

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51 192 A total of 199 participants completed the online survey (20 of the 230 people  
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53 193 recruited did not meet the eligibility criteria and eleven did not complete the  
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55 194 entire survey). Most (n=140, 70%) of the sample were classified as “parent-led  
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57 195 feeding”, 42 (21%) as “self-identified BLW”, 17 (9%) as “adherent BLW”, and 0  
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59 196 (0%) as “unclassified method”. Table 3 presents the participant characteristics.

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3 197 All participants who answered the survey were mothers. The mean age of the  
4 198 infants was 8.6 months. Approximately half of the mothers in the sample were  
5 199 30 to 39 years of age, 66% had a tertiary qualification, and 55% had more than  
6 200 one child. Maternal age ( $p=0.047$ ; a greater proportion of mothers aged 20-29  
7 201 followed “self-identified BLW”) and residing region ( $p=0.001$ ; “adherent BLW”  
8 202 was most likely among those living in Christchurch and least likely among those  
9 203 living in Auckland) were significantly associated with feeding method. There  
10 204 were no other significant differences in participant characteristics between  
11 205 feeding methods ( $p\geq 0.05$ ). Compared to recent national maternity data, the  
12 206 current sample had a higher proportion of New Zealand European (61% vs.  
13 207 55%), and a lower proportion of Māori (6% vs. 20%), women [15]. The sample  
14 208 also had a higher proportion of mothers with tertiary level education (66% vs.  
15 209 45%) [16] and a lower proportion of single parents (23% vs. 31%) [17].  
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**Table 3 Characteristics of participants**

		All (n=199)	Parent-led feeding (n= 140) n (%)	Self-identified BLW (n= 42) n (%)	Adherent BLW (n=17) n (%)	p-value
Maternal age at child's birth (years)	<20	13	11 (8.2)	1 (2.4)	1 (6.25)	<b>0.005</b>
	20-29	49	28 (20.0)	17 (40.5)	4 (23.5)	
	30-39	103	71 (50.7)	24 (57.1)	8 (47.1)	
	40-49	28	24 (17.1)	0	4 (23.5)	
	Missing	6	6	0	0	
Infant age (months)	6-7	52	36 (25.7)	13 (30.9)	3 (17.6)	0.194
	7-8	23	18 (12.9)	2 (4.8)	3 (17.6)	
	8-9	34	27 (19.3)	5 (11.9)	2 (11.8)	
	9-10	31	18 (12.9)	12 (28.6)	1 (5.9)	
	10-11	29	19 (13.6)	5 (11.9)	5 (29.4)	
	11-12	30	22 (15.7)	5 (11.9)	3 (17.6)	
	Missing	0	0	0	0	
Maternal education	Year 11 or below**	6	3 (2.1)	3 (7.1)	0	0.572
	Year 12 or 13†	55	39 (27.9)	11 (26.2)	5 (29.4)	
	Post-secondary school	34	27 (19.3)	5 (11.9)	2 (11.8)	
	University degree or higher	98	65 (46.4)	23 (54.8)	10 (58.8)	
	Missing	6	6	0	0	
Ethnicity	NZ European	121	78 (55.7)	32 (76.2)	11 (64.7)	0.966
	NZ Māori	12	8 (5.7)	4 (9.5)	0	
	Samoan	2	2 (1.4)	0	0	
	Indian	4	4 (2.9)	0	0	
	Chinese	1	1 (0.7)	0	1 (5.9)	
	English	8	6 (4.3)	2 (4.8)	0	
	Other	10	6 (4.3)	3 (7.1)	1 (5.9)	
	Missing	40	35	1	4	
Parity	Primiparous	89	66 (47.1)	14 (33.3)	9 (52.9)	0.240
	Multiparous	110	74 (52.9)	28 (66.7)	8 (47.1)	
	Missing	0	0	0	0	
Household composition	Mother and father	160	115 (82.1)	30 (71.4)	15 (88.2)	0.271
	Single parent	23	17 (12.1)	6 (14.3)	0	
	Missing	16	8	6	2	
Residing region	Auckland	78	61 (43.6)	17 (43.6)	0	<b>0.001</b>
	Wellington	42	28 (20.0)	12 (28.6)	2 (11.8)	
	Christchurch	29	17 (12.1)	4 (9.5)	8 (47.1)	
	Dunedin	31	21 (15.0)	5 (11.9)	5 (29.4)	
	Other	8	7 (5.0)	1 (2.4)	0	
	Missing	11	6	3	2	
Maternal employment status	Currently in paid employment	44	25 (18.7)	15 (35.7)	4 (23.5)	0.119
	Not in paid employment	89	62 (46.3)	21 (50.0)	6 (35.3)	
	On parental leave, returning to paid employment	40	32 (23.9)	5 (11.9)	3 (17.6)	
	On parental leave, not returning to paid employment	18	15 (11.2)	1 (2.4)	2 (11.8)	
	Missing	8	6	0	2	

211 \* p-value compares feeding methods

212 \*\* Year 11 is usually at age 15-16 years

213 † Years 12 &amp; 13 are usually at ages 16-18 years

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6 218 More than half (58%) of the sample surveyed exclusively breastfed their infant  
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8 219 to five months of age, and only 4% reported never exclusively breastfeeding.  
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10 220 However, 63% of infants received complementary food before the recommended  
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12 221 age of six months. A greater number in the “adherent BLW” group (53 %) met  
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14 222 the WHO recommendation to exclusively breastfeed for 6 months [18] compared  
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16 223 to the “self-identified” (28 %) and “parent-led feeding” (21 %) groups (p=0.026).  
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18 224 Similarly, the number managing to meet the recommendation to introduce  
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20 225 complementary foods at 6 months was significantly greater in the “adherent  
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22 226 BLW” group. A total of 65 % in the “adherent BLW” compared to the 33 % in the  
23  
24 227 “self-identified BLW” and 34% in the “parent-led feeding” group introduced  
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26 228 complementary food at  $\geq 6$  months (p=0.044).  
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28 229  
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30 230 Table 4 summarizes a range of feeding practices and health-related behaviours.  
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32 231 Compared to the “self-identified BLW” and “parent-led feeding” groups, the  
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34 232 “adherent BLW” group were more likely to be having foods that the family ate  
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36 233 (i.e. the same food but not necessarily at the same time as the rest of the family)  
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38 234 (p=0.018), more likely to begin eating family foods when they started  
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40 235 complementary foods or within the first month of starting (p<0.001), and were  
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42 236 less likely to be offering their baby commercially prepared baby food (p=0.002).  
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44 237 Both BLW groups were more likely to be sharing all or most of their meals with  
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46 238 the family (i.e. having meals at the same time but not necessarily the same food)  
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48 239 compared to “parent-led feeding” (p=0.040). In contrast to the “self-identified  
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50 240 BLW” and “parent-led feeding” groups, “adherent BLW” children were not  
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52 241 offered infant iron-fortified cereal as their first food.  
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**Table 4 Feeding practices and health-related behaviours by feeding method used to introduce complementary foods**

		All (n=199)	Parent-led feeding (n= 140) n (%)	Self-identified BLW (n= 42) n (%)	Adherent BLW (n=17) n (%)	p-value*
Baby eats family food ( <i>may be modified or eaten at a different time</i> )	Doesn't eat family foods	8	2 (1.4)	6 (14.3)	9 (52.9)	<b>0.018</b>
	Occasionally	150	113 (80.7)	28 (66.7)	8 (47.1)	
	Most of the time or all of the time	41	25 (17.8)	8 (19.0)	8 (47.1)	
	Missing	0	0	0	0	
Age baby started eating family food	When started CF or within 1 mo	20 (10.1)	7 (5.0)	4 (9.5)	9 (52.9)	<b>&lt;0.001</b>
	2-4mo after starting CF	68 (34.2)	50 (35.7)	13 (31.0)	5 (31.3)	
	Doesn't eat with family	111 (55.8)	83 (59.3)	25 (59.5)	3 (18.8)	
	Missing	0	0	0	0	
Baby shares their meal with the family ( <i>even if food is different</i> )	None of their meals	43	34 (24.2)	7 (16.7)	2 (11.5)	<b>0.040</b>
	Some of their meals	90	67 (47.8)	19 (45.2)	4 (23.5)	
	Most of their meals	48	28 (20.0)	12 (28.6)	8 (47.1)	
	All of their meals	16	9 (6.5)	4 (9.5)	3 (17.6)	
	Missing	2	2	0	0	
First food offered	Baby rice cereal	100	75 (53.6)	24 (57.1)	1 (5.9)	<b>0.001</b>
	Fruit	70	48 (34.3)	12 (28.6)	10 (58.8)	
	Vegetables	29	17 (12.1)	6 (14.3)	6 (35.3)	
	Meat	0	0	0	0	
	Missing	0	0	0	0	
Amount of commercially prepared baby food	All of it	14	11(7.9)	3 (7.1)	0	<b>0.002</b>
	Most of it	34	21 (15.0)	11 (26.2)	2 (11.8)	
	Half of it	47	38 (27.0)	8 (19.0)	1 (5.9)	
	Hardly any of it	78	58 (41.4)	15 (35.7)	5 (29.4)	
	None of it	26	12 (8.6)	5 (11.9)	9 (52.9)	
Missing	0	0	0	0		
Reported a choking episode	No	130 (67.3)	95 (69.3)	24 (60.0)	11 (68.8)	0.567
	Yes	63 (32.6)	42 (30.7)	16 (40.0)	5 (31.3)	
	Missing	7	3	2	2	
Reported a gagging episode	No	51 (26.2)	39 (27.9)	7 (16.6)	5 (29.4)	0.286
	Yes	143 (73.7)	99 (70.7)	34 (81.0)	10 (58.8)	
	Missing	5	2	1	2	

\* p-value compares feeding methods

CF Complementary foods

Mo months

246 Across the whole sample, 32.6% of participants reported at least one choking  
247 episode, and most (71.4%) of these participants reported that choking had  
248 occurred with whole food. There was no difference between groups for the  
249 proportion reporting at least one choking episode, the form (puréed, mashed or  
250 whole) that the food was in, or the method of feeding (spoon-feeding or self-  
251 feeding) when the choking episode occurred ( $p>0.05$ ). There was also no group  
252 difference in the proportion reporting at least one gagging episode ( $p>0.05$ ).

