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Determinants of breast-feeding in a Finnish birth cohort

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Abstract

Objective: To assess milk feeding on the maternity ward and during infancy, and their relationship to sociodemographic determinants. The validity of our 3-month questionnaire in measuring hospital feeding was assessed.
Design: A prospective Finnish birth cohort with increased risk to type 1 diabetes recruited between 1996 and 2004. The families completed a follow-up form on the age at introduction of new foods and age-specific dietary questionnaires.
Setting: Type 1 Diabetes Prediction and Prevention (DIPP) project, Finland.
Subjects: A cohort of 5993 children (77 % of those invited) participated in the main study, and 117 randomly selected infants in the validation study.
Results: Breast milk was the predominant milk on the maternity ward given to 99 % of the infants. Altogether, 80 % of the women recalled their child being fed supplementary milk (donated breast milk or infant formula) on the maternity ward. The median duration of exclusive breast-feeding was 1·4 months (range 0–8) and that of total breast-feeding 7·0 months (0–25). Additional milk feeding on the maternity ward, short parental education, maternal smoking during pregnancy, small gestational age and having no siblings were associated with a risk of short duration of both exclusive and total breast-feeding. In the validation study, 78 % of the milk types given on the maternity ward fell into the same category, according to the questionnaire and hospital records.
Conclusions: The recommendations for infant feeding were not achieved. Infant feeding is strongly influenced by sociodemographic determinants and feeding practices on the maternity wards. Long-term breast-feeding may be supported by active promotion on the maternity ward.

Keywords
Breast-feeding
Infant feeding
Maternity ward
Cow's milk
Sociodemographic determinants
Dietary assessment method

As a global public health recommendation of the WHO[1], infants should be exclusively breast-fed for the first 6 months of life and with continued breast-feeding for 2 years and beyond. There is strong scientific evidence of short- and long-term health benefits of breast-feeding in infants, as well as the advantages for the mothers, the health-care system and the society[2–6]. Due to a number of complex lifestyle and cultural factors, and in some cases biological reasons[7], breast-feeding rates around the world seldom achieve the recommended level[8].

The Baby-Friendly Hospital Initiative (BFHI) is proven to increase breast-feeding duration and prevalence[9–11]. One of the ten steps of the BFHI states that newborn infants should not be given food or drinks other than breast milk unless medically indicated (http://www.babyfriendly.org.uk). The effect of supplemental fluids or feedings during the first days of life on the duration of total and exclusive breast-feeding remains uncertain due to the lack of adequate evidence[12]. The feeding during the first days on the maternity ward is rarely taken into account when reporting the duration of exclusive breast-feeding[8,13–17]. There is a definite need to develop simple, valid and reliable tools to measure infant feeding including the feeding on the maternity ward[18]. The problem of measurement arises primarily because infant feeding practices encompass a series of age-specific, interrelated behaviours that are difficult to summarise into one or even a few variables.

Social class differences in diet and health are seen at all ages starting in early life. Risk factors including lack of breast-feeding, smoking, physical inactivity, obesity and unhealthy diet are clustered in the lower socio-economic groups[19]. Food preferences are strongly influenced by

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social, demographic and lifestyle factors related to the family, particularly to the mother[20]. Social factors determining the initiation and duration of breast-feeding are often studied separately. In industrialised countries, children of well-educated, older and non-smoking mothers come closer to meeting the recommended feeding practices[13–17,21–26]. The impact of other family characteristics has been more controversial.

In the present study, we had the aim to assess the type and determinants of milk feeding on the maternity ward and during the first 2 years, among 5993 infants participating a population-based birth cohort study. The objective was also to evaluate the validity of the 3-month questionnaire in measuring hospital feeding.

