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ORIGINAL ARTICLE

# In-hospital supplementation and subsequent breastfeeding practices in Finland: A cross-sectional population-level study

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## Abstract

**Background:** The Baby-Friendly Hospital Initiative suggests that in-hospital supplementation should be avoided unless medically indicated. The supporting evidence is contradictory, as nonexperimental studies have shown an association between supplementation and decreased breastfeeding rates, whereas trials have failed to do so. The aim of this study was to investigate whether in-hospital supplementation is associated with exclusive breastfeeding to the age of 5 months and any breastfeeding to the age of 12 months in full-term, normal-weight singleton infants.

**Methods:** This is a secondary analysis of national-level, cross-sectional survey data. The data were collected in child health clinics in Finland. Families attending a regular health examination with a child aged 2 weeks to 12 months were eligible to participate. Full-term, normal-weight, singleton infants (n = 3025) were included in this study. Multivariate logistic regression was performed using in-hospital supplementation and socioeconomic characteristics as covariates and exclusive and any breastfeeding as outcomes.

**Results:** In total, 55.3% (n = 1631) of the infants received in-hospital supplementation. After controlling for socioeconomic factors, in-hospital supplementation was associated with decreased exclusive breastfeeding to the age of 5 months and with a decrease in any breastfeeding to the age of 7 months.

**Conclusions:** Our findings suggest that noncontrolled supplementation, without a trial's rigorous procedures of care, is associated with decreased breastfeeding postdischarge. Both donor milk and infant formula use were associated with lower breastfeeding rates, although the association was stronger with formula use. In clinical settings, liberal, nonmedically indicated supplementation should be avoided.

KEYWORDS

Baby-Friendly Hospital Initiative, breastfeeding, maternity care, supplementation

## 1 | INTRODUCTION

Recommended breastfeeding practices are generally not achieved in high-resource countries.[1,2] Sociodemographic characteristics associated with breastfeeding are well known. In Europe, 58%–98% of infants receive breast milk directly after birth, and between 13% and 39% are exclusively breastfed at 6 months of age.[3] Primiparity, being a single mother, maternal age, education level, use of tobacco products, family economic situation, and having a foreign background are associated with breastfeeding practices after a stay in a maternity ward.[4]

Evidence-based counseling and lactation management, support from peers and the community, and society with appropriate legislation and financing, together with limitations on marketing of breast milk substitutes, are interventions to improve breastfeeding rates.[2,5] The Baby-Friendly Hospital Initiative (BFHI) is an evidence-based program and set of interventions to protect, promote, and support breastfeeding in maternity and neonatal services.[6] In addition to the nine other steps, BFHI recommends avoiding nonmedically indicated supplementation, according to step 6: *Do not provide to newborns any food or drink other than breast milk, unless medically indicated*.[6] The BFHI has an impact on increasing breastfeeding rates. Perez-Escamilla et al.[5] found that the number of steps implemented correlated positively with breastfeeding rates. Furthermore, step 6 has been identified as a key element in increasing breastfeeding rates, probably because in order to implement it, other steps must first be taken.[6]

However, avoiding supplementation continues to be controversial. In the recently updated BFHI, the systematic review found little or no evidence to support step 6.[7] In a Cochrane review, controversially, early supplementation with a limited amount of artificial milk was found to result in marginally increased rates of exclusive breastfeeding.[8] Recent randomized controlled trials (RCT)[9–12] found no difference in the rates of exclusive or any breastfeeding between supplemented and non-supplemented groups. In these RCTs, weight loss was used as an indicator for supplementation.[9–12] All of these studies used 10 ml supplementation after every breastfeed, either with artificial milk[9–11] or donor milk.[12] In contrast to the findings from RCTs, recent longitudinal nonexperimental studies have consistently shown an association between in-hospital supplementation and decreased breastfeeding rates. In these large-sample studies, in-hospital supplementation with formula led to decreased rates of exclusive breastfeeding[13,14] and any breastfeeding.[13,15,16] The amount of supplementation was not specified in the studies.[13–16]

As such, it is unclear whether supplementation during a maternity ward stay has an effect on exclusive breastfeeding and any breastfeeding after discharge. RCTs[9–12] suggest that a limited amount of medically indicated supplementation should be favored in clinical settings. This may erroneously lead to a liberal supplementation policy in hospitals. The association between non-rigorous supplementation and subsequent breastfeeding practices is partly unknown, which impedes the implementation of evidence-based lactation practices in clinical settings. Moreover, comparisons between donor milk and formula as supplemental milk have not been made. Therefore, the aim of this study was to investigate whether supplementation during a maternity ward stay is associated with exclusive breastfeeding to the age of 5 months and any breastfeeding from discharge to the age of 12 months in full-term, normal-weight singleton infants.