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3 253 Thirty-eight per cent of all participants had not heard of BLW, 7.6% reported  
4 254 knowing a lot about it, and the remaining 54.1% reported knowing a moderate  
5  
6 255 or small amount. A large proportion of the “parent-led feeding” group had never  
7  
8 256 heard of BLW (64.4%). Participants reported hearing about BLW through a  
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10 257 friend or family member rather than from a healthcare professional.

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13 259 All families who had followed BLW reported that they would recommend the  
14  
15 260 method, but interestingly more than half (59.6%) would recommend that BLW  
16  
17 261 be used in combination with spoon-feeding. Forty-six per cent of those who had  
18  
19 262 followed “parent-led feeding” would be willing to try BLW if they had another  
20  
21 263 child. The main reasons reported for not wanting to try BLW were fear of their  
22  
23 264 infant choking (55.3%), concern about the infant’s ability to eat enough (44.2%),  
24  
25 265 reservation that the infant would not have the necessary motor skills to self-feed  
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27 266 (27.6%), or considering that “parent-led feeding” had worked fine, so there was  
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29 267 no need to change (27.1%).

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3 2694 270 **DISCUSSION**

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6 271 This is the first study to describe BLW and parent-led feeding in a sample from  
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8 272 the general population. In contrast, previous studies have recruited participants  
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10 273 separately from BLW specific groups or websites, with controls coming from  
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12 274 other sources such as patient lists [9], and nurseries and community centres [4-  
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14 275 6]. We found that the association between infant feeding method and health-  
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16 276 related behaviours differed depending on the extent to which families followed  
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18 277 BLW. This indicates that it is essential for healthcare professionals, as well as  
19  
20 278 researchers, to collect information on the extent of infant self-feeding when  
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22 279 parents report following BLW. Compared to the “self-identified BLW” and  
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24 280 “parent-led feeding” group, the “adherent BLW” were more likely to meet the  
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26 281 WHO recommendations to exclusively breastfeed for 6 months, and to begin  
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28 282 complementary foods at 6 months of age. [18] The “adherent BLW” group were  
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30 283 also more likely to be having foods that the family ate, and were less likely to be  
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32 284 offering their baby commercially prepared baby food. Both BLW groups were  
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34 285 more likely to be sharing all or most of their meals with the family compared to  
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36 286 the “parent-led feeding” group. In contrast to the “self-identified BLW” and  
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38 287 “parent-led feeding”, children, “adherent BLW” children were not offered infant  
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40 288 iron-fortified cereal as their first food.

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42 290 In this study, adherent BLW was defined as the baby feeding themselves all or  
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44 291 most of the time at 6 to 7 months of age (i.e. little or no parent spoon-feeding).  
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46 292 Previous studies [4 5] have defined BLW according to the extent of spoon-  
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48 293 feeding and/or purées consumed. As our previous work [10] had suggested that  
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50 294 purées could be offered to the self-feeding infant (for instance puréed mince on  
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52 295 toast) the definition used here related only to the method of feeding (self-feeding  
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54 296 vs. spoon-feeding) and not the form of food (purée, mashed, or whole). In  
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56 297 practice only a small number of families (8% of this sample) were classified as  
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58 298 following adherent BLW. A large proportion (21%) of families who reported  
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60 299 using BLW were instead following a more flexible approach that included a  
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301 300 combination of self-feeding and spoon-feeding. This agrees with our earlier  
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303 301 qualitative study [10], in which families following BLW also reported using some

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3 302 spoon-feeding. Generally this occurred at times when their infant appeared  
4 303 unable to feed themselves (e.g., during illness) or specifically to ensure  
5 304 appropriate iron intake (parents spoon-fed iron-fortified baby cereal at  
6 305 breakfast). This suggests that BLW and spoon-feeding are not viewed as  
7 306 dichotomous methods within the community but instead as styles of infant  
8 307 feeding that can be combined to suit the needs of the child and the family in each  
9 308 feeding situation.

10 309  
11 310 A concern that is commonly expressed about BLW [10] is the potential increased  
12 311 risk of choking when infants self-feed whole foods. When infants transition from  
13 312 milk to solid foods they are at increased risk of choking because they may not  
14 313 have developed the coordination of chewing, breathing and swallowing needed  
15 314 to eat food safely. [19 20] Choking is when the airway is obstructed and  
16 315 respiration is interrupted [21] and food related choking can be fatal. [20 22]  
17 316 Prevalence data on choking are limited, and no data exist on the rates of choking  
18 317 when complementary foods are being introduced, whether using a traditional or  
19 318 a BLW method. The most relevant data available show that in New Zealand in the  
20 319 period from 2002 to 2009, nine deaths occurred in children under six years of  
21 320 age as a result of the inhalation of food, specifically meat, sausage, peanuts, apple  
22 321 and grapes [22]. In contrast, gagging, which is very common among all infants, is  
23 322 less serious. [23] The gag reflex very effectively keeps large pieces of food well to  
24 323 the front of the mouth, only allowing well masticated food to reach the back of  
25 324 the mouth for swallowing. [1 24-26]. In this survey we found no difference  
26 325 between the groups in the proportion reporting at least one gagging or choking  
27 326 episode. However, more than 30% of the total sample reported at least one  
28 327 choking episode, and this mostly commonly involved whole foods. Since choking  
29 328 can be very serious it would be of concern if these reports reflect actual choking  
30 329 rates. Parents often find it difficult to distinguish between choking and gagging  
31 330 and therefore, although we included a definition of both choking and gagging in  
32 331 our survey, it is likely that parents have incorrectly identified choking, in  
33 332 particular mistaking gagging for choking. It is also important to note that  
34 333 because serious choking episodes are rare, this relatively small study was not  
35 334 powered to identify differences in these rates between the complementary



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3 335 feeding groups.  
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6 337 We found a number of important associations between feeding method and the  
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8 338 likelihood of achieving the nutrition recommendations for infants as outlined by  
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10 339 the New Zealand Ministry of Health and WHO [3 18]. The “adherent BLW” group  
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12 340 were more likely to meet both the recommendation to exclusively breastfed to  
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14 341 six months, and to introduce complementary foods at six months. Two possible  
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16 342 explanations for this finding are that the desire to follow BLW results in parents  
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18 343 waiting until six months, which is the age when it is considered that most healthy  
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20 344 infants are developmentally ready to self-feed, [7 27 28] or that parents who  
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22 345 choose BLW are more aware of and adhere to health recommendations.  
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24 346 However, it is also feasible that parents who follow a parent-led method are able  
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26 347 to encourage their infant to begin complementary foods earlier by feeding  
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28 348 purées or infant cereal by spoon, which requires little input from the infant and  
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30 349 therefore is not reliant on their developmental ability to actively participate in  
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32 350 feeding. The results from the current study are consistent with a cross-sectional  
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34 351 study from the United Kingdom where BLW (defined as less than 10% spoon-  
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36 352 feeding or less than 10% purée use for total food intake) was associated with  
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38 353 later introduction of complementary foods. [5] Furthermore a United Kingdom  
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40 354 based survey examining the knowledge of infant feeding guidelines and the  
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42 355 influence of healthcare professionals identified BLW as the strongest predictor  
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44 356 for introducing complementary foods at the recommended age. [29]

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48 358 The feeding method used by families was associated with many other potentially  
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50 359 health-related behaviours. Those in the “adherent BLW” group were most likely  
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52 360 to offer fruits and vegetables as first complementary foods rather than iron-  
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54 361 fortified cereal. It is of concern that for the “adherent BLW group” the first foods  
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56 362 reported in this survey were poor sources of iron, as this increases the infant’s  
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58 363 risk of suboptimal iron status [3 30-33]. Although fruits and vegetables are  
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60 364 nutrient rich foods, they do not provide all the nutrients necessary for six-  
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366 365 month-old children. [3] In particular, infants should receive iron-rich  
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368 366 complementary foods such as meat, meat alternatives, or iron-fortified foods  
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370 367 immediately when starting complementary foods to supply necessary iron. [3