Subjects and methods

The subjects in the present study were recruited from the Type 1 Diabetes Prediction and Prevention Study (DIPP) cohort (http://www.dipp.fi). All newborn infants with human leukocyte antigen (HLA)-conferred susceptibility to type 1 diabetes are recruited from the university hospital areas of Turku, Oulu and Tampere. The nutrition study was initiated within the framework of the DIPP project in Oulu and Tampere[27]. That study aims at examining the effect of maternal diet during pregnancy and lactation in line with the child's diet during infancy and childhood on the development of type 1 diabetes, allergic diseases and asthma. The present study was approved by the Ethics Committee of the participating hospitals. The present series comprises the at-risk children born between 2 September 1996 and 31 August 2004 in Oulu University Hospital and between 20 October 1997 and 5 September 2004 in Tampere University Hospital. A total of 5993 subjects (77 % of the children invited) in the present study comprised children whose parents had returned at least one of the study questionnaires during the first follow-up year (characteristics presented in Table 1). From a questionnaire completed at 3 months after delivery, the following information was obtained: parents' age, basic and vocational education, occupation and the number of siblings. Data on duration of gestation, mode of delivery, birth weight and length and maternal smoking during pregnancy were obtained from the Medical Birth Registries of the Oulu and Tampere University Hospitals.

Substudy on validity of questions on infant feeding on the maternity ward in the 3-month questionnaire

Altogether, 120 subjects were randomly selected from the cohort of children born in Oulu University Hospital by taking 20 subjects from each cohort year from 1997 to 2002. From the questionnaire completed at 3 months after delivery, the following information concerning the feeding on the maternity ward was obtained: days spent in hospital after birth and type (breast milk, donated breast milk and/or infant formula) and the brand name of any milk given in the hospital. The questionnaire was mainly completed by the mother; only two forms were completed by the father. Information on feeding reported in hospital records (the delivery report and the nursing plan) was collected and used as a gold standard. The data included information on the type and duration (days) of oral feeding on the maternity ward. Three children were excluded because of missing hospital records. Among the subjects, 56 % were boys and 44 % girls.

Dietary and background data collection

Structured dietary questionnaire

Data on infant feeding were obtained from questionnaires completed when the child was 3 months, 6 months, 1 year and 2 years of age. In the 3-month dietary questionnaire, the details of the feeding on the maternity ward was asked: whether the child was breast-fed, had received donated breast milk, was exposed to infant formula and if so to which formula. The respondent was also asked to name the most frequently given milk in the hospital with the possibility to name more than one option. At the age of 3 months all the food items the infant had so far received were carefully recorded in the questionnaire. All questionnaires asked for the duration of breast-feeding and the age at introduction and brand names of all infant formulas that the child had received as well as the age at introduction of cow's milk and cow's milk products. The brand name of the infant formula was recorded and the formulas were later classified as regular cow's milk-based, special (hydrolysed) or soya-based. Trained study nurses checked the questionnaires during the respective visits.

Follow-up form

During the first 2 years of life the family was asked to complete continuously at home the 'age at introduction of new foods' form, developed by the DIPP nutrition research group. Parents were asked to mark down on the dietary follow-up form the age when the infant started to receive various supplementary foods (including taste portions of food). The age of the infant, when exclusive and total breast-feeding was stopped, was added by a study nurse during the interview. The follow-up form was completed at home, and it was checked at every visit (at 3, 6, 9, 12, 18 and 24 months) and the information was transferred to the dietary database.

Definitions

Exclusive breast-feeding was defined as the period during which the child received, in addition to breast milk (own mother's milk or donated breast milk), only drops of water and/or vitamin/mineral supplements (mainly vitamin D starting 2 weeks after delivery). Feeding on the

maternity ward was taken into account when calculating the duration of exclusive breast-feeding. If the child had been given infant formula on the maternity ward, he/she was not considered as being exclusively breast-fed any more. Total breast-feeding was defined as the period during which the child received breast milk. From 1996 to 2003, the WHO recommended 4–6 months of exclusive breast-feeding[28]. During the last years of data collection (2003–2004), the new recommendation of 6 months' exclusive breast-feeding was set by the WHO[1].