## 2 | METHODS

### 2.1 | Design

This is a secondary analysis of national-level, cross-sectional survey data. The aim of the primary study was to produce national-level breastfeeding prevalence indicators for national, regional, and international use.[17]

### 2.2 | Setting

The survey was conducted in public child health clinics in Finland. Finland, along with other Nordic countries, is culturally a breastfeeding-friendly society with universal health care, long paid maternity leave, and high breastfeeding intention and initiation rates. During pregnancy, 71% of mothers plan to exclusively breastfeed, and 18% plan to combine breastfeeding and formula feeding.[18] Moreover, 59.9% of infants are exclusively breastfed under the age of 6 months and 58.7% of infants are breastfed at the age of 12 months.[17] Parent who plan combined feeding are supported to exclusively breastfeed during hospitalization in a maternity ward and to introduce formula after breastfeeding is established. Hospitals have guidelines for medical reasons for supplementation, although nonmedically indicated supplementation is also permitted.

Participants were recruited during regular health examinations in child health clinics. In Finland, health examinations in municipality-based, public health nurse (PHN)-led child health clinics are offered free of charge to all children under the age of 7. Municipalities are obligated to offer at least 15 health examinations during infancy and childhood, including 5 with a physician.[19] Approximately 99.6% of families participate in health examinations.[20]

## 2.3 | Data collection

The data were collected in selected municipalities in Finland to achieve a geographically and socioeconomically representative national data set. The municipalities were selected using stratified cluster sampling. Hospital districts in Finland (n = 20) formed the clusters, with the following modifications: First, the smallest hospital districts (measured by birth rates) were combined into geographically coherent larger units, and second, the capital city area was separated into an area independent from its hospital district because of its large size. In total, 16 clusters were used. In the clusters, municipalities with <10 annual births (n = 38) were excluded from the sampling frame. The largest municipality in each cluster (measured by birth rates) (n = 16) was selected with sampling odds of 1. Then, two municipalities were randomly selected from each cluster, apart from the Uusimaa cluster, which included three randomly selected municipalities because of its large size. In total, 47 municipalities were selected, and all agreed to participate in the study.

All the child health clinics in the selected municipalities participated in the data collection, with the exemption of special health clinics for disabled children and families recovering from substance abuse. The number of child health clinics in each municipality ranged from 1 to 22. The PHNs working in the child health clinics participated in webinars (n = 5) that were held by the primary investigator. In the webinars, the data collection practices were described, the nurses were motivated to collect the data, and there was also time for questions. In addition, the PHNs received written information and guidelines for data collection by mail and e-mail, both in Finnish and Swedish (the official languages in Finland). For the families, posters were displayed in the waiting rooms of the clinics indicating that they would be invited to participate in the study during their appointments. The contact information of a primary researcher was provided to the PHNs and families on an information sheet and on web pages about the research.

All families with children aged 2 weeks to 12 months attending regular health examinations during October 2019 were recruited by the PHNs. The study was approved by the Working Group on Research Ethics at the Finnish Institute for Health and Welfare, Finland. Information about the study's aims, procedures, and voluntariness were offered before the decision to participate, both in written handouts and verbally, by a trained PHN. The data were collected anonymously. A structured electronic (Webropol) questionnaire was used. The recommended data collection method was a structured interview by a trained PHN during the visit. However, if that was not possible, (for example, because of a lack of time), the PHN gave a link to the questionnaire to the family and recommended that they answer immediately after the appointment. Although this may cause variation in the data, this approach was selected to ensure that all the families had equal opportunity to participate, even if they had several issues to discuss with the PHN, leaving no time to fill out the questionnaire during the appointment.

The information for informed consent and the questionnaire were available in four languages: Finnish, Swedish, English, and Russian. These languages are the most frequently spoken in Finland among the target group. The translations from Finnish were made by professional translators if the questions did not already exist in those languages. The translated information sheet and questionnaire were reviewed by one or two native layperson speakers.

## 2.4 | Measurements

The primary outcome of the study was exclusive breastfeeding (an infant receives nothing other than breast milk) and any breastfeeding (an infant receives breast milk, either exclusively or together with other fluids and/or solid foods). Exclusive breastfeeding was determined by the following question: *Has your child been given something other than breast milk within the previous 24 hours?* The recall of 24 hours was based on the World Health Organization (WHO) recommendation.[21] Any breastfeeding was determined also using 24-hour recall: *Has your child been given breast milk within the previous 24 hours?* The answer options for both questions were binary: yes/no.

The associated factors in this study were in-hospital supplementation and sociodemographic factors. Supplementation during hospitalization was determined with a single question: *Was the child given supplemental milk at the delivery hospital (e.g., donated breast milk or infant formula)?* The answer options were (1) yes, donated milk; (2) yes, infant formula; (3) no; and (4) cannot say. The answer option "cannot say" (2.2%, n = 66) was coded as missing information.