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3 368 30-33] We are unable to determine how long only fruit and vegetables were  
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5 369 offered, and at what age iron-rich foods, such as meat, were introduced.  
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7 370 However, spoon-feeding iron-fortified baby rice cereal is a popular way for  
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9 371 parents to increase their infant's iron intake, [3] and the semi-liquid form of  
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11 372 infant cereals makes them a difficult food for infants to feed themselves at six  
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13 373 months. In this survey none of the "adherent BLW" group offered infant cereal as  
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15 374 a first food. In contrast, some of the "self-identified BLW" group did - presumably  
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17 375 by spoon. Conversely, because the infant following BLW is eating family foods  
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19 376 there may be greater potential for a wider variety of iron-rich foods such as  
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21 377 pieces of cooked red meat to be offered. The bioavailability of iron from these  
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23 378 foods is also much higher (15.5%) than from infant cereals (3%) [34]. However,  
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25 379 biochemical iron status was not determined in this study so we are unable to  
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27 380 determine whether the risk of iron deficiency differed amongst the different  
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29 381 complementary feeding groups.  
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33 383 Family meals have been linked to healthier eating patterns including greater  
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35 384 intake of fruits and vegetables and lower intake of unhealthy foods. [35-37]  
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37 385 However this relationship has only been examined in older children (two years  
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39 386 and over) and the benefits of family meals for younger children (i.e., 6 to 12  
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41 387 months) is yet to be determined. Furthermore, no longitudinal studies have  
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43 388 investigated whether the health benefits associated with sharing family meals  
44  
45 389 track into later life. Aside from the potential nutritional benefits associated with  
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47 390 sharing family meals, there are other important reasons why infants should eat  
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49 391 with the family, such as mealtimes providing an opportunity to communicate,  
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51 392 learn, and develop family rituals. [38] Our results showed the "adherent BLW"  
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53 393 parents were sharing a greater number of meals with their infant, and were  
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55 394 likely to be doing this within one month of the initiation of complementary  
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57 395 feeding. Brown and Lee [6] reported similar results in their qualitative study.  
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59 396 Results from the pilot study (n=10) of Rowan and Harris [11] also showed BLW  
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397 families were sharing most meals (average of 3 out of the 3.5 meals per day)  
398 with their child by 9 months of age.  
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3 400 In addition to sharing family meals, exposure to family foods (the same foods  
4 401 eaten by other family members) may encourage healthier long-term eating  
5 402 patterns. [39-41] Results from a recent representative Scottish study showed  
6 403 that eating family foods was the most important aspect of family meals  
7 404 associated with a healthier diet at age five years (i.e., it is the food choice that has  
8 405 greater importance than the form and function of the meal). [42] In our survey,  
9 406 the “adherent BLW” infants were having a greater amount of family foods, as  
10 407 well as less commercially purchased food, whereas, families who followed the  
11 408 “parent-led feeding” method reported a greater proportion of commercially  
12 409 prepared food. Whilst purchased baby food is nutritionally appropriate [3] and  
13 410 many parents choose it for this reason, it is typically bland and of a smooth  
14 411 consistency. Only a longitudinal study would be able to determine the effects of  
15 412 early exposure to family foods compared with commercially prepared baby food  
16 413 on long term dietary behaviours.

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18 415 Most parents in the current study had either followed BLW or would be willing  
19 416 to try it with a subsequent child. All families who had followed BLW reported  
20 417 that they would recommend the method, but interestingly more than half would  
21 418 recommend that BLW be used in combination with spoon-feeding. Although  
22 419 more than one-third of the sample had not heard of BLW, after watching a short  
23 420 video and reading the brief description of BLW embedded in the survey 46%  
24 421 reported being willing to try it with another child. Combining the parents who  
25 422 were willing to use BLW with those who reported already using it suggests that  
26 423 79% of this sample would be willing to adopt, at least aspects of, a baby-led  
27 424 approach, even though a large proportion had, prior to the survey, not heard of  
28 425 BLW. Those not willing to try BLW were concerned about choking, energy intake,  
29 426 and developmental readiness of the infant to self-feed at six months or  
30 427 considered that the “parent-led feeding” method had worked well for their  
31 428 family, precluding any need to change.

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33 430 This study has a number of strengths and weaknesses. We attempted to improve  
34 431 the representativeness of our sample by advertising the study in public domains  
35 432 (particularly community distributed free newspapers). Recruiting participants

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3 433 from the general population instead of specific groups improves the likelihood of  
4 434 a more representative sample. [43 44] We also avoided mentioning BLW in the  
5 435 advertisement to reduce the bias associated with recruiting only those familiar  
6 436 with BLW. However, as the survey was administered through the Internet it  
7 437 required participants to have access to the Internet and possess computer skills.  
8 438 Recent figures show that 86% of NZ families have personal internet access [45]  
9 439 suggesting a large proportion could access the current survey. However our  
10 440 newspaper advertising was restricted to urban areas and this may have affected  
11 441 our sample, as the demographic characteristics of the current sample do not  
12 442 reflect those of the general New Zealand population in some respects. In  
13 443 particular, the sample was highly educated with more mothers having a  
14 444 university degree (66%) compared to the general population (40%) [46], and  
15 445 the rate of exclusive breastfeeding to 6 months (26 %) was greater than that of  
16 446 the general population (16%) [47]. In addition, although we observed significant  
17 447 associations between the method used for introducing complementary foods and  
18 448 health outcomes, the direction of these associations cannot be determined due to  
19 449 the cross-sectional study design. This highlights the urgency with which  
20 450 prospective studies, and randomised controlled trials of BLW are required so  
21 451 that the nature and direction of health-related associations can be firmly  
22 452 established. Therefore, as this study was relatively small (n=199), may have  
23 453 comprised participants who were more computer literate, and was cross-  
24 454 sectional, caution must be used when interpreting these results.

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42 456 In conclusion, the majority of our sample were using the parent-led method of  
43 457 spoon-feeding purées to introduce complementary foods to their child. Twenty-  
44 458 one percent of the sample reported using BLW but were not strictly limiting  
45 459 spoon-feeding, and a smaller number (8%) followed a strict BLW approach. We  
46 460 found several important associations between feeding method and health  
47 461 related behaviours, suggesting that greater adherence to the self-feeding tenet of  
48 462 BLW was associated with exclusively breastfeeding for 6 months, beginning  
49 463 complementary foods at 6 months, and eating the same foods as the rest of the  
50 464 family from the start of the complementary feeding period. However, it is  
51 465 concerning that these infants were not offered infant iron-fortified cereal as a  
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3 466 first food. Both BLW groups were more likely to be sharing all or most of their  
4 467 meals with their family. The results of this study suggest that for many families  
5 468 the practice of BLW deviates substantially from the theory. It is therefore  
6 469 essential that health professionals, as well as researchers, do not rely on parental  
7 470 self-reports of BLW, but also quantify the extent of infant self-feeding.  
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17 476 and editing of this paper. SC designed and executed the online survey and was  
18 477 responsible for the analysis and interpretation of the data. SC wrote the first  
19 478 draft of the paper, and A-L H and RWT made important intellectual contributions  
20 479 to the content and approved the final version.

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26 485 Ethics Committee.

27 486 **Provenance and peer review** Not commissioned.

28 487 **Data sharing statement** No additional data are available.  
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5 **Title: Parent-led or Baby-led? Associations between complementary**  
6 **feeding practices and health-related behaviours in a survey of New**  
7 **Zealand families.**  
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**Key words** complementary feeding, baby-led weaning.**Word count = 4442**

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**ABSTRACT**

**Objective:** To determine feeding practices and selected health-related behaviours in New Zealand families following a “baby-led” or more traditional “parent-led” method for introducing complementary foods.

**Design, setting and participants:** 199 mothers completed an online survey about introducing complementary foods to their infant. Participants were classified into one of four groups: “adherent Baby-Led Weaning (BLW)”, the infant mostly or entirely fed themselves at 6-7 months; “self-identified BLW”, mothers reported following BLW at 6-7 months but were using spoon-feeding at least half the time; “parent-led feeding”, the mother reported not having tried BLW; and “unclassified method”, the mother reported they were not following BLW at 6-7 months but reported the infant mostly or entirely fed themselves at 6-7 months.

**Results:** 8% were following “adherent BLW”, 21% “self-identified BLW” and 0% were following the “unclassified method”. Compared to “self-identified BLW” and “parent-led feeding”, a higher proportion of the “adherent BLW” met the WHO recommendations to exclusively breastfeed for 6 months and to introduce complementary foods at 6 months. The “adherent BLW” group was more likely to have family foods ( $p=0.018$ ), and less likely ( $p=0.002$ ) to have commercially prepared baby food. Both BLW groups were more likely to share meals with the family compared to “parent-led feeding”. In contrast to “self-identified BLW” and “parent-led feeding”, the “adherent BLW” group did not offer iron-fortified cereal as a first food.

**Conclusion:** This study suggests that although many parents consider they follow BLW, very few are following it strictly. The extent to which BLW was followed was associated with potential benefits (e.g., sharing family meals) and risks (e.g., low iron first foods) highlighting the importance for health professionals and researchers of accurately determining the extent of adherence to BLW.

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5 61 **ARTICLE SUMMARY**

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7 62 **Article focus**

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9 63• Baby-Led Weaning (BLW) is becoming increasingly popular amongst parents  
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11 64 of young infants.

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13 65• There are a number of proposed benefits associated with BLW including a  
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15 66 healthier BMI, and a number of possible risks, including poorer iron intakes.

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17 67• However, very little is known about how BLW is practised in the community  
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19 68 and how strictly it is followed by parents.

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23 70 **Key messages**

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25 71• The extent to which BLW is practised varies.

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27 72• The association of BLW with potential benefits and possible risks may differ  
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29 73 depending on the extent to which the method is adhered to.

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31 74• Most parents use traditional spoon-feeding for introducing complementary  
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33 75 foods, but many would be willing to try BLW if they had another infant.

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37 77 **Strengths and limitations of this study**

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39 78• This is the first study to investigate BLW in the general population.

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41 79• The survey was advertised in main urban centres of New Zealand and may  
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43 80 not be representative of rural families.

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45 81• As the sample size is small results should be interpreted with caution.

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## 84 INTRODUCTION

85 Baby-Led Weaning (BLW) is an alternative method for introducing  
86 complementary foods to infants in which the infant feeds themselves hand-held  
87 foods instead of being spoon-fed by an adult [1]. Unlike the traditional method of  
88 infant feeding where infants may be given finger foods alongside spoon-feeding,  
89 and in many countries their introduction is delayed to 7 or 8 months of age ([2  
90 3]), BLW, in its purest form, does not include any spoon-feeding by the adult. The  
91 infant is only offered pieces of food, appropriately prepared, so that they can  
92 feed themselves.

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94 Although anecdotal evidence suggests that BLW is becoming popular with  
95 parents, scientific research is limited to eight publications [4-11]. The small body  
96 of existing research suggests that BLW is feasible for most 6-month old infants  
97 from a motor development point of view. [7 8] It also suggests that BLW is  
98 associated with potential benefits including lower levels of maternal anxiety,  
99 restriction, pressure to eat and monitoring during the complementary feeding  
100 period; [4] and perhaps healthier eating patterns and BMI. [9] However, none of  
101 the studies to date have drawn their BLW cases and parent-led controls from the  
102 same population. Given the paucity of current research, and the lack of  
103 randomized controlled trials, healthcare professionals [10] and health governing  
104 bodies [12] are unwilling to support BLW as a population recommendation.  
105 Anecdotal reports suggest that the use of BLW is increasing in New Zealand and  
106 other countries including the United Kingdom.

