Initiation of Complementary Feeding and Duration of Total Breastfeeding: Unlimited Access to Lactation Consultants Versus Routine Care at the Well-Baby Clinics

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Abstract

Introduction: Breastfeeding has several advantages for both mother and child. Lactation consultants may promote prolonged breastfeeding, but little is known about their impact on the initiation of complementary feeding.

Subjects and Methods: Dietary intake during the initial complementary feeding period from 5 to 6 months was collected on mother–infant pairs who had unlimited access to lactation consultants along with those mother–infant pairs who received routine care at the well-baby clinics. The total duration of breastfeeding in each study population was also recorded, and total breastfeeding durations of infants receiving complementary foods from 4 months and those exclusively breastfed for 6 months in each of the two study populations were compared.

Results: Higher proportion of infants of mothers with unlimited access to lactation consultants were fed vegetable and vegetable purées ($p=0.05$) and more than one food type ($p=0.05$) at 5 months. Furthermore, a lower percentage of them had three meals per day at 6 months ($p=0.001$) compared with those receiving routine care at the well-baby clinics. Infants exclusively breastfed for 6 months all had similar duration of total breastfeeding.

Conclusions: Mother–infant pairs with unlimited access to lactation consultant had slower introduction of complementary foods at the initial complementary feeding period, according to number of infant's meals at 6 months of age. Furthermore, those exclusively breastfed for 6 months had more prolonged breastfeeding compared with mothers who began complementary feeding at 4 months regardless of exposure to lactation consultants.

Introduction

NUTRITION AT EARLY DEVELOPMENTAL stages in life seems to have long-term effects on health outcomes later in life and the risk of noncommunicable diseases. The mechanism is thought to be through nutritional influences on

growth.^{1,2} Studies indicate that rapid growth in infancy is associated with increased risk of childhood obesity^{3,4} and that prolonged breastfeeding may have protective effects on overweight and obesity in childhood and adolescence.^{5–7}

Breastfeeding support is critical to breastfeeding success. Pre- and postnatal education and support by lactation

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consultants are strongly associated with a longer duration of breastfeeding.^{8–13} A recent systematic review showed that professional breastfeeding support at the individual level increased the rate of breastfeeding between 4 and 5 months of age, a time when breastfeeding rates typically decline sharply.¹⁴ Very little is known about the impact of lactation consultants on the process of complementary feeding, including the frequency of giving complementary foods and the choice of foods provided to infants early in the complementary feeding process. Complementary feeding at this critical time period in early life might be influenced by lactation consultants, and furthermore the complementary foods might influence growth in infancy and therefore future health outcomes.¹⁵

The aim of the present study was to assess the effect of unlimited access to lactation consultants on complementary feeding from 5 to 6 months for infants receiving complementary foods from 4 months of age in addition to breastmilk and their effect on total breastfeeding duration.

Subjects and Methods

Participants and study design

In this study we examined complementary feeding practices between 5 and 6 months of age and total breastfeeding duration by comparing dietary intake data from study subjects from two previously reported studies.^{16–18} One of the two studies was a randomized controlled trial where participating mothers received counseling from an International Board Certified Lactation Consultant and had unlimited access to the lactation consultants. The other study was a national prospective cohort study where mothers and infants received routine care at the well-baby clinics at the primary health care centers. Both studies from which the current analysis was conducted had similar eligibility criteria and were conducted at a similar time period, thus providing the opportunity to compare the complementary feeding practices during the initial complementary feeding period and total duration of breastfeeding, based on exposure to professional lactation consultation.

The sample of mother–infant pairs who had unlimited access to lactation consultants was recruited in seven healthcare centers in Iceland between November 2007 and November 2009 into a randomized controlled trial.^{16,17} Infants were randomly assigned either to receive complementary foods from the age of 4 months in addition to breastmilk ($n=50$) or to continue being exclusively breastfed to the age of 6 months ($n=50$). Randomization was performed, as previously described,^{16,17} by a lactation consultant at each healthcare center when the infant was 4 months of age. During the study the mothers could at all times contact the consultant for support and advice.

The sample of mother–infant pairs receiving routine care at the well-baby clinics was from a national prospective cohort study of infants born between January and December 2005 who were randomly selected by Statistics Iceland when the infants were 4 months old. During the study the infants received routine care at the well-baby clinics.¹⁸ In total, 250 infants were collected in the study, and of these, 28 infants received complementary foods from 4 months of age in addition to breastmilk, and 15 infants were exclusively

breastfed for 6 months. These 43 infants were included in the current study.