Data analysis

Median and range were used to describe the duration of breast-feeding. Differences in feeding patterns due to selected maternal and infant characteristics were analysed with the non-parametric Mann–Whitney and Kruskal–Wallis tests. The χ^2 test was used to test the differences in proportions between groups. The relative agreement between the 3-month questionnaire and hospital records was examined by proportion of subjects classified into the same categories of milk feeding by both methods. For comparisons between the duration of exclusive breast-feeding with and without taking into account the information on hospital feeding, the Wilcoxon signed-rank test was used. A Cox regression analysis was applied to study the duration of exclusive and total breast-feeding, and age at introduction of regular cow's milk in relation to selected maternal and infant characteristics. The end-points were determined as duration of exclusive breast-feeding less than 4 months *v.* 4 months or more, duration of total breast-feeding less than 12 months *v.* 12 months and introducing regular cow's milk before 12 months *v.* 12 months or more. Logistic regression was used to analyse additional milk feeding on the maternity ward (yes/no) in relation to background characteristics. Evidence from the literature and, accordingly, associations found in the present study were used to decide which variables were chosen into the final multivariate models. Infant and maternal characteristics were categorised as shown in Table 1. The SPSS for Windows statistical software package version 15·0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analyses.

Results

Family characteristics

The characteristics of the participating infants are presented in Table 1. The mean birth weight of the children was 3537 g (SD 573) ranging from 680 to 5890 g. The average stay in the hospital after birth was 4 d (range 0–200). The average age of all mothers at the time of delivery was 29·4 (SD 5·3) years. Among the mothers, 2 % were younger than 20 years, and 18 % were 35 years or older. The 3-month dietary questionnaire was returned by 5558 (93 %), the 6-month questionnaire by 4964 (83 %), the 1-year questionnaire by 4451 (74 %) and the 2-year questionnaire by 3698 (62 %) families.

Infant feeding in the delivery hospital

Breast milk was the main milk given on the maternity ward (Table 2). Altogether, 99 % of the children for whom we had data on feeding on the maternity ward (*n* 5558, 93 % of all the children) received breast milk from the mother either on its own or in combination with something else during the stay in the hospital after the delivery. The combination of breast milk and donated breast milk was the most common combination (Table 2). Altogether, 80 % of the women (*n* 5558) recalled their child being fed supplementary milk (donated breast milk or infant formula) on the maternity ward during the first days after delivery. Of the women, 76 % (*n* 4214) reported that the given milk was donated breast milk, 12 % (*n* 642) reported that it was infant formula and 12 % (*n* 660) could not name the type of the given milk.

Validity of questions on infant feeding on the maternity ward in the 3-month questionnaire

The degree of misclassification across different milk types between the 3-month questionnaire and hospital records was examined by cross-classification of reported milk types based on both data sources (Table 3). Altogether, 78 % of milk types given on the maternity ward fell into the same class, according to both sources of information. There were, altogether, nineteen infants (16 %) in whom a discrepancy in the feeding history between two data sources was found, and seven (6 %) babies for whom the mother could not name the milk types given on the maternity ward (these were marked as 'milk type unknown'). The greatest misclassifications in milk feeding were found for the combination of breast milk, donated milk and formula (five out of eight (63 %) in a wrong group) and for the group of breast milk only (five out of nine (55 %) in a wrong group).

Exclusive and total breast-feeding

According to the 3-month questionnaire, thirty-one (0·6 %) of the infants were never breast-fed. At 1 month of age, the proportion of breast-fed infants was 92 %, decreasing from 72 % at 4 months to 58 % at 6 months (Fig. 1). Some form of breast-feeding continued until the end of the first year in 18 % of the infants. The proportion of exclusively breast-fed infants was 56 % at 1 month, and then rapidly decreased from 32 % at 3 months to 20 % at 4 months and 1 % at 6 months (Fig. 1). Additional information on feeding in the delivery hospital changed the observed duration of exclusive breast-feeding ($P < 0{\cdot}001$ in Wilcoxon signed-ranks test). Median duration of exclusive breast-feeding, however, was the same in both: 1·4 months (range 0–8) when taking or not taking into account the information asked about delivery hospital feeding.

Table 1 Characteristics of the participating DIPP (Type I Diabetes Prediction and Prevention Study) families and their infants and median (range) duration of exclusive and total breast-feeding