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108 Baby-Led Weaning in its strictest form requires that the infant has complete  
109 control over their own eating from the beginning of the complementary feeding  
110 period. [1] In theory, BLW is therefore a distinctly different method of infant  
111 feeding compared to the traditional method of spoon-feeding purées. [1]  
112 However, essential questions, such as how parents actually follow BLW in  
113 practice, and the extent to which BLW is associated with health-related  
114 behaviours in the general population, remain unanswered.

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116 The aim of this survey was to determine feeding practices and selected health-

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3 117 related behaviours in New Zealand families following “baby-led” or more  
4 118 traditional “parent-led” methods for introducing complementary foods.  
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## 120 **METHODS**

### 121 **Participants**

122 Two hundred and thirty parents who had an infant aged 6-12 months were  
123 recruited from four main urban centres in New Zealand (Auckland, Wellington,  
124 Christchurch, Dunedin) by newspaper advertisement. Inclusion criteria were  
125 that participants had a healthy child aged 6-12 months who was born full term  
126 and was currently living in New Zealand, with no diagnosed neurological or  
127 developmental condition. Recruitment for the study stated that we were  
128 interested in when and how complementary foods were introduced to babies. To  
129 reduce selection bias, BLW was not mentioned. Advertisements for the study  
130 provided a web link to the online questionnaire. The study was approved by the  
131 Human Ethics Committee of the University of Otago, Dunedin, New Zealand.  
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### 133 **Data collection**

134 The population-based, cross-sectional survey was administered from May 2010  
135 to August 2010 (three months in total). Participants could only complete the  
136 survey once for one child. Consent and eligibility were established using check  
137 boxes that had to be completed before the participant was allowed entry to the  
138 survey.  
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### 140 **The survey**

141 The current survey questions were based on a web-based infant feeding survey  
142 previously administered in the United Kingdom [5], current infant nutrition  
143 literature, and consultation with a paediatrician, a paediatric dietitian, and health  
144 researchers. The survey was designed and hosted using  
145 www.SurveyMonkey.com (Survey Monkey Copyright © 1999 - 2009  
146 SurveyMonkey.com). A pretest was electronically administered to 15 parents  
147 with young children aged 1-10 years to verify survey functionality and  
148 understandability and the survey was modified based on the pretesting results.  
149 The modifications included deleting a repeated question and rephrasing some  
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150 questions to improve clarity.

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152 The online survey was divided into four main sections (Table 1):

- 153 1. Starting complementary foods
- 154 2. Baby-Led Weaning
- 155 3. Attitudes towards, and experiences of, feeding the infant
- 156 4. Demographic information

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**Table 1. Overview of data collected in the survey**

Survey section	Data collected
Section 1: Starting complementary foods	<p data-bbox="653 399 1052 423"><b>Timing and type of complementary food</b></p> <p data-bbox="653 428 1776 505">Participants were asked: Age (months) when infant first had complementary food, main reason(s) for starting food at this age, the type of food given, form the food was in (puréed, mashed, whole), whether the food was home made or commercially prepared.</p> <p data-bbox="653 532 968 557"><b>Mealtimes and eating patterns*</b></p> <p data-bbox="653 561 1776 638">Participants were asked: Frequency with which they ate with the infant (could have been different foods but baby ate at the same time), frequency infant ate family foods (could have been at a different time but they ate the same food that the rest of the family ate).</p> <p data-bbox="653 665 863 690"><b>Gagging and choking</b></p> <p data-bbox="653 695 1776 743">Many parents confuse gagging with choking or find it hard to differentiate between the two [13]. We provided a written description before asking about gagging and choking.</p> <p data-bbox="653 748 1776 792">Participants were asked: If child had ever gagged or choked and if so, how often, the form (purée, mashed, whole) of food that was involved, child's age when choked.</p>
Section 2: Baby-Led Weaning	<p data-bbox="653 824 1776 873">Participants were asked: had they tried BLW, the extent to which they had followed BLW, whether they would recommend the method to other parents.</p> <p data-bbox="653 878 1776 979">Participants who reported not having tried BLW were directed to questions asking their opinion of BLW based on a brief description (table 2) and short 'introduction to BLW' video, which was embedded in the survey. They were asked whether they would try BLW if they had another child and to provide reasons why they would or would not try it.</p>
Section 3: Attitudes towards, and experiences of, feeding the infant	<p data-bbox="653 1011 1776 1084">Participants were asked: about their satisfaction with their choice of infant feeding method for the current infant, whether they would consider changing feeding methods if they had another child, reasons for liking or disliking the method of feeding used.</p>
Section 4: Demographic information	<p data-bbox="653 1117 1776 1161">Participants were asked: age, sex, ethnicity, education, household, number of other children, employment status, region of New Zealand they lived in.</p>

\* To obtain data for all infants at 6 to 7 months of age, parents were asked to answer questions relating to current age and also when the child was 6 to 7 months of age. Parents whose child was currently 6 to 7 months of age only completed this section once and then skipped to the following section.



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**Table 2. Description of Baby-Led Weaning included in the Survey**

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Traditional infant feeding involves offering the baby puréed foods first, then gradually increasing the texture from purée to mash, to lumpy and then to family foods. Baby Led Weaning is different and involves the infant feeding themselves right from the start. You offer your baby pieces of soft food of a size and shape that the baby can handle (for example steamed broccoli or carrots). The baby is allowed to explore the food at their own pace and they decide how much they will eat. Rather than preparing separate meals for your baby, they are offered foods similar to what the rest of the family is eating.

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4 158 **Data analysis**

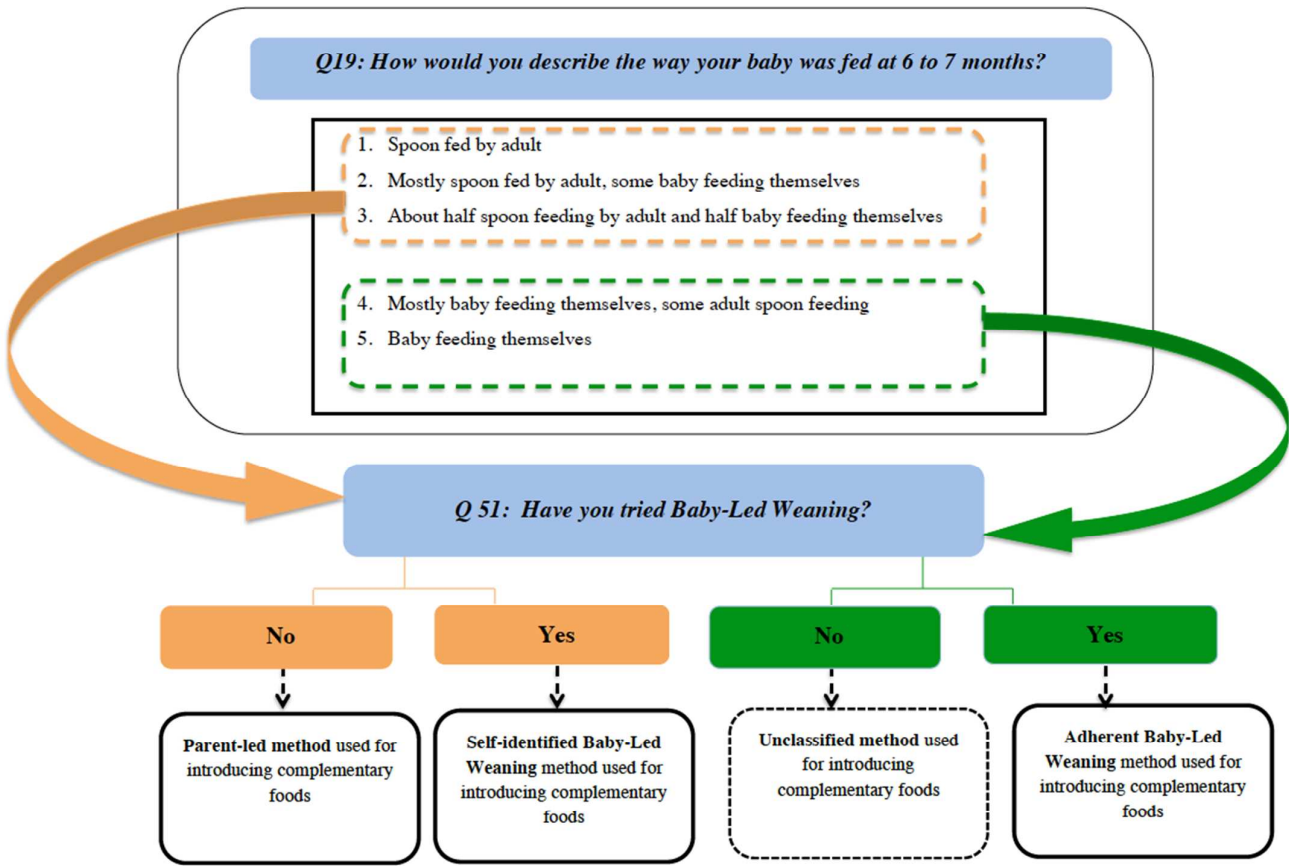
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6 159 To compare those who considered themselves to be following BLW with those  
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8 160 who met stricter criteria for BLW at 6-7 months of age we defined two BLW  
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10 161 groups. Figure 1 shows the questions that determined which of the methods  
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12 162 parents were considered to have used for introducing complementary foods.  
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166 Figure 1. Survey questions used to classify infant feeding method