Associated sociodemographic factors were selected based on previous studies and the results of the primary study.[4,17] The sociodemographic factors were determined by single questions about the mother's birth year, number of births, education, use of tobacco products (cigarettes, electronic cigarettes, or snuff), the number of adults in the household, and birth country. The family's economic situation was determined by a self-rated 5-point Likert scale ranging from "very good" to "very poor." Sociodemographic factors were dichotomized, as presented in Table 1. The birthing person's age was used

**TABLE 1** Demographic characteristics

| Infant's age characteristic | 0–1 months ($n = 557$) | 2–3 months ($n = 726$) | 4–5 months ($n = 663$) | 6–7 months ($n = 430$) | 8–10 months ($n = 411$) | 11–12 months ($n = 232$) |
|---|---|---|---|---|---|---|
| | M (SD) | M (SD) | M (SD) | M (SD) | M (SD) | M (SD) |
| Mother's age | 30.0 (5.2) | 30.3 (5.2) | 30.7 (5.0) | 30.7 (5.1) | 30.7 (5.1) | 30.3 (5.3) |
| | *n* (%) | *n* (%) | *n* (%) | *n* (%) | *n* (%) | *n* (%) |
| Number of adults in a family | | | | | | |
| One | 30 (5.4) | 43 (6.0) | 35 (5.3) | 16 (3.8) | 23 (5.6) | 9 (4.1) |
| More than one | 526 (94.6) | 682 (94.0) | 624 (94.7) | 411 (96.2) | 387 (94.4) | 221 (95.9) |
| Mother's birth country | | | | | | |
| Finland | 530 (95.2) | 678 (93.4) | 627 (94.5) | 400 (92.9) | 383 (93.2) | 217 (93.4) |
| Other than Finland | 27 (4.8) | 48 (6.6) | 37 (5.5) | 30 (7.1) | 28 (6.8) | 15 (6.6) |
| Mother's education | | | | | | |
| Vocational school or less | 306 (55.0) | 378 (52.1) | 343 (51.7) | 239 (55.5) | 229 (55.8) | 135 (58.1) |
| Bachelor or higher | 250 (45.0) | 348 (47.9) | 320 (48.3) | 192 (44.5) | 182 (44.2) | 97 (41.9) |
| Family's economic situation | | | | | | |
| Moderate or poor | 159 (28.7) | 228 (31.3) | 213 (32.2) | 130 (30.1) | 140 (34.1) | 102 (44.2) |
| Good | 396 (71.3) | 498 (68.7) | 449 (67.7) | 301 (69.9) | 270 (65.5) | 128 (55.2) |
| Use of tobacco products | | | | | | |
| Yes | 30 (5.4) | 58 (8.0) | 40 (6.1) | 29 (6.6) | 41 (9.9) | 22 (9.7) |
| No | 527 (94.6) | 668 (92.0) | 623 (93.9) | 402 (93.4) | 371 (90.1) | 209 (90.3) |
| Child's birth order | | | | | | |
| First | 261 (46.8) | 339 (46.6) | 302 (45.5) | 188 (43.7) | 198 (48.1) | 108 (46.5) |
| Other | 292 (52.5) | 384 (53.0) | 357 (53.8) | 242 (56.3) | 212 (51.1) | 122 (52.6) |

as a continuous variable. The results are presented using infants' parent-reported age as a grouping factor, as presented in Table 1.

Information about maternal or infant health was not collected. The amounts of supplementation were not available. The hospital-based supplementation guidelines, made by pediatricians, typically follow the former national guideline of 10 ml/kg at each feed.[22]

## 2.5 | Data preparation

Families with infants aged 2 weeks to 12 months who attended regular health examinations were eligible to participate. In total, 3418 families participated, with data coverage of 22% calculated from the national data on performed health examinations.[20] Young mothers (≤25 years) and individuals with lower education were underrepresented in the sample as compared to national birth statistics.[23] Therefore, the data were weighted to better represent the population. The weighting was calculated as follows: $w_i = \frac{NK_i}{n_i}$, where **W** is weight, **N** is the number of observations, **K** is the expected distribution in group *i*, and **n** is the number of observations in group *i*. The weights used are presented in the primary study report.[17] All the analyses were conducted using weighted data. Because of missing information, the weighted data consisted of 3366 participants.

For this secondary analysis, only singleton, full-term (≥37 gestational weeks), and normal weight (2500–4499 g) infants were included, based on parent-reported information. The rationale for this was that being a twin, preterm, low birthweight, or having fetal macrosomia may cause disorders in adaptation and nutrition, increasing heterogeneity. After these exclusions, n = 3025 formed the final study sample (Figure 1). Missing information in an individual question ranged 0–0.5% (n = 0–15).