The infants selected in both studies were born in Iceland and fulfilled similar inclusion criteria for participation (i.e., singleton birth, gestational interval at least 37 weeks, and absence of congenital abnormalities or chronic health issues). Exclusive breastfeeding was defined as breastfeeding with no additional liquid or solid foods other than vitamin drops and medications,¹⁹ although infants of mothers having unlimited access to lactation consultants were allowed to receive up to 10 feedings of formula or water during the first 6 months. Complementary feeding was defined as consumption of any solid or semisolid foods or liquid with continued breastfeeding. Meals were only included in the comparison of number of meals if the infant had solid, semisolid, or soft foods; formula feeding alone did not count as a meal. The primary outcome in the current study was a comparison of the number of food types at 5 months and number of meals between the two study populations at 5–6 months of age. The secondary outcome was a comparison of total breastfeeding duration among the infants.

Both studies were reviewed and approved by the Data Protection Authority and National Bioethical Committee in Iceland, and the randomized controlled trial was also approved by the Partners Health System Institutional Review Board, Boston, MA.

Advice on complementary feeding

Preventive health services for 0–5-year-old children in Iceland are based on guidelines published by the Directorate of Health.²⁰ In line with those guidelines, infants in both cohorts came for regular visits at their healthcare center at 6 and 9 weeks and 3, 5, and 6 months of age and met a nurse in all visits and a doctor at 3 and 6 months. A booklet with the infant dietary recommendations²¹ was provided to all mothers in both cohorts during one of these visits to the healthcare center, and the parents were advised about complementary feeding. Mothers receiving routine care at the well-baby clinics received recommendations about complementary foods in the visit to the healthcare centers at 5 months if the nurse judged it important to educate the mother about complementary foods or if the mother asked for advice about the complementary feeding. At the same visit the infant's weight, length, and head circumference were measured, and the child also received immunizations. The mothers were advised to give their infants porridges and purées of fruits and vegetables if they had begun to give the infant complementary foods or were interested in doing so. In general, mother–infant pairs in routine care at the well-baby clinics do not attend for an additional visit at 4 months of age, and therefore the mothers in this cohort did not receive any advice on complementary feeding from a professional until the infant was 5 months old, when they had already been eating complementary foods for a month.

All mothers who had unlimited access to lactation consultants and were randomized to give their infant complementary foods from 4 months of age in addition to breastmilk were thoroughly advised about the complementary feeding in an additional 4-month visit by a lactation consultant. The lactation consultants gave similar advice to that given in routine care at the well-baby clinics (i.e., to give the infant

mainly porridges and purées of fruits and vegetables). Yet, the lactation consultants emphasized to the mothers the importance of giving diverse complementary foods and that breastmilk should be the main food in the infant's diet until 6 months of age; mothers were therefore advised to give their infants small amounts of complementary foods and that one teaspoon once a day was enough until 6 months. The mothers with unlimited access to lactation consultants received more nutritional support during the initial complementary feeding period than is usually provided in routine care at the well-baby clinics.

Data collection

Dietary data were collected in both cohorts. Mothers of infants receiving complementary foods from 4 months of age and having unlimited access to lactation consultants obtained a 3-day weighed food records when the infant reached approximately 5 months and 1 week (± 7 days) of age. Foods were weighed on accurate electronic scales with 1 g accuracy (Philips model HR 2385; Philips Corp., Budapest, Hungary) provided to mothers by the research staff. Furthermore, parents recorded the date that every new food item and a new meal were added to the infant's diet during the time period 4–6 months. Information was retrospectively collected on total duration of breastfeeding for all infants.

Among mother–infant pairs receiving routine care at the well-baby clinics, dietary data were collected monthly from 5 to 8 months by 24-hour food records, where mothers recorded all foods the infant consumed. Furthermore, information on total duration of breastfeeding was collected retrospectively for all infants. Comparable dietary data for the two study groups were for ages 5 and 6 months.

Statistical analysis

Statistical analyses were performed using the SPSS Windows statistical software package version 20.0 (SPSS Inc., Chicago, IL). Mean and SD values were used to describe normally distributed variables, whereas median and inter-

quartile range values were used for skewed variables. For comparison between two groups, the independent *t* test was used for normally distributed data, and the nonparametric Mann–Whitney U test was used when data were not normally distributed. The χ^2 tests of association and two-sided Fisher's exact test were used to compare dichotomous variables. A one-way analysis of variance and Bonferroni's post hoc test were used to assess the differences in total breastfeeding duration. The level of significance in the study was set at $p \leq 0.05$.