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3 167 The **adherent BLW group** consisted of those who reported having tried BLW,  
4 168 and whose infant mostly or always self-fed at 6 to 7 months (Figure 1). A broader  
5 169 definition of BLW was used to assign parents to the **self-identified BLW** group.  
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8 170 These participants reported having tried BLW, but spoon-fed their infant at least  
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10 171 half the time. All other participants who reported not having tried BLW were  
11 172 classified as either: i) **parent-led feeding** (if they reported spoon-feeding their  
12 173 infant at least half the time), or ii) **unclassified method** (if they reported their  
13 174 infant mostly or always self-fed at 6 to 7 months). This group was named  
14 175 “unclassified” as they were allowing their infant to self-feed (a key premise of  
15 176 BLW) but did not identify themselves as doing BLW.  
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22 178 Information on ethnicity was collected using the 2006 NZ Census of Populations  
23 179 and Dwellings question as recommended by Statistics NZ. [14] Participants who  
24 180 nominated two or more ethnic groups were assigned to a single group using the  
25 181 prioritization system recommended by Statistics NZ, with the order of priority  
26 182 being (from highest to lowest): Māori, Pacific, Asian, Other, NZ European. [14]  
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### 32 184 **Statistical analysis**

33 185 All analyses were conducted using Stata™ version 12 (STATA Corporation,  
34 186 College Station, Texas, USA). Descriptive statistics were tabulated and **Pearson’s**  
35 187 chi-squared tests and Fishers Exact test (when cell counts were less than 10)  
36 188 were performed to examine differences in proportions. A p-value < 0.05 was  
37 189 considered to indicate statistical significance. Characteristics, and feeding and  
38 190 health-related practices were compared across three groups: 1) “adherent BLW”,  
39 191 2) “self-identified BLW”, and 3) “parent-led feeding”.  
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## 49 194 **RESULTS**

50 195 A total of 199 participants completed the online survey (20 of the 230 people  
51 196 recruited did not meet the eligibility criteria and eleven did not complete the  
52 197 entire survey). Most (n=140, 70%) of the sample were classified as “parent-led  
53 198 feeding”, 42 (21%) as “self-identified BLW”, 17 (9%) as “adherent BLW”, and **0**  
54 199 **(0%) as “unclassified method”**. Table 3 presents the participant characteristics.  
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3 200 All participants who answered the survey were mothers. The mean age of the  
4 201 infants was 8.6 months. Approximately half of the mothers in the sample were  
5 202 30 to 39 years of age, 66% had a tertiary qualification, and 55% had more than  
6 203 one child. Maternal age ( $p=0.047$ ; a greater proportion of mothers aged 20-29  
7 204 followed “self-identified BLW”) and residing region ( $p=0.001$ ; “adherent BLW”  
8 205 was most likely among those living in Christchurch and least likely among those  
9 206 living in Auckland) were significantly associated with feeding method. There  
10 207 were no other significant differences in participant characteristics between  
11 208 feeding methods ( $p\geq 0.05$ ). Compared to recent national maternity data, the  
12 209 current sample had a higher proportion of New Zealand European (61% vs.  
13 210 55%), and a lower proportion of Māori (6% vs. 20%), women [15]. The sample  
14 211 also had a higher proportion of mothers with tertiary level education (66% vs.  
15 212 45%) [16] and a lower proportion of single parents (23% vs. 31%) [17].

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**Table 3 Characteristics of participants**

		All (n=199)	Parent-led feeding (n= 140) n (%)	Self-identified BLW (n= 42) n (%)	Adherent BLW (n=17) n (%)	p-value
Maternal age at child's birth (years)	<20	13	11 (8.2)	1 (2.4)	1 (6.25)	<b>0.005</b>
	20-29	49	28 (20.0)	17 (40.5)	4 (23.5)	
	30-39	103	71 (50.7)	24 (57.1)	8 (47.1)	
	40-49	28	24 (17.1)	0	4 (23.5)	
	Missing	6	6	0	0	
Infant age (months)	6-7	52	36 (25.7)	13 (30.9)	3 (17.6)	0.194
	7-8	23	18 (12.9)	2 (4.8)	3 (17.6)	
	8-9	34	27 (19.3)	5 (11.9)	2 (11.8)	
	9-10	31	18 (12.9)	12 (28.6)	1 (5.9)	
	10-11	29	19 (13.6)	5 (11.9)	5 (29.4)	
	11-12	30	22 (15.7)	5 (11.9)	3 (17.6)	
	Missing	0	0	0	0	
Maternal education	Year 11 or below**	6	3 (2.1)	3 (7.1)	0	0.572
	Year 12 or 13†	55	39 (27.9)	11 (26.2)	5 (29.4)	
	Post-secondary school	34	27 (19.3)	5 (11.9)	2 (11.8)	
	University degree or higher	98	65 (46.4)	23 (54.8)	10 (58.8)	
	Missing	6	6	0	0	
Ethnicity	NZ European	121	78 (55.7)	32 (76.2)	11 (64.7)	0.966
	NZ Māori	12	8 (5.7)	4 (9.5)	0	
	Samoan	2	2 (1.4)	0	0	
	Indian	4	4 (2.9)	0	0	
	Chinese	1	1 (0.7)	0	1 (5.9)	
	English	8	6 (4.3)	2 (4.8)	0	
	Other	10	6 (4.3)	3 (7.1)	1 (5.9)	
	Missing	40	35	1	4	
Parity	Primiparous	89	66 (47.1)	14 (33.3)	9 (52.9)	0.240
	Multiparous	110	74 (52.9)	28 (66.7)	8 (47.1)	
	Missing	0	0	0	0	
Household composition	Mother and father	160	115 (82.1)	30 (71.4)	15 (88.2)	0.271
	Single parent	23	17 (12.1)	6 (14.3)	0	
	Missing	16	8	6	2	
Residing region	Auckland	78	61 (43.6)	17 (43.6)	0	<b>0.001</b>
	Wellington	42	28 (20.0)	12 (28.6)	2 (11.8)	
	Christchurch	29	17 (12.1)	4 (9.5)	8 (47.1)	
	Dunedin	31	21 (15.0)	5 (11.9)	5 (29.4)	
	Other	8	7 (5.0)	1 (2.4)	0	
	Missing	11	6	3	2	
Maternal employment status	Currently in paid employment	44	25 (18.7)	15 (35.7)	4 (23.5)	0.119
	Not in paid employment	89	62 (46.3)	21 (50.0)	6 (35.3)	
	On parental leave, returning to paid employment	40	32 (23.9)	5 (11.9)	3 (17.6)	
	On parental leave, not returning to paid employment	18	15 (11.2)	1 (2.4)	2 (11.8)	
	Missing	8	6	0	2	

214 \* p-value compares feeding methods

215 \*\* Year 11 is usually at age 15-16 years

216 † Years 12 &amp; 13 are usually at ages 16-18 years

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4 220 More than half (58%) of the sample surveyed exclusively breastfed their infant  
5 221 to five months of age, and only 4% reported never exclusively breastfeeding.  
6 222 However, 63% of infants received complementary food before the recommended  
7 223 age of six months. A greater number in the “adherent BLW” group (53 %) met  
8 224 the WHO recommendation to exclusively breastfeed for 6 months [18] compared  
9 225 to the “self-identified” (28 %) and “parent-led feeding” (21 %) groups (p=0.026).  
10 226 Similarly, the number managing to meet the recommendation to introduce  
11 227 complementary foods at 6 months was significantly greater in the “adherent  
12 228 BLW” group. A total of 65 % in the “adherent BLW” compared to the 33 % in the  
13 229 “self-identified BLW” and 34% in the “parent-led feeding” group introduced  
14 230 complementary food at  $\geq 6$  months (p=0.044).

15 231  
16 232 Table 4 summarizes a range of feeding practices and health-related behaviours.  
17 233 Compared to the “self-identified BLW” and “parent-led feeding” groups, the  
18 234 “adherent BLW” group were more likely to be having foods that the family ate  
19 235 (i.e. the same food but not necessarily at the same time as the rest of the family)  
20 236 (p=0.018), more likely to begin eating family foods when they started  
21 237 complementary foods or within the first month of starting (p<0.001), and were  
22 238 less likely to be offering their baby commercially prepared baby food (p=0.002).  
23 239 Both BLW groups were more likely to be sharing all or most of their meals with  
24 240 the family (i.e. having meals at the same time but not necessarily the same food)  
25 241 compared to “parent-led feeding” (p=0.040). In contrast to the “self-identified  
26 242 BLW” and “parent-led feeding” groups, “adherent BLW” children were not  
27 243 offered infant iron-fortified cereal as their first food.