## 2.6 | Data analysis

The data were described using univariate statistics. The associations between in-hospital supplementation and breastfeeding practices were studied using 95% confidence intervals, cross-tabulation, and the chi-square test. The association between sociodemographic factors and in-hospital supplementation was studied using

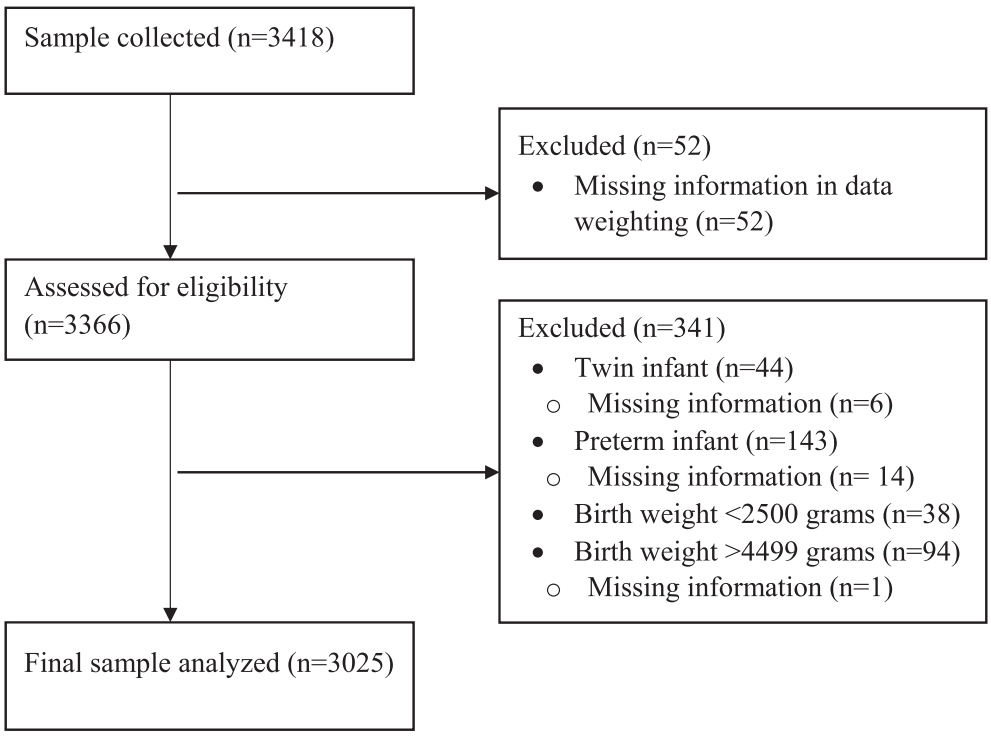


**FIGURE 1** Participant flow diagram

cross-tabulation and the chi-square test for the dichotomous variables and with bivariate logistic regression for the continuous variable. Multivariate logistic regression with the enter method was used to examine the associations of in-hospital supplementation (with donor milk or formula) and sociodemographic factors with breastfeeding practices. The socioeconomic factors were selected based on the previous studies[4] and results of the primary study.[17] Combined age groups (Table 1) were used to ensure that each group had a sufficient amount of data (at least 10 observations for 1 covariate) for the multivariate analysis. Furthermore, the association between supplementation type (donor milk vs formula) and breastfeeding practices was studied using cross-tabulation and the chi-square test. The small sample size, especially in the formula group, did not allow multivariate analysis to be performed.

Sensitivity analyses were performed in different infant birthweight groups, as follows: 2499–2999 g, 3000–3999 g, and 4000–4499 g. In these analyses, the age groups were combined to gain a sufficient size in each group. Only significant controlling variables defined in the previous analysis were added to the models to decrease errors because of small sample sizes. Moreover, the type of participation (PHN interviewed/parent self-completed) was added to the original models to assess the impact of data heterogeneity on the outcomes.

In all the analyses, the level of statistical significance was set at $P < 0.05$. SPSS version 28.0 (IBM) was used in the analysis.

## 3 | RESULTS

### 3.1 | Participants

The mothers' (n = 3025) mean age was 30.5 years (SD = 5.2), and 46.2% (n = 1398) were primiparous. Most of the families (94.8%, n = 2856) had at least two adults in the household, and 6% (n = 185) of the mothers were born outside of Finland. A majority of the mothers (54.0%, n = 1633) had an educational level of vocational school or less, and one-third (32.2%, n = 975) experienced their family's economic situation as moderate or poor. Only 7.3% (n = 221) used tobacco products. The PHN conducted the interview in 60.5% (n = 1827) of the participants. Table 1 presents the sociodemographic characteristics of the participants by infant age group.