Characteristic	*n*	%	Duration of exclusive breast-feeding (months)†		Duration of total breast-feeding (months)†	
			Median	Range	Median	Range
Infant sex			$P = 0{\cdot}233$		$P = 0{\cdot}129$	
Boys	3181	53	1·2	0–8	6·5	0–25
Girls	2812	47	1·4	0–8	7·0	0–25
Hospital of birth			$P < 0{\cdot}001$		$P = 0{\cdot}873$	
Oulu (North Finland)	2861	48	1·0	0–7	7·0	0–25
Tampere (South Finland)	3132	52	1·4	0–8	6·5	0–25
Number of siblings in the family‡			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
No	2714	45	1·1	0–6·5	6·0	0–25
One	1791	30	1·4	0–8	6·5	0–25
Two or more	1292	22	1·6	0–7	8·5	0–25
Missing information	196	3	1·5	0–5·5	6·5	0–25
Maternal basic education‡			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
Less than high-school graduate	2575	43	1·0	0–8	5·0	0–25
High-school graduate	3164	53	1·6	0–8	8·0	0–25
Missing information	254	4	1·4	0–5·5	6·0	0·1–25
Maternal professional education			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
None or vocational school or course	1993	33	1·0	0–6·5	4·5	0–25
Secondary vocational education	2521	42	1·4	0–8	7·0	0–25
University studies or degree	1281	22	2·0	0–8	9·0	0–25
Missing information	198	3	1·0	0–5·5	6·0	0·5–25
Paternal basic education†			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
Less than high-school graduate	3440	58	1·1	0–8	6·0	0–25
High-school graduate	2182	36	1·6	0–8	8·0	0–25
Missing information	371	6	1·1	0–5·5	5·0	0–25
Paternal professional education			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
None or vocational school or course	2812	47	1·0	0–7	6·0	0–25
Secondary vocational education	1611	27	1·6	0–6·5	7·0	0–25
University studies or degree	1249	21	1·5	0–8	8·0	0–25
Missing information	321	5	1·1	0–5·5	5·00	0–25
Maternal age (years)‡			$P = 0{\cdot}030$		$P < 0{\cdot}001$	
<25	1121	19	1·2	0–6·5	5·0	0–25
25–29	2048	34	1·4	0–7	6·5	0–25
30–34	1753	29	1·5	0–8	7·0	0–25
≥35	1071	18	1·0	0–8	8·0	0–25
Gestational age (weeks)			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
1st quartile: <38·9	1502	25	1·0	0–8	6·0	0–25
2nd quartile: 39·0–40·0	1663	28	1·5	0–8	7·0	0–25
3rd quartile: 40·1–40·9	1413	24	1·3	0–7	7·0	0–25
4th quartile: ≥41·0	1348	22	1·4	0–6·5	7·0	0–25
Missing information	67	1	0·9	0–6	7·0	0·2–25
Route of delivery			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
Caesarean section	806	13	0·9	0–6	5·0	0–25
Other	5134	86	1·4	0–8	7·0	0–16
Missing information	53	1	0·5	0–5·5	7·3	0·2–25
Maternal smoking during pregnancy			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
Yes	574	10	0·8	0–6	2·8	0–25
No	5206	87	1·38	0–8	7·0	0–25
Missing information	213	3	1·10	0–6	6·0	0–25
Feeding in maternity hospital			$P < 0{\cdot}001$		$P < 0{\cdot}001$	
Only breast milk	1098	18	2·8	0–8	8·0	0·2–25
Donated milk	3786	63	1·4	0–8	7·0	0–25
Infant formula	661	11	0·0	0–3·5	4·0	0–25
Missing information	448	8	1·5	0–8	6·0	0–25
Total	5993	100				

†Median (range); if the child was still breast-fed at the age of 2 years, 25 months was marked as the duration of total breast-feeding. *P*-values based on Mann–Whitney and Kruskal–Wallis tests. Class of missing values not taken into account in the analysis.
‡At the time of the birth of the child.

Milk feeding

Type/s of milk consumed during the previous week was asked in the 3-month questionnaire, and the main milk feeding was asked in all the subsequent questionnaires. Only a few infants consumed regularly cow's milk already during the first 3 months (Table 4). Low fat milk (1%–1·5% fat) was the most commonly given regular milk, and its use as a main milk drink increased rapidly from 0·1% at the age of 3 months to 65% at the age of 2 years. Regular infant formula was still commonly used (by 37%

of infants) as the main milk type at the age of 1 year. Regular cow's milk (liquid milk or icecream) was introduced at a median age of 10·5 months (range 0·23–25 months). Timing of the introduction of cow's milk products (infant formula included) was strongly associated with the duration of breast-feeding, the Spearman correlation with the duration of exclusive breast-feeding being 0·89 and that of total breast-feeding 0·53. The use of special and soya-based formulas peaked at the age of 1 year and decreased thereafter. The results on weaning other foods will be presented in a separate manuscript.