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**Table 4 Feeding practices and health-related behaviours by feeding method used to introduce complementary foods**

		All (n=199)	Parent-led feeding (n= 140) n (%)	Self-identified BLW (n= 42) n (%)	Adherent BLW (n=17) n (%)	p-value*
Baby eats family food ( <i>may be modified or eaten at a different time</i> )	Doesn't eat family foods	8	2 (1.4)	6 (14.3)	9 (52.9)	<b>0.018</b>
	Occasionally	150	113 (80.7)	28 (66.7)	8 (47.1)	
	Most of the time or all of the time	41	25 (17.8)	8 (19.0)	8 (47.1)	
	Missing	0	0	0	0	
Age baby started eating family food	When started CF or within 1 mo	20 (10.1)	7 (5.0)	4 (9.5)	9 (52.9)	<b>&lt;0.001</b>
	2-4mo after starting CF	68 (34.2)	50 (35.7)	13 (31.0)	5 (31.3)	
	Doesn't eat with family	111 (55.8)	83 (59.3)	25 (59.5)	3 (18.8)	
	Missing	0	0	0	0	
Baby shares their meal with the family ( <i>even if food is different</i> )	None of their meals	43	34 (24.2)	7 (16.7)	2 (11.5)	<b>0.040</b>
	Some of their meals	90	67 (47.8)	19 (45.2)	4 (23.5)	
	Most of their meals	48	28 (20.0)	12 (28.6)	8 (47.1)	
	All of their meals	16	9 (6.5)	4 (9.5)	3 (17.6)	
	Missing	2	2	0	0	
First food offered	Baby rice cereal	100	75 (53.6)	24 (57.1)	1 (5.9)	<b>0.001</b>
	Fruit	70	48 (34.3)	12 (28.6)	10 (58.8)	
	Vegetables	29	17 (12.1)	6 (14.3)	6 (35.3)	
	Meat	0	0	0	0	
	Missing	0	0	0	0	
Amount of commercially prepared baby food	All of it	14	11(7.9)	3 (7.1)	0	<b>0.002</b>
	Most of it	34	21 (15.0)	11 (26.2)	2 (11.8)	
	Half of it	47	38 (27.0)	8 (19.0)	1 (5.9)	
	Hardly any of it	78	58 (41.4)	15 (35.7)	5 (29.4)	
	None of it	26	12 (8.6)	5 (11.9)	9 (52.9)	
Missing	0	0	0	0		
Reported a choking episode	No	130 (67.3)	95 (69.3)	24 (60.0)	11 (68.8)	0.567
	Yes	63 (32.6)	42 (30.7)	16 (40.0)	5 (31.3)	
	Missing	7	3	2	2	
Reported a gagging episode	No	51 (26.2)	39 (27.9)	7 (16.6)	5 (29.4)	0.286
	Yes	143 (73.7)	99 (70.7)	34 (81.0)	10 (58.8)	
	Missing	5	2	1	2	

\* p-value compares feeding methods

CF Complementary foods

Mo months

247 Across the whole sample, 32.6% of participants reported at least one choking  
 248 episode, and most (71.4%) of these participants reported that choking had  
 249 occurred with whole food. There was no difference between groups for the  
 250 proportion reporting at least one choking episode, the form (puréed, mashed or  
 251 whole) that the food was in, or the method of feeding (spoon-feeding or self-  
 252 feeding) when the choking episode occurred ( $p>0.05$ ). There was also no group  
 253 difference in the proportion reporting at least one gagging episode ( $p>0.05$ ).



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3 254 Thirty-eight per cent of all participants had not heard of BLW, 7.6% reported  
4 255 knowing a lot about it, and the remaining 54.1% reported knowing a moderate  
5 256 or small amount. A large proportion of the “parent-led feeding” group had never  
6 257 heard of BLW (64.4%). Participants reported hearing about BLW through a  
7 258 friend or family member rather than from a healthcare professional.  
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13 260 All families who had followed BLW reported that they would recommend the  
14 261 method, but interestingly more than half (59.6%) would recommend that BLW  
15 262 be used in combination with spoon-feeding. Forty-six per cent of those who had  
16 263 followed “parent-led feeding” would be willing to try BLW if they had another  
17 264 child. The main reasons reported for not wanting to try BLW were fear of their  
18 265 infant choking (55.3%), concern about the infant’s ability to eat enough (44.2%),  
19 266 reservation that the infant would not have the necessary motor skills to self-feed  
20 267 (27.6%), or considering that “parent-led feeding” had worked fine, so there was  
21 268 no need to change (27.1%).  
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3 270 **DISCUSSION**  
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5 271 This is the first study to describe BLW and parent-led feeding in a sample from  
6 272 the general population. In contrast, previous studies have recruited participants  
7 273 separately from BLW specific groups or websites, with controls coming from  
8 274 other sources such as patient lists [9], and nurseries and community centres [4-  
9 275 6]. We found that the association between infant feeding method and health-  
10 276 related behaviours differed depending on the extent to which families followed  
11 277 BLW. This indicates that it is essential for healthcare professionals, as well as  
12 278 researchers, to collect information on the extent of infant self-feeding when  
13 279 parents report following BLW. Compared to the “self-identified BLW” and  
14 280 “parent-led feeding” group, the “adherent BLW” were more likely to meet the  
15 281 WHO recommendations to exclusively breastfeed for 6 months, and to begin  
16 282 complementary foods at 6 months of age. [18] The “adherent BLW” group were  
17 283 also more likely to be having foods that the family ate, and were less likely to be  
18 284 offering their baby commercially prepared baby food. Both BLW groups were  
19 285 more likely to be sharing all or most of their meals with the family compared to  
20 286 the “parent-led feeding” group. In contrast to the “self-identified BLW” and  
21 287 “parent-led feeding”, children, “adherent BLW” children were not offered infant  
22 288 iron-fortified cereal as their first food.  
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38 290 In this study, adherent BLW was defined as the baby feeding themselves all or  
39 291 most of the time at 6 to 7 months of age (i.e. little or no parent spoon-feeding).  
40 292 Previous studies [4 5] have defined BLW according to the extent of spoon-  
41 293 feeding and/or purées consumed. As our previous work [10] had suggested that  
42 294 purées could be offered to the self-feeding infant (for instance puréed mince on  
43 295 toast) the definition used here related only to the method of feeding (self-feeding  
44 296 vs. spoon-feeding) and not the form of food (purée, mashed, or whole). In  
45 297 practice only a small number of families (8% of this sample) were classified as  
46 298 following adherent BLW. A large proportion (21%) of families who reported  
47 299 using BLW were instead following a more flexible approach that included a  
48 300 combination of self-feeding and spoon-feeding. This agrees with our earlier  
49 301 qualitative study [10], in which families following BLW also reported using some  
50 302 spoon-feeding. Generally this occurred at times when their infant appeared  
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3 303 unable to feed themselves (e.g., during illness) or specifically to ensure  
4 304 appropriate iron intake (parents spoon-fed iron-fortified baby cereal at  
5 305 breakfast). This suggests that BLW and spoon-feeding are not viewed as  
6 306 dichotomous methods within the community but instead as styles of infant  
7 307 feeding that can be combined to suit the needs of the child and the family in each  
8 308 feeding situation.

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15 310 A concern that is commonly expressed about BLW [10] is the potential increased  
16 311 risk of choking when infants self-feed whole foods. When infants transition from  
17 312 milk to solid foods they are at increased risk of choking because they may not  
18 313 have developed the coordination of chewing, breathing and swallowing needed  
19 314 to eat food safely. [19 20] Choking is when the airway is obstructed and  
20 315 respiration is interrupted [21] and food related choking can be fatal. [20 22]  
21 316 Prevalence data on choking are limited, and no data exist on the rates of choking  
22 317 when complementary foods are being introduced, whether using a traditional or  
23 318 a BLW method. The most relevant data available show that in New Zealand in the  
24 319 period from 2002 to 2009, nine deaths occurred in children under six years of  
25 320 age as a result of the inhalation of food, specifically meat, sausage, peanuts, apple  
26 321 and grapes [22]. In contrast, gagging, which is very common among all infants, is  
27 322 less serious. [23] The gag reflex very effectively keeps large pieces of food well to  
28 323 the front of the mouth, only allowing well masticated food to reach the back of  
29 324 the mouth for swallowing. [1 24-26]. In this survey we found no difference  
30 325 between the groups in the proportion reporting at least one gagging or choking  
31 326 episode. However, more than 30% of the total sample reported at least one  
32 327 choking episode, and this mostly commonly involved whole foods. Since choking  
33 328 can be very serious it would be of concern if these reports reflect actual choking  
34 329 rates. Parents often find it difficult to distinguish between choking and gagging  
35 330 and therefore, although we included a definition of both choking and gagging in  
36 331 our survey, it is likely that parents have incorrectly identified choking, in  
37 332 particular mistaking gagging for choking. It is also important to note that  
38 333 because serious choking episodes are rare, this relatively small study was not  
39 334 powered to identify differences in these rates between the complementary  
40 335 feeding groups.

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4 337 We found a number of important associations between feeding method and the  
5 338 likelihood of achieving the nutrition recommendations for infants as outlined by  
6 339 the New Zealand Ministry of Health and WHO [3 18]. The “adherent BLW” group  
7 340 were more likely to meet both the recommendation to exclusively breastfed to  
8 341 six months, and to introduce complementary foods at six months. Two possible  
9 342 explanations for this finding are that the desire to follow BLW results in parents  
10 343 waiting until six months, which is the age when it is considered that most healthy  
11 344 infants are developmentally ready to self-feed, [7 27 28] or that parents who  
12 345 choose BLW are more aware of and adhere to health recommendations.  
13 346 However, it is also feasible that parents who follow a parent-led method are able  
14 347 to encourage their infant to begin complementary foods earlier by feeding  
15 348 purées or infant cereal by spoon, which requires little input from the infant and  
16 349 therefore is not reliant on their developmental ability to actively participate in  
17 350 feeding. The results from the current study are consistent with a cross-sectional  
18 351 study from the United Kingdom where BLW (defined as less than 10% spoon-  
19 352 feeding or less than 10% purée use for total food intake) was associated with  
20 353 later introduction of complementary foods. [5] Furthermore a United Kingdom  
21 354 based survey examining the knowledge of infant feeding guidelines and the  
22 355 influence of healthcare professionals identified BLW as the strongest predictor  
23 356 for introducing complementary foods at the recommended age. [29]

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25 358 The feeding method used by families was associated with many other potentially  
26 359 health-related behaviours. Those in the “adherent BLW” group were most likely  
27 360 to offer fruits and vegetables as first complementary foods rather than iron-  
28 361 fortified cereal. It is of concern that for the “adherent BLW group” the first foods  
29 362 reported in this survey were poor sources of iron, as this increases the infant’s  
30 363 risk of suboptimal iron status [3 30-33]. Although fruits and vegetables are  
31 364 nutrient rich foods, they do not provide all the nutrients necessary for six-  
32 365 month-old children. [3] In particular, infants should receive iron-rich  
33 366 complementary foods such as meat, meat alternatives, or iron-fortified foods  
34 367 immediately when starting complementary foods to supply necessary iron. [3  
35 368 30-33] We are unable to determine how long only fruit and vegetables were