### 3.2 | In-hospital supplementation and associated factors

In total, 55.3% (n = 1631) of the infants received in-hospital supplementation. Of these, most (75.8%, n = 1237) received donor breast milk. Being a single parent (66.7% vs 54.6%, $P = 0.004$), maternal completion of vocational school or less (57.4% vs 52.8%, $P = 0.013$), maternal use of tobacco products (63.2% vs 54.7%, $P = 0.016$), and being primiparous (66.5% vs 45.7%, $P = 0.001$) were associated with in-hospital supplementation. Maternal age ($P = 0.366$), maternal foreign

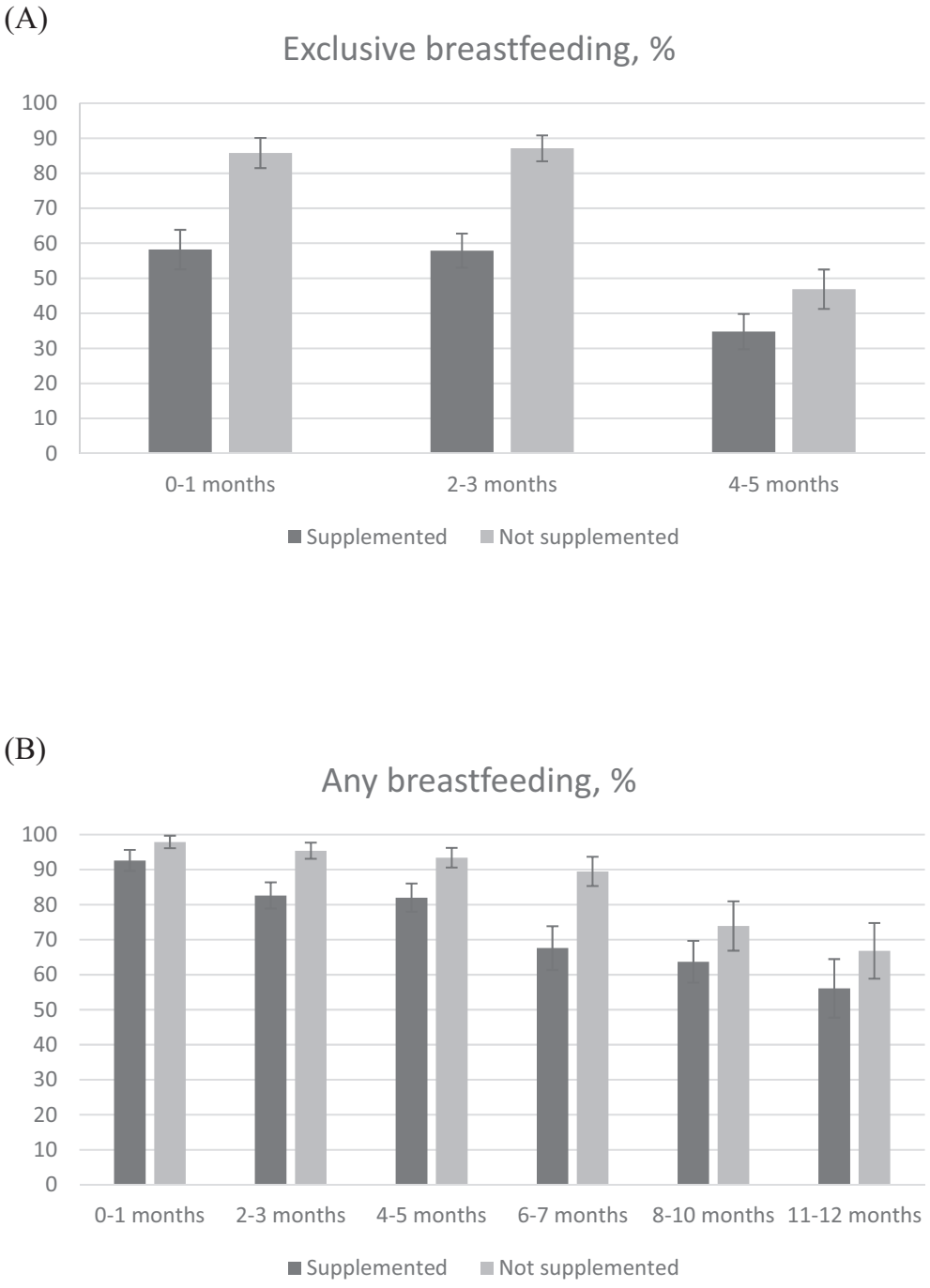


**FIGURE 2** Exclusive breastfeeding and any breastfeeding in supplemented and nonsupplemented infants, relative frequencies, and 95% confidence intervals

background (58.8% vs 55.1%, $P = 0.326$), and moderate or poor economic situation (55.8% vs 55.0%, $P = 0.689$) were not associated with in-hospital supplementation.

### 3.3 | In-hospital supplementation and breastfeeding practices

In-hospital supplementation was associated with exclusive breastfeeding in the age groups of 0–1 month ($P < 0.001$), 2–3 months ($P < 0.001$), and 4–5 months ($P = 0.002$) (Figure 2). The association remained significant after controlling for sociodemographic factors, with a 1.5- to 4.4-fold increased risk of nonexclusive breastfeeding (Table 2). Other factors associated with exclusive breastfeeding in all age groups were lower education level and maternal use of tobacco products (Table 2).