Results

Sample size and characteristics of subjects

In total, 50 mother–infant pairs who had unlimited access to lactation consultants and 28 mother–infant pairs who received routine care at well-baby clinics were included in the primary data analysis for those infants who received complementary foods from 4 months of age in addition to breastmilk and also in the secondary data analysis. In total, 50 mother–infant pairs who had unlimited access to lactation consultant and 15 mother–infant pairs who received routine care at well-baby clinics were included in the secondary data analysis for those who were exclusively breastfed for 6 months. No significant differences were seen in the characteristics between subjects of the study groups, as shown in Table 1.

Dietary diversity and number of meals

Table 2 compares the number of types of solid, semisolid, and soft foods that infants consumed over a 24-hours period at approximately 5 months of age in the two study populations. A higher proportion of infants whose mothers had unlimited access to lactation consultants consumed some vegetables and vegetable purées ($p=0.05$) in these 24 hours; furthermore, a greater proportion of them consumed more than one food type ($p=0.05$) compared with mother–infant pairs who received routine care at the well-baby clinics. Food

TABLE 1. BASELINE CHARACTERISTICS OF PARTICIPANTS IN THE STUDY

Variable	Complementary feeding from 4 months of age		Exclusive breastfeeding for 6 months	
	Lactation consultant	Routine care	Lactation consultant	Routine care
Birth weight (kg)	3,706 (448)	3,745 (376)	3,707 (518)	3,816 (301) ^a
Length at birth (cm)	51.4 (1.8)	51.8 (1.6)	51.6 (2.0)	52.2 (1.3) ^a
Weight at 6 months (kg)	7,961 (1,058)	7,978 (816) ^a	8,005 (1,046)	8,136 (1,077) ^a
Length at 6 months (cm)	68.2 (2.3)	68.7 (2.1) ^a	68.5 (2.2)	68.9 (1.9) ^a
Maternal age	29.7 (4.4)	31.2 (4.9)	30.7 (5.1)	32.6 (4.9) ^b
Maternal education at university level ^{c,d}	30 (60%)	12 (50%) ^b	24 (48%)	6 (55%) ^b
Breastfeeding frequency (times/24 hours)	8.2 (2.0)	8.7 (2.9)	—	—
Total time breastfeeding (minutes/24 hours)	69.5 (31.5)	78.9 (40.8)	—	—

Characteristics of subjects and breastfeeding behavior at 5 months are given for mother–infant pairs who had unlimited access to lactation consultants (received complementary foods from 4 months, $n=50$; exclusively breastfed for 6 months, $n=50$) and mother–infant pairs who received routine care at the well-baby clinics (received complementary foods from 4 months, $n=28$; exclusively breastfed for 6 months, $n=15$). Data are mean (SD) values unless otherwise indicated.

^aTwo missing values ($n=13$ and $n=26$, respectively).

^bFour missing values ($n=11$ and $n=24$, respectively).

^cFinished studies at university level.

^dData are number (%).

TABLE 2. NUMBER OF TYPES OF SOLID FOODS THAT INFANTS CONSUMED AT 5 MONTHS OF AGE

<i>Number of food types</i>	<i>Lactation consultant</i>	<i>Routine care</i>	<i>p value</i>
Total number of food types ^a	1.5 (1.0)	1.0 (1.0) ^b	0.06
> 1 food type	25 (50%)	7 (27%)	0.05
> 2 food types	9 (18%)	2 (8%)	0.31
> 3 food types	5 (10%)	2 (8%)	1.00
Porridge	40 (80%)	24 (92%)	0.20
> 1 type	3 (6%)	2 (8%)	1.00
Vegetables and vegetable purées	11 (22%)	1 (4%)	0.05
> 1 type	3 (6%)	0 (0%)	0.55
Fruit and fruit purées	17 (34%)	7 (27%)	0.53
> 1 type	4 (8%)	1 (4%)	0.66

Selected food types that infants received at approximately 5 months are given among those who received complementary foods from the age of 4 months in addition to breastmilk and having unlimited access to lactation consultant ($n=50$) or who received routine care at the well-baby clinics ($n=28$). Data are number (%) unless otherwise indicated.

^aData are median (interquartile) values.

^bTwo missing values ($n=26$).

types of solid, semisolid, and soft foods that infants consumed at 5 months were solely porridges, fruits and fruit purées, vegetables and vegetable purées, oils, and butter in both study populations. Table 3 compares numbers of infants receiving a specific number of meals daily at 5 and 6 months of age in the two study groups. At 5 months of age there was no significant difference seen in numbers of infants receiving a specific number of meals daily between the two groups; however, at 6 months a significantly higher number of infants receiving routine care at the well-baby clinics had three meals per day ($p=0.001$) compared with infants of mothers having unlimited access to a lactation consultant.