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3 369 offered, and at what age iron-rich foods, such as meat, were introduced.  
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5 370 However, spoon-feeding iron-fortified baby rice cereal is a popular way for  
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7 371 parents to increase their infant's iron intake, [3] and the semi-liquid form of  
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9 372 infant cereals makes them a difficult food for infants to feed themselves at six  
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11 373 months. In this survey none of the "adherent BLW" group offered infant cereal as  
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13 374 a first food. In contrast, some of the "self-identified BLW" group did - presumably  
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15 375 by spoon. Conversely, because the infant following BLW is eating family foods  
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17 376 there may be greater potential for a wider variety of iron-rich foods such as  
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19 377 pieces of cooked red meat to be offered. The bioavailability of iron from these  
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21 378 foods is also much higher (15.5%) than from infant cereals (3%) [34]. However,  
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23 379 **biochemical iron status was not determined in this study so we are unable to**  
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25 380 **determine whether the risk of iron deficiency differed amongst the different**  
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27 381 **complementary feeding groups.**  
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31 383 Family meals have been linked to healthier eating patterns including greater  
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33 384 intake of fruits and vegetables and lower intake of unhealthy foods. [35-37]  
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35 385 However this relationship has only been examined in older children (two years  
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37 386 and over) and the benefits of family meals for younger children (i.e., 6 to 12  
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39 387 months) is yet to be determined. Furthermore, no longitudinal studies have  
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41 388 investigated whether the health benefits associated with sharing family meals  
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43 389 track into later life. Aside from the potential nutritional benefits associated with  
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45 390 sharing family meals, there are other important reasons why infants should eat  
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47 391 with the family, such as mealtimes providing an opportunity to communicate,  
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49 392 learn, and develop family rituals. [38] Our results showed the "adherent BLW"  
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51 393 parents were sharing a greater number of meals with their infant, and were  
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53 394 likely to be doing this within one month of the initiation of complementary  
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55 395 feeding. Brown and Lee [6] reported similar results in their qualitative study.  
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57 396 Results from the pilot study (n=10) of Rowan and Harris [11] also showed BLW  
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59 397 families were sharing most meals (average of 3 out of the 3.5 meals per day)  
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398 with their child by 9 months of age.

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400 In addition to sharing family meals, exposure to family foods (the same foods  
401 eaten by other family members) may encourage healthier long-term eating

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3 402 patterns. [39-41] Results from a recent representative Scottish study showed  
4 403 that eating family foods was the most important aspect of family meals  
5 404 associated with a healthier diet at age five years (i.e., it is the food choice that has  
6 405 greater importance than the form and function of the meal). [42] In our survey,  
7 406 the “adherent BLW” infants were having a greater amount of family foods, as  
8 407 well as less commercially purchased food, whereas, families who followed the  
9 408 “parent-led feeding” method reported a greater proportion of commercially  
10 409 prepared food. Whilst purchased baby food is nutritionally appropriate [3] and  
11 410 many parents choose it for this reason, it is typically bland and of a smooth  
12 411 consistency. Only a longitudinal study would be able to determine the effects of  
13 412 early exposure to family foods compared with commercially prepared baby food  
14 413 on long term dietary behaviours.

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16 415 Most parents in the current study had either followed BLW or would be willing  
17 416 to try it with a subsequent child. All families who had followed BLW reported  
18 417 that they would recommend the method, but interestingly more than half would  
19 418 recommend that BLW be used in combination with spoon-feeding. Although  
20 419 more than one-third of the sample had not heard of BLW, after watching a short  
21 420 video and reading the brief description of BLW embedded in the survey 46%  
22 421 reported being willing to try it with another child. Combining the parents who  
23 422 were willing to use BLW with those who reported already using it suggests that  
24 423 79% of this sample would be willing to adopt, at least aspects of, a baby-led  
25 424 approach, even though a large proportion had, prior to the survey, not heard of  
26 425 BLW. Those not willing to try BLW were concerned about choking, energy intake,  
27 426 and developmental readiness of the infant to self-feed at six months or  
28 427 considered that the “parent-led feeding” method had worked well for their  
29 428 family, precluding any need to change.

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31 430 This study has a number of strengths and weaknesses. We attempted to improve  
32 431 the representativeness of our sample by advertising the study in public domains  
33 432 (particularly community distributed free newspapers). Recruiting participants  
34 433 from the general population instead of specific groups improves the likelihood of  
35 434 a more representative sample. [43 44] We also avoided mentioning BLW in the

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3 435 advertisement to reduce the bias associated with recruiting only those familiar  
4 436 with BLW. However, as the survey was administered through the Internet it  
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6 437 required participants to have access to the Internet and possess computer skills.  
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8 438 Recent figures show that 86% of NZ families have personal internet access [45]  
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10 439 suggesting a large proportion could access the current survey. However our  
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12 440 newspaper advertising was restricted to urban areas and this may have affected  
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14 441 our sample, as the demographic characteristics of the current sample do not  
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16 442 reflect those of the general New Zealand population in some respects. In  
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18 443 particular, the sample was highly educated with more mothers having a  
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20 444 university degree (66%) compared to the general population (40%) [46], and  
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22 445 the rate of exclusive breastfeeding to 6 months (26 %) was greater than that of  
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24 446 the general population (16%) [47]. In addition, although we observed significant  
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26 447 associations between the method used for introducing complementary foods and  
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28 448 health outcomes, the direction of these associations cannot be determined due to  
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30 449 the cross-sectional study design. This highlights the urgency with which  
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32 450 prospective studies, and randomised controlled trials of BLW are required so  
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34 451 that the nature and direction of health-related associations can be firmly  
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36 452 established. Therefore, as this study was relatively small (n=199), may have  
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38 453 comprised participants who were more computer literate, and was cross-  
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40 454 sectional, caution must be used when interpreting these results.  
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44 456 In conclusion, the majority of our sample were using the parent-led method of  
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46 457 spoon-feeding purées to introduce complementary foods to their child. Twenty-  
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48 458 one percent of the sample reported using BLW but were not strictly limiting  
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50 459 spoon-feeding, and a smaller number (8%) followed a strict BLW approach. We  
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52 460 found several important associations between feeding method and health  
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54 461 related behaviours, suggesting that greater adherence to the self-feeding tenet of  
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56 462 BLW was associated with exclusively breastfeeding for 6 months, beginning  
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58 463 complementary foods at 6 months, and eating the same foods as the rest of the  
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60 464 family from the start of the complementary feeding period. However, it is  
465 concerning that these infants were not offered infant iron-fortified cereal as a  
466 first food. Both BLW groups were more likely to be sharing all or most of their  
467 meals with their family. The results of this study suggest that for many families

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3 468 the practice of BLW deviates substantially from the theory. It is therefore  
4 469 essential that health professionals, as well as researchers, do not rely on parental  
5 470 self-reports of BLW, but also quantify the extent of infant self-feeding.  
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11 473 this study. SC was funded by a University of Otago PhD Scholarship.

12  
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14 475 design of the study, the analysis and interpretation of the data and the writing  
15 476 and editing of this paper. SC designed and executed the online survey and was  
16 477 responsible for the analysis and interpretation of the data. SC wrote the first  
17 478 draft of the paper, and A-L H and RWT made important intellectual contributions  
18 479 to the content and approved the final version.  
19

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22 482 non-profit sectors.  
23

24 483 **Competing interests** None.  
25

26 484 **Ethical approval** Ethical approval was obtained from the University of Otago  
27 485 Ethics Committee.  
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29 486 **Provenance and peer review** Not commissioned.  
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31 487 **Data sharing statement** No additional data are available.  
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	2 & 5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	11 & Table 1 & Figure 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	11 & Table 1
Bias	9	Describe any efforts to address potential sources of bias	16
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6 & 7
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	Treated as missing Table 3 & Table 4
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A

<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 & Table 3
		(b) Indicate number of participants with missing data for each variable of interest	Table 3 & 4
Outcome data	15*	Report numbers of outcome events or summary measures	12 -16
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	2 & 22
Generalisability	21	Discuss the generalisability (external validity) of the study results	22
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

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Te Whare Wānanga o Ōtago

Professor Richard Sands  
Managing Editor, BMJ Open  
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28/10/2013

Dear Professor Sands

Thank you for your email on 14/10/2013 advising us that our manuscript "Parent-led or Baby-led? Associations between complementary feeding practices and health-related behaviours in a survey of New Zealand families" (Manuscript ID bmjopen-2013-003946) has been recommended for publication in *BMJ Open*.

We have carefully considered the comments of each reviewer and provide an itemized discussion of each point (reviewer's comments in italics) with our revised manuscript as follows:

**Reviewer #1 (Remarks to the Author):**

- 1. The discussion would benefit from more explicit articulation and examination of the problem of causality in the relationship between adherent BLW and related health behaviours.***

Additional discussion regarding causality has been added to the Discussion (page 22, lines 445-451).

- 2. The tables would benefit from having the test statistics added rather than just the p-values.***

We used the Pearson's chi-squared test to determine whether there were statistically significant differences between the complementary feeding groups because this enabled us to compare proportions. This approach does not produce a meaningful test statistic. To clarify this we have replaced "chi square test" with "Pearson's chi-squared test" in the statistical methods section (page 11, line 188).

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**Reviewer #2 (Remarks to the Author):**

- 1. As a minor point, the first sentence doesn't seem to quite flow. I think a clear and slightly more detailed definition of blw is needed.**

Further detail about BLW has been added as requested (page 4, lines 87- 95).

