Early introduction of solid foods and tiny tastings shortens the duration of breastfeeding

Jenny Stern

Sophiahemmet University

Eva-Lotta Funkquist

Uppsala University

Maria Grandahl (✉ maria.grandahl@kbh.uu.se)

Uppsala University

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Abstract

Background: Since 2011, the National Food Agency in Sweden has informed parents that they can introduce *tiny tastings* (1 mL of solid food, i.e., other sources of nutrition than breastmilk/formula) to infants from four months of age. It is unknown how national recommendations, which differ from the World Health Organization's recommendation, affect breastfeeding. We hypothesized that introduction of tiny tastings of solid foods would shorten the duration of partial breastfeeding.

Methods: This retrospective study utilizes data from the longitudinal 'Swedish Pregnancy Planning Study' in which mothers were recruited at antenatal clinics and answered three questionnaires up to one year after birth (n=1,251). Linear regression models were used to analyze the association between the introduction of solid foods and the duration of breastfeeding.

Results: The main findings of this study were that half of all infants (48%) were fed with *tiny tastings* already in the fourth month, and correlation analysis showed that the earlier the infants started with *tiny tastings*, the earlier they ate larger amounts of solid food. In a multivariate linear regression analysis, five factors were identified as having a negative effect on the duration of breastfeeding: low infant age at the introduction of *tiny tastings*, low maternal age, low level of maternal education, high maternal BMI, and twin birth.

Conclusions: Early introduction of tiny tastings of solid foods shortened the duration of breastfeeding.

Introduction

The World Health Organization (WHO) recommends exclusive breastfeeding for six months and partial breastfeeding for at least two years or longer (1). Exclusive breastfeeding provides more health benefits than partial breastfeeding and is sufficient as the sole nutrition for the first six months of an infant's life (2). In both high- and low-income countries, breastfeeding has positive effects on both the child and maternal health. Exclusive breastfeeding decreases the risk of respiratory infections during infancy, type 1 diabetes, and childhood leukemia. Moreover, long-term breastfeeding reduces the odds of being overweight or obesity in children. Maternal health benefits are related to a reduced incidence of breast cancer, ovarian cancer, and diseases related to the metabolic syndrome (3-5).

It is well known that mixed milk feeding increases the risk for breastfeeding cessation (6). However, research has shown conflicting results if also early introduction of solid foods is associated with a shorter duration of breastfeeding. In the Swedish study above, there was no association, while one from UK both showed association and a dose-response effect (7). In this context, it is notable that these two countries differ a lot in breastfeeding habits. Early introduction of solid foods, i.e., other sources of nutrition than breastmilk/formula, is related to maternal sociodemographic factors, such as lower educational level, smoking, and lower age (8).

Even though breastfeeding is associated with health benefits for both the mother and the child, breastfeeding recommendations in several high-income countries are in conflict with the WHO's recommendation.(1) It is unknown how national recommendations affect breastfeeding. Sweden is considered a pro-breastfeeding country and the breastfeeding incidence peaked during the 1990s when more than 40% of infants were exclusively breastfed for six months (9). This was partly a result of a planned strategy to increase breastfeeding rates, the Baby Friendly Hospital Initiative (10). However, the prevalence of exclusive breastfeeding for six months has decreased over the last few decades to 11% in 2019 (9). One recommendation, in particular, in the national guidelines has possibly had a significant impact on breastfeeding. Since 2011, the National Food Agency has informed parents that they can introduce *tiny tastings* (1 mL of solid food) from four months of age. Due to a non-evidence-based belief that exclusive breastfeeding might delay and complicate the introduction of solid foods, the Child Health Care had not recommended exclusive breastfeeding for six months. Based on this misunderstanding, the National Food Agency made the change in the national guidelines (11). This change has been utilized by the Swedish baby food industry, offering a range of products intended from four months of age. Furthermore, the Child Health Care continue to encourage parents to start providing food at four months and in contrast, women express that they want to breastfeed exclusively for six months (12). In the present study, we hypothesized that early introduction of solid foods, including *tiny tastings*, was associated with shorter duration of breastfeeding.

Methods

This retrospective study was a part of the longitudinal 'Swedish Pregnancy Planning Study' (13) and approved by the Swedish Ethical Review Authority, d.nr. 2010/085, with supplemental applications during the years. The aim was to investigate at what age solid foods, including *tiny tastings*, were introduced to Swedish infants and to investigate the effect of introduction of solid foods on the duration of breastfeeding.