Total breastfeeding duration

Total breastfeeding durations of infants receiving complementary foods from 4 months and those exclusively breastfed for 6 months in each of the two study populations were compared. Total breastfeeding duration was logarithmically transformed because of its skewed distribution, and it differed significantly among the four study groups ($F_{3,133}=5.26$, $p=0.002$). Bonferroni's post hoc test com-

parisons indicated that infants exclusively breastfed for 6 months whose mothers had unlimited access to lactation consultants (1.08 ± 0.15 ; $n=50$) had significantly longer total breastfeeding duration than infants who received complementary foods from 4 months of age, both among those who received routine care at the well-baby clinics (0.96 ± 0.13 ; $n=26$; 95% confidence interval 0.03, 0.22) and those who had unlimited access to lactation consultants (1.01 ± 0.11 ; $n=49$; 95% confidence interval -0.001 , 0.16). They did, however, not have longer total breastfeeding duration than infants exclusively breastfed for 6 months and whose mothers received routine care at the well-baby clinics (1.08 ± 0.27 ; $n=12$; 95% confidence interval -0.12 , 0.14). No other significant differences were seen among groups.

Figure 1 shows breastfeeding frequency at every age in the study populations. Half of the mothers who exclusively breastfed their infants for 6 months breastfed their infants for 12 months or beyond, both among those who received unlimited access to lactation consultants (50%) and among those who received routine care at the well-baby clinics (50%). Of the mothers who introduced complementary foods from 4 months of age, 27% and 35% were still breastfeeding their infants at 12 months of age among those receiving routine care at the well-baby clinics and having unlimited access to lactation consultants, respectively. Only infants of mothers who were exclusively breastfed for 6 months were breastfed up to or beyond 2 years, both among those receiving unlimited access to lactation consultants (8%) and those receiving routine care at the well-baby clinics (14%).

Discussion

At approximately 5 months of age, a greater proportion of infants whose mothers had unlimited access to lactation consultants consumed some vegetables and vegetable purées over a 24-hour period, and a higher proportion of them had more than one food type in their diet at this age. The mothers who had unlimited access to lactation consultants had slower introduction of complementary foods, according to numbers of infant's meals at 6 months, than mothers receiving routine care at the well-baby clinics.

The importance of adequate diet in infancy has long been recognized, and it has become evident that early nutrition can affect the development of diseases later in life.²²⁻²⁴ Infants receiving excessive complementary foods at a young age might be at risk of too rapid weight gain in infancy, which

TABLE 3. NUMBER OF MEALS THE INFANTS CONSUMED DAILY AT 5 AND 6 MONTHS OF AGE

<i>Daily meal frequency</i>	<i>5 months of age</i>			<i>6 months of age</i>		
	<i>Lactation consultant</i>	<i>Routine care^a</i>	<i>p value</i>	<i>Lactation consultant^b</i>	<i>Routine care^b</i>	<i>p value</i>
One meal	34 (68%)	21 (81%)	0.24	18 (37%)	5 (19%)	0.10
Two meals	16 (32%)	3 (12%)	0.06	29 (59%)	11 (41%)	0.12
Three meals	0 (0%)	2 (8%)	0.11	1 (2%)	8 (30%)	0.001
Four meals	0 (0%)	0 (0%)	—	1 (2%)	3 (11%)	0.13

Numbers of meals at 5 and 6 months of age are given among infants receiving complementary foods from the age of 4 months in addition to breastmilk and having unlimited access to lactation consultant ($n=50$) or who received routine care at the well-baby clinics ($n=28$). Data are number (%).

^aTwo missing values ($n=26$).

^bOne missing value ($n=49$ and $n=27$, respectively).

FIG. 1. Breastfeeding frequency at every age in the two study populations: infants whose mothers had unlimited access to lactation consultants (received complementary foods at 4 months [EBF4] [$n=49$] or exclusively breastfed for 6 months [EBF6] [$n=50$]) and those who received routine care at the well-baby clinics (received complementary foods at 4 months [EBF4] [$n=26$] or exclusively breastfed for 6 months [EBF6] [$n=12$]).

could furthermore increase the risk of being overweight or obese in childhood and adulthood.¹⁵ Because of the well-substantiated advantages of breastmilk, recommendations for the introduction of complementary foods of breastfeeding children should take into account the effect of complementary feeding practices on breastmilk intake.²⁵ National recommendations for minimum dietary diversity and meal frequency do not exist for Icelandic or U.S. infants younger than 6 months. Some studies suggest that fewer meals and therefore probably higher breastmilk intake might be beneficial for infants at this age.^{25,26} It should be noted that at 6 months, information on dietary intake of infants whose mothers received unlimited access to lactation consultants was derived from food diaries, and it is thus possible that caregivers may have forgotten to record a meal in the food diary, and therefore the frequency of meals could be underestimated. Furthermore, it is likely that many of the mothers with unlimited access to lactation consultants were interested in nutrition and breastfeeding; therefore the results of the current study might not be generalizable for the whole population.