In-hospital supplementation was associated with any breastfeeding in the age groups of 0–1 month ($P = 0.004$), 2–3 months ($P < 0.001$), 4–5 months ($P < 0.001$), and

**TABLE 2** Predictors for exclusive breastfeeding

| Infant's age | Predictor | Reference | *p* | $OR^{adj}$ | 95% C.I.for $OR^{adj}$ | | $R^2$ |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| 0–1 months | | | | | | | 0.284 |
| | In-hospital supplementation | No | <0.001 | 4.280 | 2.660 | 6.887 | |
| | Mother's age | | 0.101 | 1.041 | 0.992 | 1.093 | |
| | Number of adults in a family | More than one | 0.596 | 1.276 | 0.519 | 3.139 | |
| | Mother's birth country | Finland | 0.535 | 1.332 | 0.539 | 3.289 | |
| | Mother's education | Bachelor or higher | 0.014 | 1.859 | 1.132 | 3.053 | |
| | Family's economic situation | Good | <0.001 | 0.403 | 0.251 | 0.648 | |
| | Use of tobacco products | No | <0.001 | 10.506 | 3.760 | 29.356 | |
| | Child's birth order | Second or more | 0.001 | 2.334 | 1.425 | 3.822 | |
| 2–3 months | | | | | | | 0.268 |
| | In-hospital supplementation | No | <0.001 | 4.428 | 2.902 | 6.759 | |
| | Mother's age | | 0.667 | 1.009 | 0.969 | 1.050 | |
| | Number of adults in a family | More than one | 0.249 | 1.542 | 0.739 | 3.220 | |
| | Mother's birth country | Finland | 0.429 | 1.323 | 0.660 | 2.652 | |
| | Mother's education | Bachelor or higher | <0.001 | 2.322 | 1.516 | 3.556 | |
| | Family's economic situation | Good | 0.026 | 0.637 | 0.428 | 0.947 | |
| | Use of tobacco products | No | <0.001 | 4.286 | 2.160 | 8.503 | |
| | Child's birth order | Second or more | 0.004 | 1.853 | 1.218 | 2.820 | |
| 4–5 months | | | | | | | 0.095 |
| | In-hospital supplementation | No | 0.018 | 1.506 | 1.073 | 2.112 | |
| | Mother's age | | 0.848 | 0.996 | 0.960 | 1.034 | |
| | Number of adults in a family | More than one | 0.829 | 1.095 | 0.480 | 2.502 | |
| | Mother's birth country | Finland | 0.275 | 1.546 | 0.707 | 3.380 | |
| | Mother's education | Bachelor or higher | 0.001 | 1.816 | 1.273 | 2.591 | |
| | Family's economic situation | Good | 0.488 | 1.141 | 0.786 | 1.657 | |
| | Use of tobacco products | No | 0.002 | 7.792 | 2.128 | 28.529 | |
| | Child's birth order | Second or more | 0.097 | 1.357 | 0.946 | 1.947 | |

6–7 months ($P < 0.001$). In the age group of 8–10 months, the association was marginally significant ($P = 0.035$), whereas in the age group of 11–12 months, it was nonsignificant ($P = 0.102$) (Figure 2). The association remained significant up to the age of 7 months when sociodemographic factors were controlled for, with a 3.3- to 4.1-fold increased risk of nonbreastfeeding (Table 3). Other associated factors for any breastfeeding in all age groups were lower education level and maternal use of tobacco products (Table 3).

Among the supplemented infants who received donor breastmilk (compared with formula), exclusive breastfeeding rates were higher at 0–1 month (61.1% vs 52.3%), 2–3 months (60.6% vs 54.1%), and 4–5 months (40.2% vs 21.9%), but the association was significant only at 4–5 months ($P = 0.206$, $P = 0.246$, and $P = 0.001$, respectively). Relating to any breastfeeding, the breastfeeding rates favored donor milk against formula at 0–1 month (94.2% vs 88.1%), 2–3 months (83.3% vs 81.1%), 4–5 months (87.4% vs 68.4%), 6–7 months (69.8% vs 59.6%), 8–10 months (64.4% vs 60.4%), and 11–12 months (57.1% vs 50.0%). Again, the association were significant only at 4–5 months ($P = 0.089$, $P = 0.605$, $P < 0.001$, $P = 0.184$, $P = 0.610$, and $P = 0.537$, respectively).