Factors associated with milk feeding

Several sociodemographic variables were strongly associated with the infants' milk feeding (Table 5). Additional milk feeding on the maternity ward was associated with a greater risk of short duration of both exclusive and total breast-feeding. The odds of additional milk feeding on the maternity ward were higher for children born by Caesarean section, delivered before the gestational age of 39 weeks, born in Northern Finland, having a mother 25 years-old or older and being the first-born in the family (Table 5). In a bit over-simplistic terms: in order to endow a Finnish infant with the best odds for long duration of both exclusive and total breast-feeding and late introduction of regular cow's milk, one should be a third child of well-educated parents from Southern Finland with the mother being a non-smoker and 30 years or older, and to be vaginally delivered after the gestational age of 39 weeks.

Table 2 Type of milk mainly given† in the maternity hospital‡

Milk type/s	*n*	%
Breast milk	3843	71·7
Breast milk and donated breast milk	987	18·4
Breast milk and infant formula	96	1·8
Donated breast milk	327	6·1
Infant formula	29	0·5
Feeding unknown	76	1·4
Total	5358	100

†The respondent was asked to name the most frequently given milk in the hospital with the possibility to name more than one option.
‡*n* 5558; the ones for whom data available on infant feeding at the maternity hospital. Altogether 200 subjects did not answer the questions on the type of milk mainly given in the maternity hospital.

Discussion

In the present study, breast-feeding on the maternity ward and overall milk feeding during the first 2 years of life among 5993 Finnish infants was assessed. Despite the fact that the majority of mothers initiated breast-feeding, 80 % of infants were given supplementary milk (donated breast milk or infant formula) during their stay in the maternity hospital. The worldwide goals for the duration of breast-feeding have not yet been achieved in Finland. The infant feeding is strongly influenced by sociodemographic determinants and feeding practices on the maternity wards, with high parental education, older maternal age, greater number of siblings, having a non-smoking mother and being exclusively breast-fed on the maternity ward predicting longer duration of both exclusive and partial breast feeding. Our 3-month questionnaire, which was assessed against delivery hospital

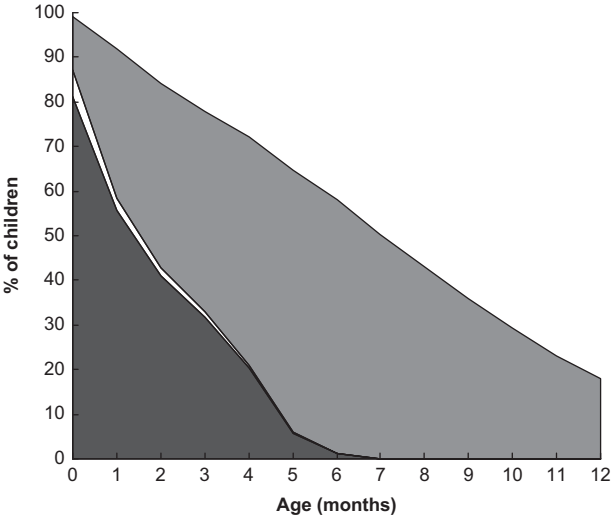

Fig. 1 Duration of exclusive and total breast-feeding in a Finnish birth cohort (■, duration of overall breastfeeding; □, duration of the exclusive breastfeeding, formula received in a hospital not included; ■, duration of the exclusive breast-feeding, formula received in a hospital included); additional information on formula feeding in the delivery hospital changed the observed duration of exclusive breast-feeding ($P < 0{\cdot}001$ in Wilcoxon signed-ranks test)

Table 3 Cross-classification of different milk types from hospital records and 3-month questionnaire†

	Hospital records				
Questionnaire	Only breast milk	Breast milk and donated milk	Breast milk, donated milk and formula	Breast milk and formula	*n*
Only breast milk	4	5	0	0	9
Breast milk and donated milk	7	84	0	0	91
Breast milk, donated milk, and formula	0	5	3	0	8
Breast milk and formula	1	1	0	0	2
Milk type unknown	2	4	1	0	7
Total	14	99	4	0	117

†Pearson χ^2, $P < 0{\cdot}001$; proportion classified in the same class 78 %.