Slower introduction of complementary foods, according to number of infant's meals at 6 months of age, among mothers having unlimited access to lactation consultants might be explained by the intervention itself because those mothers were randomized in either of the two groups and might therefore not see as much benefit of giving complementary foods, especially in large amounts, compared with mothers receiving routine care. Mothers receiving routine care at the well-baby clinics had generally chosen to begin complementary feeding before 6 months for a particular reason (e.g., their infant appeared to be hungry, had trouble sleeping, and was waking up more often during the night [authors' unpublished data] and might therefore have had more reason for

faster introduction of complementary foods). This might weaken the theory that the observed difference in introduction of complementary foods is primarily related to the exposure to lactation consultants. Yet, having easy access to lactation consultants may improve the quality of advice to mothers and give them the confidence to continue to breastfeed, despite encountered problems. Further studies need to be done on the impact of advising by lactation consultants on the initiation of complementary feeding.

In the present study we found that infants whose mothers received unlimited access to lactation consultants and were exclusively breastfed for 6 months had longer duration of breastfeeding compared with the infants receiving complementary foods from 4 months of age in both study groups. Additionally, no difference was seen in total duration of breastfeeding between the two study groups whose mothers exclusively breastfed their infants for 6 months. The prevalence rate of exclusive breastfeeding for 6 months is low globally, in both resource-rich and constrained countries.²⁷ It is possible that more exposure to lactation consultants during the first months of the infant's life would increase the prevalence of mothers exclusively breastfeeding for 6 months and, according to the results of the current study, may therefore have more prolonged breastfeeding. Maternal age and education are known to positively affect duration of breastfeeding,^{28–32} but in the current study those factors were similar at baseline and therefore not considered to be confounding factors in the outcome.

The World Health Organization recommends breastfeeding together with complementary foods until 2 years of age or beyond,³³ and the American Academy of Pediatrics recommends breastfeeding for 1 year or beyond.³⁴ Breastfeeding support is important for mothers so they can achieve these recommendations and longer duration of exclusive and total

breastfeeding. Results from the present study indicate that exclusive breastfeeding for 6 months appears to support longer total breastfeeding duration compared with exclusive breastfeeding for 4 months, regardless of exposure to lactation consultants. In the present study only mothers who exclusively breastfed their infants for 6 months achieved the World Health Organization recommendations.

Although the health benefits of breastfeeding are well known,^{34,35} less is known about the benefits of prolonged breastfeeding beyond 1 year of age. For example, more prolonged breastfeeding has been shown to be associated with a lower incidence of childhood infections.^{36–38} It remains to be established whether a longer duration of breastfeeding is associated with a decreased risk of overweight and obesity in childhood and beyond.^{39,40} Because exclusive breastfeeding for 6 months can increase the total breastfeeding duration compared with infants exclusively breastfed for 4 months, this may have significant benefits beyond the period of infancy.

Conclusions

The results of this study suggest that mothers with unlimited access to lactation consultants are slower to introduce complementary foods at the initial complementary feeding period, according to the number of infant's meals at 6 months of age. Furthermore, infants exclusively breastfed for 6 months seem to have longer total breastfeeding duration compared with those receiving complementary foods from the age of 4 months, irrespective if the families receive routine care at the well-baby clinics or have unlimited access to lactation consultants. Mothers with more exposure to lactation consultants might become more confident and likely to follow advice given about complementary feeding compared with those receiving routine care at the well-baby clinics. Further studies are needed to determine the generalizability of these findings and their long-term effect on the dietary patterns and food choices of young children.

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Author Contributions

All authors had full access to the trial data for interpretation. O.H.J. was responsible for the final decision to submit the report for publication.

Disclosure Statement

M.S.F. has received research funding from and undertaken advisory work for companies manufacturing infant formulas and baby foods within the past 3 years. O.H.J., G.G., R.E.K., P.L.H., J.M.J., I.E., A.M.R., and I.T. declare no competing financial interests exist.

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