## 3.4 | Sensitivity analysis

After dividing the sample by birthweight into small, normal weight, and large infants, the association between

**TABLE 3** Predictors for any breastfeeding

| Infant's age | Predictor | Reference | *P* | $OR^{adj}$ | 95% C.I. for $OR^{adj}$ | | $R^2$ |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| 0–1 months | | | | | | | 0.302 |
| | In-hospital supplementation | No | 0.030 | 3.277 | 1.124 | 9.553 | |
| | Mother's age | | 0.338 | 0.959 | 0.880 | 1.045 | |
| | Number of adults in a family | More than one | 0.124 | 2.693 | 0.762 | 9.516 | |
| | Mother's birth country | Finland | 0.143 | 3.270 | 0.670 | 15.959 | |
| | Mother's education | Bachelor or higher | 0.076 | 3.598 | 0.874 | 14.810 | |
| | Family's economic situation | Good | 0.001 | 0.211 | 0.082 | 0.544 | |
| | Use of tobacco products | No | 0.001 | 6.062 | 2.014 | 18.246 | |
| | Child's birth order | Second or more | 0.638 | 1.275 | 0.464 | 3.502 | |
| 2–3 months | | | | | | | 0.297 |
| | In-hospital supplementation | No | <0.001 | 4.149 | 2.143 | 8.033 | |
| | Mother's age | | 0.053 | 0.945 | 0.892 | 1.001 | |
| | Number of adults in a family | More than one | 0.260 | 1.641 | 0.692 | 3.891 | |
| | Mother's birth country | Finland | 0.166 | 0.431 | 0.131 | 1.419 | |
| | Mother's education | Bachelor or higher | 0.004 | 2.726 | 1.385 | 5.365 | |
| | Family's economic situation | Good | 0.212 | 0.707 | 0.410 | 1.219 | |
| | Use of tobacco products | No | <0.001 | 6.971 | 3.452 | 14.077 | |
| | Child's birth order | Second or more | 0.373 | 1.317 | 0.719 | 2.411 | |
| 4–5 months | | | | | | | 0.285 |
| | In-hospital supplementation | No | <0.001 | 3.279 | 1.743 | 6.169 | |
| | Mother's age | | 0.431 | 1.022 | 0.968 | 1.080 | |
| | Number of adults in a family | More than one | 0.681 | 0.795 | 0.267 | 2.371 | |
| | Mother's birth country | Finland | 0.518 | 1.435 | 0.481 | 4.284 | |
| | Mother's education | Bachelor or higher | 0.002 | 2.726 | 1.453 | 5.115 | |
| | Family's economic situation | Good | 0.321 | 0.749 | 0.423 | 1.326 | |
| | Use of tobacco products | No | <0.001 | 20.087 | 8.489 | 47.528 | |
| | Child's birth order | Second or more | 0.110 | 1.617 | 0.897 | 2.914 | |
| 6–7 months | | | | | | | 0.252 |
| | In-hospital supplementation | No | <0.001 | 3.976 | 2.212 | 7.146 | |
| | Mother's age | | 0.136 | 1.042 | 0.987 | 1.100 | |
| | Number of adults in a family | More than one | 0.400 | 1.691 | 0.498 | 5.742 | |
| | Mother's birth country | Finland | 0.462 | 0.669 | 0.229 | 1.951 | |
| | Mother's education | Bachelor or higher | <0.001 | 3.852 | 2.029 | 7.314 | |
| | Family's economic situation | Good | 0.653 | 1.139 | 0.645 | 2.014 | |
| | Use of tobacco products | No | 0.001 | 4.877 | 1.980 | 12.013 | |
| | Child's birth order | Second or more | 0.519 | 1.214 | 0.674 | 2.184 | |
| 8–10 months | | | | | | | 0.169 |
| | In-hospital supplementation | No | 0.118 | 1.476 | 0.905 | 2.407 | |
| | Mother's age | | 0.484 | 1.018 | 0.968 | 1.071 | |
| | Number of adults in a family | More than one | 0.997 | 1.002 | 0.350 | 2.868 | |
| | Mother's birth country | Finland | 0.097 | 2.033 | 0.880 | 4.700 | |
| | Mother's education | Bachelor or higher | 0.001 | 2.387 | 1.407 | 4.049 | |
| | Family's economic situation | Good | 0.917 | 0.975 | 0.603 | 1.577 | |

TABLE 3 (Continued)

| Infant's age | Predictor | Reference | *P* | $OR^{adj}$ | 95% C.I. for $OR^{adj}$ Lower | 95% C.I. for $OR^{adj}$ Upper | $R^2$ |
|---|---|---|---|---|---|---|---|
| | Use of tobacco products | No | <0.001 | 5.708 | 2.544 | 12.806 | |
| | Child's birth order | Second or more | 0.399 | 1.241 | 0.752 | 2.047 | |
| 11–12 months | | | | | | | 0.189 |
| | In-hospital supplementation | No | 0.203 | 1.496 | 0.804 | 2.784 | |
| | Mother's age | | 0.542 | 0.981 | 0.921 | 1.044 | |
| | Number of adults in a family | More than one | 0.448 | 1.738 | 0.417 | 7.245 | |
| | Mother's birth country | Finland | 0.003 | 6.791 | 1.887 | 24.436 | |
| | Mother's education | Bachelor or higher | 0.038 | 2.010 | 1.041 | 3.879 | |
| | Family's economic situation | Good | 0.716 | 1.119 | 0.610 | 2.056 | |
| | Use of tobacco products | No | 0.017 | 3.228 | 1.238 | 8.417 | |
| | Child's birth order | Second or more | 0.047 | 1.938 | 1.010 | 3.718 | |

in-hospital supplementation and exclusive breastfeeding to the age of 5 months remained significant when controlling for sociodemographic factors (Table S1). Furthermore, the association between in-hospital supplementation and any breastfeeding at the ages of 4–7 months remained significant after controlling for sociodemographic factors (Table S2).