Table 4 Milk feeding† at different ages among Finnish infants and young children, *n* (%)

Milk type	3 months		6 months		1 year		2 years	
Returned the questionnaire (*n*, % of all)	*n* 5558	93	*n* 4964	83	*n* 4451	74	*n* 3698	62
Breast milk	4369	78·6	2700	54·4	723	16·2	45	1·2
Infant formula								
Regular cow's milk formula	2498	44·9	2432	49·0	1666	37·4	17	0·5
Special infant formula‡	59	1·1	123	2·5	185	4·2	89	2·4
Soya-based formula	19	0·3	18	0·4	45	1·0	20	0·5
Regular cow's milk								
Full-fat milk	1	0·0	4	0·1	90	2·0	176	4·8
Low-fat milk	3	0·1	12	0·2	1866	41·9	2394	64·7
Skimmed milk	0		4	0·1	486	10·9	1419	38·4
Different types of cow's milk	0		1	0·0	748	1·7	46	1·2
Sour milk	0		0		232	5·2	666	18·0

†Main milk feeding asked at all age points other than at the age of 3 months, when type/s of milk used during the previous week was asked in the questionnaire. More than one option could be given.
‡Includes hydrolysed formulas, premature formulas and other special formulas.

records, was found to be a reasonably good method for assessing the delivery hospital feeding of the infants.

As many as 80% of the infants received supplementary milk on the maternity ward. Only 12% of the infants were given infant formula, donated milk being the dominant type of supplementary milk. Consistently with earlier studies[10,29], supplementary feeding on the maternity ward, and infant formula in particular, was a strong determinant of short duration of exclusive and total breast-feeding. The present results on hospital feeding raise a question whether almost routinely given supplementary milk is actually needed in most circumstances. Our observations indicate that a change in the feeding practices towards avoidance of supplementary milk on the maternity wards could potentially increase the duration of breast-feeding. Except for Austria and Finland, the number of Baby Friendly Hospitals and the proportion of infants born in Baby Friendly Hospitals have increased everywhere in Europe[30]. It has been shown that training for the BFHI leads to better hospital practice and higher breast-feeding rates in high-income countries with a modern health-care system[10].

There is still some distance between the recommendations for infant feeding and actual feeding practices in Finland. The median duration of exclusive breast-feeding is more than 4 months shorter than the current WHO recommendation (1·4 *v.* 6 months)[1], and that of total breast-feeding almost half a year less than the Finnish recommendation (7 *v.* 12 months)[31]. When one reviews Western breast-feeding studies during the last decades, it can be appreciated that the global target of exclusive breast-feeding for 6 months has been difficult to achieve even in the form of total breast-feeding in most of the countries[9,32]. However, recent trends point towards higher prevalence and duration of breast-feeding with some exceptions.

Between-study comparisons regarding the breast-feeding prevalence and duration are difficult and partly inaccurate due to discrepancies in recall methods, calculation and mode of expression. In the present study, additional information on formula feeding on the maternity ward changed the observed duration of exclusive breast-feeding. The higher the proportion of infants getting formula on the maternity ward, the bigger the overestimation in the estimates of exclusive breast-feeding if feeding on the maternity ward is not taken into account. The accuracy of breast-feeding variables is usually set according to the aims of the study, national definitions and/or international definitions. Current exclusive breast-feeding status, most commonly obtained from a 24 or 48 h recall, does not accurately represent the feeding pattern from birth, though it might provide appropriate data for describing population trends[33,34]. Long-term (>6 months) recall data on exclusive breast-feeding are even more inaccurate and tend to overestimate the duration of exclusive breast-feeding[34,35]. By taking feeding on the maternity ward into account when calculating the duration of exclusive breast-feeding, one could guarantee that the true picture of breast-feeding history is given.