Antenatal clinics (n = 215) in ten (n=10/21) regions were invited to participate, and 153 (71%) agreed to participate. Women were asked to complete questionnaires during registration at antenatal clinics in early pregnancy (Q1), in the third trimester (Q2), and one-year post-partum (Q3). The recruitment was conducted in 2012 to 2015. A total of 5,494 women were initially approached, out of which 4,969 women accepted participation. In the end, 3,389 completed and returned Q1. The first follow-up questionnaire (Q2) was sent to a total of 3,215 women, and 2,583 completed and returned the questionnaire. The second follow-up (Q3) was sent to 2,018 women, and 1,263 returned the questionnaire. A more detailed description of the procedure is previously published (14). Four of these questionnaires lacked an ID and were not possible to match to previous questionnaires. For the current study, we also excluded women who had not provided data for all three questionnaires (n=4), who's child was no longer alive (n=3), and who provided data for an older sibling (n=1). The final study sample comprises 1,251 women.

The self-reported questionnaires included sociodemographic questions about the mother (age, sex, previous children, country of birth, level of education, and household income), the pregnancy (level of pregnancy planning, single/multiple pregnancy), mode of delivery (how it started, ended, and if there was hemorrhage >1000ml), and the infant (birth weight, gestational age, sex, neonatal care, congenital states, and twins), see Table 1. Furthermore, there were a detailed question about nutrition for the infant's first year (0–12 months): duration of breastfeeding, and introduction of solid foods including *tiny tastings*, see supplemental file.

Insert **Table 1**.

Statistical analyses

The primary aim and sample characteristics were explored with descriptive statistics. Linear regression was used to analyze the effect of introduction of solid foods (independent variable) on duration of breastfeeding (dependent variable). Independent co-variables were chosen based on previous knowledge on breastfeeding and are presented in Table 1. Independent variables were analyzed at univariate level, and all significant variables were then included in the analysis at multivariate level. Cox and Snell pseudo-R² and Nagelkerke pseudo-R² are presented as measures of the proportion of variation of outcomes explained by the model. For all statistical analysis, a two-sided p-value <0.05 was considered significant. Data were entered and analyzed using IBM SPSS Statistics version 26 (IBM Corp. Armonk, NY, U.S.A.).

Results

The age at which solid foods were introduced

Background characteristics of the mothers and their pregnancies, deliveries, and infants are presented in Table 2. The median age for introducing solid foods was during the fourth month. Almost all participants (94%) introduced their infant to solid foods during their fourth to seventh month, most commonly during their fourth month (48%). Tiny tastings (1ml) were the most common kind of food intake during the third to fifth month, tastings (5–10ml) the most common during the sixth month, and thereafter food in larger servings (15ml or more), see Figure 1. During their seventh month, more infants were fed with solid foods than with breastmilk. The regression analysis showed that the age of introduction of tiny tastings (1ml) was associated with age of introduction of food (15ml or more), i.e., the earlier infants started with tiny tastings, the earlier they ate larger amounts of solid foods (β 0.813, $p < 0.001$).

Insert **Table 2**.

Insert **Figure 1**.

The effect of introduction of solid foods on the duration of breastfeeding

Variables associated with the duration of breastfeeding on univariate level were included in the multiple regression model and are presented in Table 3. In the multivariate linear regression analysis, higher maternal age, higher maternal education, lower maternal body mass index, singleton pregnancy, and higher age at introduction of tiny tastings were associated with longer duration of breastfeeding (Table 3).

Insert Table 3.

Discussion

The main findings of this study were that half of all infants were fed with *tiny tastings* already in the fourth month and that the earlier the infant started with *tiny tastings*, the earlier they ate larger amounts of solid food. In the multivariate linear regression analysis, five factors were identified as having a negative effect on the duration of breastfeeding: the infant's age at the introduction of *tiny tastings*, low maternal age, low level of maternal education, high maternal BMI, and twin birth.

The Swedish recommendation of tiny tasting from four months of age is contradicting to the WHO recommendation (1) and the impact on breastfeeding has not been studied before. This study shows negative effects on breastfeeding duration. To recommend exclusive breastfeeding for six months could help scaling up breastfeeding and generate benefits besides those of the breastmilk itself, since breastmilk intake among children is associated with lower odds of consuming non-recommended foods, such as cookies, crackers, and sweetened drinks (15, 16). Instead, Nutrition Committees continue to emphasize introduction of solids from four months (17). One common concern about exclusive breastfeeding for six months is the risk for iron-deficiency anemia. However, the risk can be successfully mitigated by delayed umbilical-cord clamping (18).

Conflicting advices and non-evidence-based recommendations have a negative effect on breastfeeding (12). In many ways, it can be perplexing for women to breastfeed in a society that is not infused by a favorable attitude toward breastfeeding. Consequently, breastmilk substitutes have become a "multi-billion dollar industry" that has the opportunity to devote considerable financial resources influencing women not to breastfeed (19).