- 2. I think the categorization using the two elements of whether the parent identified themselves as baby-led or not and then their behavior is very interesting. I think this needs further consideration in the discussion section though and is a critical point for future research. There must be some parents in the sample (or in the general population currently weaning their babies) who display similar behaviours but label themselves as baby-led or not. So they have the same amount of spoon feeding, but one considers themselves to be baby-led, the other has never heard of it. Is this important? Might this affect outcomes for the child?**

This is a very interesting point and certainly warrants further investigation. We have revised Figure 1 to better reflect the nature of the groups, i.e., participants were classified first by whether they were self-feeding, and then by whether or not they considered that they were following BLW. We had not included a group for participants who were self-feeding but did not identify themselves as following BLW because there were no cases of this in the study sample. For completeness, and clarity, Figure 1 now includes a group who were "unclassified", and we have specifically stated in the Results (page 11, lines 200-201) that no cases of the "unclassified" method were found. We agree that it would be very interesting to see a study in which the elements of responsive feeding were considered alongside those of BLW, because it is possible that any health benefits of BLW are mediated by responsive feeding.

- 3. You raise the point in the discussion that parents want to do a mix of blw and spoon feeding - but how is that different to normal weaning practices? In the UK it is recommended that babies are given finger foods alongside purees from six months. Does this matter? Does the label of baby-led matter? Is it a way of thinking?**

In New Zealand BLW is not compatible with the New Zealand Ministry of Health (MOH) guidelines and, indeed, is not supported by the Ministry of Health (at least as a population approach) due to a lack of evidence regarding its use (<http://www.health.govt.nz/our-work/preventative-health-wellness/nutrition/baby-led-weaning-ministry-position-statement>). The conventional method of infant feeding currently advised and supported by the MOH and NZ healthcare professionals is to spoon-feed purées from 6 months and not to introduce finger foods until at least 7-8 months, at which time they would generally only represent a small proportion of the diet. Therefore, mothers following BLW are seen as following an alternative method in NZ, at least at this point in time. Although infants in the UK are recommended to have finger-foods from 6 months of age we would assume that only a small proportion would be making these the main component of their diet. It would be interesting to see a similar study from the UK in which spoon-

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3 feeding and self-feeding rates are compared in parents who identify as doing BLW,  
4 and parents following the traditional method of feeding. Certainly studies to date  
5 (including the present one) suggest that the mothers who follow BLW are  
6 demographically different and have different levels of control around feeding. This  
7 suggests that BLW may be a group of behaviours, perhaps including a more  
8 responsive feeding style, and not just a single behaviour working in isolation.  
9

- 10  
11 **4. This leads me to my second point. Essentially, what is baby-led weaning? Is it**  
12 **about what foods the baby is given? How they are fed/feed themselves?**  
13 **Whether they join in mealtimes? Or is it more about letting the baby control**  
14 **their intake or even just a way of thinking about weaning and child feeding**  
15 **in general? When does someone become classed as blw? I know a key debate**  
16 **on blw forums is whether someone classes themselves as blw or not. Some**  
17 **believe you have to be very adherent, others are more relaxed and**  
18 **occasionally give purees. Does spoon feeding matter? Or is it more about**  
19 **how they are spoon fed if they are – responsively? I think a key question for**  
20 **future research is ‘what is important about the method’. Evidence is starting**  
21 **to emerge that the method may have a positive impact upon child eating**  
22 **behavior and weight but WHY does this occur? What is ‘special’ about the**  
23 **method? Or is it just something different about the mothers who choose to**  
24 **follow it? Finally can those elements ever be applied to standard weaning for**  
25 **those who don’t want to follow blw?**  
26

27 Please see response to point 3.  
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- 29  
30 **5. There are very high rates of exclusive breastfeeding in your sample which I**  
31 **presume are far exceeding population norms for NZ. This limitation needs to**  
32 **be considered.**  
33

34 We acknowledge the reviewer’s point and agree that is it uncommon for mothers to  
35 exclusively breastfeed to 6 months in New Zealand (current national rate of  
36 exclusive breastfeeding at 6 months is 16%). We have added a sentence to the  
37 Discussion (page 22, lines 443-445).  
38

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40 **6. The numbers in the sample of those who are adherent to blw are very low.**  
41 **This is natural due to the recruitment methods used but does offer a small**  
42 **group for comparison.**  
43

44 We acknowledge the reviewer’s comment. It is reassuring that although the number  
45 of parents who were adherent to BLW was small, it did still provide sufficient power  
46 to demonstrate small, but statistically significant, associations between this group  
47 and health related outcomes. However, it would be important to examine the non-  
48 significant variables such as choking and gagging in a larger sample before coming  
49 to any conclusions about their presence or absence in infants following BLW (a  
50 comment to this effect has been added to the Discussion page 18 lines 334-337).  
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7. ***Also, even within this adherent group, many report behaviours that are at odds with definitions of adherent BLW. For example a proportion gave baby rice as their first food. Many use commercial foods to some extent. Others don't eat as a family with their baby. I think any definition of BLW needs to allow some variation – but I think this could possibly be a further discussion point. Again, what is BLW, do you have to follow it strictly and what elements are most important?***

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This is a very interesting point. As our previous work (Cameron, Heath and Taylor BMJ Open 2012) had suggested that purées could be offered to the self-feeding infant (for instance puréed mince on toast) the definition used here related only to the method of feeding (i.e., self-feeding vs. spoon-feeding) and not to the form of food (i.e., purée, mashed, or whole). Therefore we classified 'adherent BLW' as meeting a minimum and specific criterion (i.e., infant always or mostly self-feeds). Only a longitudinal study could determine what are the important aspects of BLW and presumably this would depend on the desired outcome.

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**Reviewer #3 (Remarks to the Author):**

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1. ***More could be done in the ms to show how representative of the population this sample was. I feel information should be divided by the four main regions sampled. So, for example, how many children were eligible to be included in this study from health records, and how many were actually recruited? How did this vary across key demographic groups (such as maternal age)? The authors touch on this, but I feel more could and should be done to support the initial claim.***

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We acknowledge the reviewer's comment about the representativeness of the sample and have added detail to the Results (page 12, lines 210-214). However, we do not feel it is appropriate to present the data by region because (a) this would substantially reduce the sample size for comparisons, and (b) we do not know how many children were eligible in each region. Unlike other BLW studies where participants have been recruited from health records, the participants in the current study were recruited from the general population via advertisement in local newspapers. Thus, no response rate can be calculated.

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2. ***Is it that health professionals should be more willing to promote BLW because parents are open to this approach when given information about it, and that it doesn't seem to be associated with a higher incidence of the types of behaviours parents are concerned with the approach, such as choking? I feel the key messages could be pulled out more explicitly through carefully rewriting some sections of text.***

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The main message of this study was that although parents may identify themselves as following BLW, it is important that healthcare professionals delve deeper into what BLW means for each family. We found that different levels of adherence to BLW were associated with different health related behaviours. We

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3 have re-written sections of the manuscript to make this more apparent.  
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- 5 **3. Comments were made in the discussion about picky eating but the ms does**  
6 **not report data on this. Other studies have looked at this though, so maybe**  
7 **some reference to these studies would be appropriate.**  
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9 We agree with the authors and have removed these comments from the  
10 Discussion.  
11

- 12 **4. When discussing the intake of iron rich foods was there any evidence that the**  
13 **A-BLW group were deficient in iron? If this wasn't studied perhaps indicate**  
14 **this as a limitation to the study, as without objective data we cannot tell if**  
15 **there is a difference in iron deficiency between the two groups so the**  
16 **discussion might be somewhat redundant.**  
17

18 We agree and have added this cautionary note on page 20, lines 378-380.  
19

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21 We hope that the revised manuscript is considered suitable for publication in *BMJ Open*  
22 and look forward to hearing from you in due course.  
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26 Yours sincerely,  
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32 Rachael Taylor, PhD (on behalf of the co-authors)  
33 Email: rachael.taylor@otago.ac.nz  
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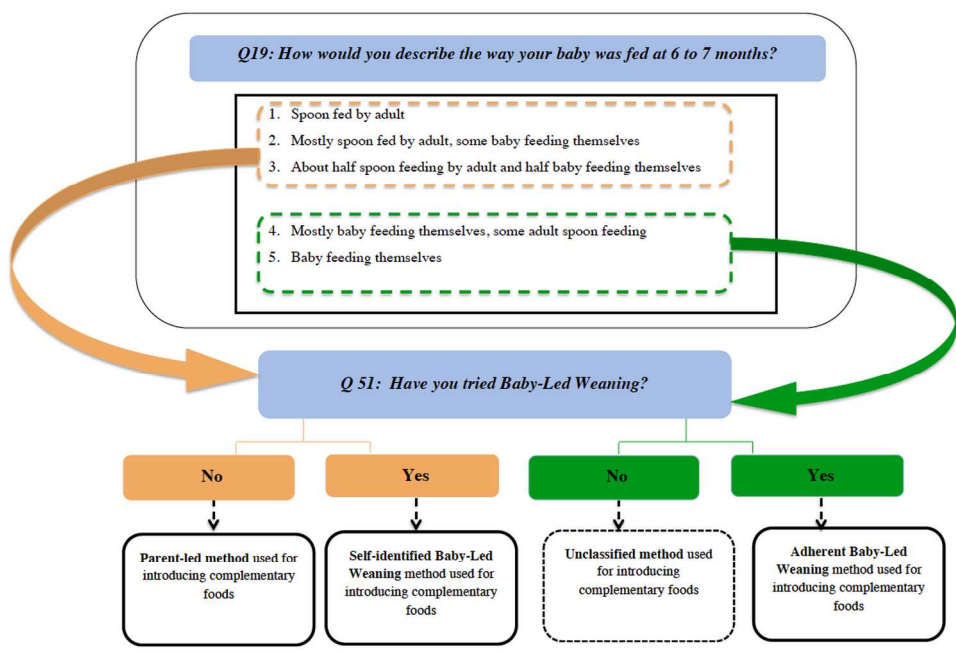


Figure 1. Survey questions used to classify infant feeding method

review only