After 6 months of age, infants were surprisingly often given cow's milk in the form of regular milk products even though unmodified cow's milk is believed to be unsuitable for infants until 12 months of age[36]. In Finland it is recommended that cow's milk can be introduced gradually from the age of 10 months beginning with the introduction of sour milk products like yoghurt and curdled milk[31]. The risk of early introduction of regular cow's milk was increased among infants having less educated parents, a young mother and a mother who smoked during pregnancy. In other studies, feeding cow's milk earlier than recommended has been more likely among women with low education, low income and high parity[15,24]. For most of the infants, cow's milk protein was the first foreign protein introduced when starting the use of infant formula. Early exposure to cow's milk protein, even in the form of infant formula, can influence the composition of the intestinal microflora, which has a major influence on the development and programming of the immune system[37]. There is increasing evidence that the gut-associated lymphoid tissue is involved in the development of immune-related diseases[38].

Table 5 Adjusted risk ratios and 95 % confidence intervals for additional milk feeding on the maternity ward, short duration of exclusive and total breast-feeding and early introduction of regular cow's milk†

	Additional milk feeding on the maternity ward		Short duration of exclusive breast-feeding <4 months		Short duration of total breast-feeding <12 months		Early introduction of regular cow's milk <12 months	
Characteristic (%)	OR	95 % CI	HR	95 % CI	HR	95 % CI	HR	95 % CI
Sex								
Boys (53)	1		1		1		1	
Girls (47)	1·01	(0·88, 1·17)	0·95	(0·89, 1·01)	0·94	(0·89, 1·01)	1·07	(1·00, 1·14)
Area of birth								
Southern Finland (52)	1		1		1		1	
Northern Finland (48)	6·13	(5·10, 7·37)**	1·20	(1·12, 1·29)**	0·97	(0·91, 1·04)	1·08	(1·01, 1·16)*
Number of siblings at the time of birth‡								
None (45)	1		1		1		1	
One (30)	0·74	(0·62, 0·88)**	0·92	(0·85, 0·99)*	1·01	(0·93, 1·08)	1·07	(0·99, 1·16)
Two or more (22)	0·75	(0·61, 0·93)**	0·83	(0·76, 0·91)**	0·73	(0·67, 0·81)**	1·05	(0·95, 1·15)
Maternal basic education‡								
Less than high-school graduate (43)	1		1		1		1	
High-school graduate (53)	1·15	(0·99, 1·36)	0·83	(0·77, 0·89)**	0·77	(0·72, 0·83)**	0·85	(0·79, 0·92)**
Paternal professional education‡								
None or vocational school or course (47)	1		1		1		1	
Secondary vocational education (27)	0·98	(0·82, 1·18)	0·82	(0·76, 0·89)**	0·85	(0·79, 0·92)**	0·90	(0·83, 0·98)*
University studies or degree (21)	1·01	(0·83, 1·24)	0·84	(0·77, 0·92)**	0·81	(0·74, 0·89)**	0·81	(0·73, 0·89)**
Maternal age (years)								
Less than 25 (19)	1		1		1		1	
25–29 (34)	1·25	(1·01, 1·55)*	1·04	(0·95, 1·14)	0·92	(0·84, 1·01)	0·84	(0·76, 0·92)**
30–34 (29)	1·15	(0·91, 1·45)	0·95	(0·87, 1·05)	0·83	(0·75, 0·91)**	0·76	(0·68, 0·84)**
35 or more (18)	1·36	(1·04, 1·78)*	0·95	(0·85, 1·06)	0·72	(0·64, 0·81)**	0·72	(0·64, 0·82)**
Route of delivery‡								
Other (86)	1		1					
Caesarean section (13)	2·00	(1·52, 2·61)**	1·01	(0·92, 1·11)	1·15	(1·04, 1·27)*	0·96	(0·87, 1·07)
Maternal smoking during pregnancy‡								
No (87)	1		1		1		1	
Yes (10)	0·85	(0·65, 1·11)	1·42	(1·28, 1·58)**	1·86	(1·67, 2·04)**	1·30	(1·16, 1·46)**
Gestational age (weeks)‡								
1st quartile: <39	1		1		1		1	
2nd quartile: 39–40	0·63	(0·51, 0·77)**	0·87	(0·80, 0·95)**	0·83	(0·76, 0·91)**	1·10	(1·00, 1·21)*
3rd quartile: 40·1–40·9	0·61	(0·49, 0·76)**	0·93	(0·87, 1·02)	0·80	(0·73, 0·88)**	1·09	(0·99, 1·20)
4th quartile: >41	0·66	(0·53, 0·83)**	0·88	(0·80, 0·96)*	0·80	(0·73, 0·88)**	1·10	(0·99, 1·21)
Feeding at the maternity hospital‡								
Only breast milk (18)			1		1		1	
Donated milk (74)			1·44	(1·32, 1·58)**	1·20	(1·10, 1·32)**	1·00	(0·92, 1·10)
Infant formula (7)			3·17	(2·82, 23·56)**	1·93	(1·72, 2·17)**	1·10	(0·98, 1·25)