Socioeconomic factors with an impact on breastfeeding

The multivariate linear regression analysis showed that low maternal age and low education had a negative impact on breastfeeding. In previous studies, several socioeconomic factors have shown an association with a shorter period of breastfeeding. For example, mothers with less privileged economic situation and less education have a shorter duration of breastfeeding (20, 21) and mothers with lower age breastfeed for fewer months (21, 22). This contributes to unequal starting points for children, already from birth. Thus, it should be in focus for targeted interventions from the Child Health Care in order to promote equal health. The United Nations' Sustainable Development Goals obligate governments to promote healthy lives and welfare for all. This makes breastfeeding a central part of the 2030 Agenda, since it contributes to the achievement of an equal, healthy, fair, affluent, and sustainable future for both people and the planet (23).

Obesity and breastfeeding

This study showed that high BMI in the mother was a significant factor for shorter duration of breastfeeding. Maternal obesity is linked to many risks, and one of them is lower initiation rate of breastfeeding and also a greater risk of early breastfeeding cessation (24). It has been suggested that the causes can be a mix of physiological, behavioral, sociocultural, psychological, and medical reasons. For example, obese women can have higher progesterone levels which may impair lacto genesis. Furthermore, large breasts may lead to problems for the infant to latch on, and the obese mother may lack confidence in the breastfeeding situation because of low body image (25).

Less breastfeeding among twins

Another factor identified as showing a negative effect on the duration of breastfeeding in the multivariate linear regression analysis was twin births. Women who have given birth to twins face special challenges, and breastfeeding rates are lower among these infants (26). The reasons for weaning twins, according to the mothers, are insufficient milk supply and infants' problematic

breastfeeding behavior (27). This indicates that mothers of twins need targeted breastfeeding support that takes into account these mothers' unique situation.

Strengths and limitations

This study was the first to investigate the impact of tiny tastings on breastfeeding. Data were provided from a large number of mothers (n=1,260), and the sample represents different geographical areas including both high and low socioeconomic statuses. The question measuring breastfeeding duration (exclusive and partial) is very detailed, consequently, it may be more reliable than the Swedish national data (9), even though the retrospective data this is a limitation, because memories might be less accurate. Conversely, the study design cannot provide causes, rather, it shows associations. The response rate for the follow-up (Q3, n=1,251), compared with baseline data (a total of 3,389 women completed and returned Q1), was lower. In addition, there might be selection bias since the study design excluded non-Swedish speaking parents.

Conclusion

This is the first study to investigate the impact of *tiny tastings* on duration of breastfeeding. The results revealed that half of all Swedish infants taste their first solid foods during their fourth month, and that the earlier the tiny tastings were introduced, the shorter the duration of breastfeeding. Most conditions that affect breastfeeding are difficult to influence, for example, the mother's educational level, BMI, age, and if she has given birth to twins. In contrast, national guidelines can always be updated. Swedish recommendations from the national authorities must adhere to international consensus and be designed to support breastfeeding.

Abbreviations

WHO - World Health Organization

BMI - Body Mass Index

Q1, Q2, Q3 – Questionnaire 1, questionnaire 2, questionnaire 3

Declarations

Ethics approval and consent to participate

The study was approved by the Swedish Ethical Review Authority, D.nr. 2010/085 and the mothers were ensured anonymity and the right to withdraw from their participation at any time without giving any reason.

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Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

ELF and **MG** conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript. **JS** designed the data collection instruments, collected data, conducted the analyses, and reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be held accountable for all aspects of the work.

Authors' information

ELF, Associate Professor, PhD, Registered nurse/midwife and Specialist Nurse in Paediatric Care. She works clinically, providing breastfeeding support to mothers with both full-term and preterm infants, and is also responsible for the education of Specialist Nurses in Paediatric Care at Uppsala University, Sweden.

JS, Associate Professor, PhD, Registered Nurse and MSc in Public Health. JS works as a Senior lecturer at the Bachelor of Nursing Programme, Sophiahemmet University, Stockholm, Sweden.

MG, Associate Professor, PhD, Specialist Nurse in Paediatric Care, MSc in Public Health and Director of the Nursing and Midwifery Programs at the Department of Women's and Children's Health, Uppsala University, Sweden. MG works clinically, supporting breastfeeding to mothers and preterm infants at the Neonatal Intensive Care Unit, Uppsala University Children's Hospital, Sweden.