According to the type of participation (PHN interviewed/parent self completed), the prevalence of exclusive and any breastfeeding was higher in the self-completed group. However, the associations between in-hospital supplementation and breastfeeding practices remained significant when the type of participation was added to the models (data not shown).

## 4 | DISCUSSION

The aim of this study was to examine whether in-hospital supplementation is associated with exclusive breastfeeding to the age of 5 months and any breastfeeding from discharge to the age of 12 months in full-term, normal-weight singleton infants. The results suggest that in-hospital supplementation is associated with exclusive breastfeeding for up to 5 months and any breastfeeding for up to 7 months of age.

The present study showed an association between in-hospital supplementation and breastfeeding practices in noncontrolled situations. In the present study, more than half of the normal-weight, full-term, singleton infants received in-hospital supplementation. This high prevalence may be indicative of liberal, nonmedically indicated supplementation policies in the hospitals. Previous trials have shown that in-hospital supplementation does not cause failure in exclusive breastfeeding or any breastfeeding.[9–12] In those studies, supplementation was clearly indicated for infant weight loss, the amount of supplemental milk was limited, and families were told the reason for supplementation and its role in a trial. All these factors have previously been associated with appropriate supplementation.[24] However, the present study suggests that noncontrolled supplementation without a trial's rigorous procedures of care is associated with breastfeeding practices postdischarge. This result is supported by previous nonexperimental studies.[13–16]

Findings indicate that the association between in-hospital supplementation and breastfeeding practices was prevalent into late infanthood, in line with previous nonexperimental studies.[13–16] One reason may be that without skilled lactation consultation, ceasing supplementation and achieving exclusive breastfeeding could be challenging postdischarge. Furthermore, combining breastfeeding and supplementation can also be difficult, and the amount of supplementation can increase, which leads to breastfeeding cessation. Supplementing without a clearly stated temporary reason can be detrimental to the mother's breastfeeding self-efficacy[25] through perceived insufficient milk supply, which complicates efforts to achieve exclusive breastfeeding and may lead to formula feeding. Among young infants, the models explained approximately 30% of the variance, decreasing among older infants, presumably as a result of other contributing factors, for example a return to maternal employment.

The comparison between donor milk and formula as supplemental milk favored donor milk, although the association remained nonsignificant, potentially because of the small sample size in the different age groups. In Finland, the use of donor milk is common, especially in temporary situations. Therefore, the observed difference

in breastfeeding rates may be as a result of the reason for supplementation (presumed short- or long-term indication) rather than formula's direct association with breastfeeding.

Sociodemographic factors were associated with breastfeeding practices, along with in-hospital supplementation. There are several potential reasons for this. First, these individuals may be less motivated to breastfeed,[26] and their social environment may support formula feeding.[27] Second, smoking during pregnancy is associated with lower birthweight in infants,[28] leading to medically indicated supplementation. Furthermore, smoking impedes lactation.[29] Third, low-income mothers may have limited possibilities of obtaining skilled lactation consultation both prenatally and postnatally despite the universal, free-of-charge maternity and child primary health care in Finland, since lactation consultation services are partly private and incur out-of-pocket costs.

## 4.1 | Strengths and limitations

The strengths of this study are its large, nationally representative data set and its ability to describe the association between in-hospital supplementation and breastfeeding practices in uncontrolled situations. The study also has some limitations. Information on maternal or infant health status was not available, and therefore comparisons between medically indicated and nonindicated supplementation could not be performed. The outcomes were measured using WHO indicators,[21] although more versatile measures[30] would have been more suitable for this secondary analysis. The data coverage was only 22%, and information on uninvited or declined participants was not available. This, along with a retrospective design, may increase the selection bias. Furthermore, the study was conducted in a breastfeeding-friendly society, limiting its generalizability.

## 4.2 | Conclusion

Previous clinical trials have consistently shown that limited, medically indicated in-hospital supplementation does not have a decreasing effect on subsequent breastfeeding and may even be a supportive factor. The present study suggests, in contrast, that supplementation is associated with decreased breastfeeding practices in uncontrolled settings, in line with previous studies with similar designs. In clinical settings, controlled amounts of medically indicated supplementation should be used. However, a liberal supplementation policy with nonmedically indicated reasons should be avoided to support breastfeeding. In all cases, skilled lactation counseling should be provided postdischarge when in-hospital supplementation has been used. A future research challenge is to examine the association of supplementation with donor milk and formula with breastfeeding with a larger sample size.

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## ETHICAL APPROVAL

The study was approved by the Working Group on Research Ethics at the Finnish Institute for Health and Welfare, Finland.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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