HR, hazard ratio.
*$P<0·05$ for significant OR/HR and their 95 % CI. **$P<0·01$ for significant OR/HR and their 95 % CI.
†The models included all covariates presented in the table except for feeding at the maternity hospital in the model having additional milk feeding on the maternity ward as the endpoint.
‡Missing information: number of siblings 196 (3 %), maternal basic education 254 (4 %), paternal professional education 321 (5 %), route of delivery 53 (1 %), maternal smoking during pregnancy 213 (4 %), gestational age 67 (1 %), birth weight 53 (1 %), feeding at the maternity hospital 453 (7 %).

The present validity study showed that reliable data on type and time of first exposures to supplemental milks could be provided using a 3-month interval between the reference period and the recall by a questionnaire. In most of the misclassified cases, donated breast milk was misreported to be mother's own breast milk or vice versa. Presumably, this is partly because of the responders' misunderstanding of the importance to differentiate between breast milk from the mother and donated breast milk. However, from an epidemiological point of view it is not a serious mistake since both will be in further analysis classified into the same exposure category (breast milk). Other misclassifications were few. The proportion of mothers not knowing the type of milk given on the maternity ward, however, requires special attention. It is a noteworthy result itself, if a conspicuous proportion of mothers have not received clear information on the type of milk given to their baby.

Infant feeding is strongly influenced by sociodemographic determinants and feeding practices on the maternity wards. Sociodemographic determinants of dietary differences are seen already during pregnancy among Finns[39], and the trend seems to continue in infancy and thereafter[40]; the youngest and less well-educated groups exhibit a greater risk of not adhering to dietary recommendations. This is not only a Finnish phenomenon; similar findings have been reported in several studies among pregnant women and infants in other Western countries[13–17,19,21–24]. The potential to achieve substantial health benefits through improved diet in pregnancy and infancy is unquestionable[2–6]. It is a challenge in Finland, as well as in most Western countries, to develop strategies to help the families having young and less-educated parents to seek the full benefit of the maternal and child health-care system. There are interrelationships between some of the sociodemographic characteristics, since the education of young people is in many cases still continuing and the number of children (i.e. family size) will increase. In agreement with other studies, Caesarean section increased the odds for short duration, and an increasing number of siblings for longer duration of total breast-feeding[14,16,25].

The main virtues of our study are well-defined feeding variables and a long period of follow-up, beginning on the first days on the maternity ward and, thus, providing the most accurate picture of breast-feeding history. However, some potential limitations exist. The distribution of subjects by infant (birth weight and height, sex) and maternal (mean age, number of previous pregnancies, proportion of Caesarean sections) characteristics was comparable to similar statistics on Finnish parturients, births and newborn infants in 1996–2004[41] (data available on request). However, the participating mothers tended to smoke less than all parturients in Finland during the last 10 years (10 % *v.* 15 %). Being a non-smoker is a characteristic that favours breast-feeding[42] and is associated with an overall healthier lifestyle[43]. Although the present cohort carries HLA-conferred susceptibility to type 1 diabetes, the infants are expected to be representative of the general population of Finnish infants[44].

In conclusion, the type of milk feeding during infancy is strongly influenced by supplementary feeding on the maternity ward and several sociodemographic factors. Compliance with the current recommendations is relatively poor for the length of exclusive and total breast-feeding and timing of the introduction of regular milk products. A majority of infants were given supplementary milk during their stay in maternity hospital. Milk types given on the maternity ward could be reliably recalled by a questionnaire completed at 3 months after delivery. These findings highlight the adverse consequences of a relatively 'harmless' practice of giving donated breast milk during the first days of life.

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