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Tables

Table 1. Operationalization of included variables in regression models

Category of variable	Variable	Categorization	Data collection
Socioeconomic variables (mother)	Age	Years	Q1
	Country of birth	Sweden versus other country	Q1
	Parents born outside of Sweden	No versus yes	Q1
	Level of education	7-graded scale, low to high	Q1
	Household income/month at Q3	11-graded scale, low to high	Q3
	Maternal leave (75%–100% leave) during month 0–12	Number of months	Q3
	Civil status at Q3	In a relationship versus single	Q3
Health related variables	Body Mass Index at Q1	Kg/m2	Q1
Pregnancy related variables	Previous biological children	No versus yes	Q1
	Multiple pregnancy	No versus yes	Q2
	Degree of pregnancy planning	5-graded scale, from Highly planned to Highly unplanned	Q1
Delivery related variables	Mode of birth: start of delivery	Spontaneous versus induced/planned caesarean section	Q3
	Mode of birth: end of delivery	Normal versus instrumental/caesarean section or complications	Q3
	Hemorrhage >1000ml	No versus yes	Q3
Variables concerning the infant	Birth weight	Grams	Q3
	Gestational age	Week	Q3
	Sex	Girl versus boy	Q3
	Neonatal care	No versus yes	Q3
	Congenital states in need of care	No versus malformation/injury/disease	Q3
	Age at introduction of solid foods	Months	Q3

Table 2. Background characteristics of study population, N=1251

<i>Characteristics of study sample</i>		<i>Study sample Mean (SD)</i>	<i>Study sample Frequency (%)</i>	<i>Comparison Official Statistics Sweden</i>
Mother	Age, years	29.9 (4.8)		30.3 ^a
	Born outside Sweden		102 (8)	27.5 ^b
	University education		701 (56)	49 ^b
	Previous children		662 (53)	56 ^a
	In a relationship		1221 (97)	34.0 ^a
Pregnancy	Level of pregnancy planning			
	Highly planned		640 (51)	d
	Quite planned		339 (27)	d
	Neither planned nor unplanned		143 (11)	d
	Quite unplanned		38 (3)	d
	Highly unplanned		88 (7)	d
	Single pregnancy		1220 (98)	98 ^b
	Multiple pregnancy		6 (0.5)	1.4 ^b
Mode of delivery	Spontaneous vaginal		946 (76)	83 ^b
	Induced vaginal		198 (16)	16.7 ^a
	Planned Cesarean		98 (8)	8 ^b
	Complications			
	Hemorrhage [¶] (>1000ml)		90 (7)	7.2 ^c
	Emergency Cesarean		111 (9)	8 ^a
	Instrumental delivery		99 (8)	7.2 ^a
Infant	Birth weight, grams	3579 (548.8)		3565 ^b
	Gestational age, weeks	40 (1.4)		39-40 ^b
	Sex			
	Girl		612 (49)	48.6 ^b
	Boy		636 (51)	51.3 ^b
	Neonatal care		77 (6)	~10 ^{b,e}
	Congenital state in need of care			
	Malformation		23 (2)	2-3 ^a
	Injury		5 (0.4)	
	Disease		34 (3)	3.7/1000 ^a

^a The National Board of Health and Welfare

^b Statistics Sweden

^c Vaginal (section=10.4%)

^d No reliable data available

^e 5.5% gestation week <37)

^f Children born with malformation or injury at birth

^g Bleeding before, during, or after the delivery

Table 3. Results for univariate and multivariate linear regression models with duration of breastfeeding during the first year after birth as the outcome

Variables	Univariate regression					Multiple regression*				
	<i>R Square</i>	<i>Adjusted R Square</i>	<i>Beta-coefficient</i>	<i>p</i>	95,0% Confidence Interval for B		<i>Beta-coefficient</i>	<i>p</i>	95,0% Confidence Interval for B	
Mother's age	0.061	0.060	0.186	<0.001	0.145	0.227	0.181	<0.001*	0.130	0.232
Mother's level of education	0.055	0.054	0.574	<0.001	0.440	0.708	0.263	0.002*	0.099	0.426
Mother's country of birth (outside <i>versus</i> inside Sweden)	0.004	0.003	0.821	<0.001	0.083	1.559	0.279	0.496	-0.525	1.082
Household income	0.014	0.013	0.221	<0.001	0.117	0.325	0.032	0.606	-0.090	0.154
Maternal leave during the first year	0.004	0.003	0.105	0.033	0.009	0.201	0.070	0.147	-0.025	0.166
Maternal Body Mass Index	0.035	0.034	-0.146	<0.001	-0.190	-0.103	-0.129	<0.001*	-0.177	-0.081
Pregnancy (single <i>versus</i> multiple)	0.010	0.009	-5.135	<0.001	-8.027	-2.242	-4.057	0.032*	-7.768	-0.346
Mode of birth/end of delivery (normal <i>versus</i> instrumental/ caesarean)	0.005	0.004	-0.273	0.020	-0.502	-0.043	-0.120	0.322	-0.356	0.117
Age for introduction of solid foods (tiny tastings, tastings, or food)	0.044	0.043	0.703	<0.001	0.520	0.886	0.590	<0.001*	0.389	0.790
* $P < 0.05$										
* Model summary $R^2 = 0.177$ Adjusted $R^2 = 0.169$										

Figures

Figure 1
Infants’ nutrition during their first 12 months

Supplementary Files

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