THE IMPACT OF OBSTETRIC INTERVENTIONS ON INFANT FEEDING AND MATERNAL NUTRITION

Ph.D. Thesis

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INTRODUCTION

Breastfeeding is the most natural, hygienic and sustainable way to feed your baby. Breast milk contains the ideal proportion and amount of energy and nutrients needed for the baby's proper growth and development. Breastfeeding not only provides nutrition for the child, but also safety and immunological protection. According to the World Health Organization (WHO), by 2023, only 48% of infants will be exclusively breastfed until six months of age globally. In the European Region, the exclusive breastfeeding rate up to six months of age is 13%. 98% of mothers would be able to breastfeed if they had the knowledge, confidence and support they needed from health professionals, family members and society. The success of breastfeeding can also be influenced by a number of external factors, such as sociodemographic factors such as maternal age, marital status, place of residence, education, financial situation, and events and circumstances surrounding obstetric and newborn care. Although appropriate obstetric care and intervention at birth can be effective in preventing many complications, many interventions are routinely used in obstetric practice globally today. The use of synthetic oxytocin (xOT) doubled between 1990 and 2010, while in the mid-20th century it was mainly used for life-saving purposes, nowadays it is mostly used to induce and/or accelerate labour. Synthetic oxytocin may have an effect on the natural oxytocin system, thereby adversely affecting the mother-child relationship and the pleasure of caring for the infant. In addition to synthetic oxytocin, the use of obstetric analgesia and anaesthesia is becoming more widespread, the most common of which is epidural anaesthesia (EDA). Most interventions used during childbirth are combined, which increases the likelihood of a caesarean section. Intrapartum EDA is associated with a higher risk of emergency caesarean section due to suspected fetal compromise, compared to deliveries without analgesia or with alternative analgesia. In caesarean section, there is often a delay or no skin-to-skin contact between mother and newborn after delivery, and thus no early conception and early breastfeeding.

Uniform breastfeeding guidelines in health care are essential for the success of family-friendly care and breastfeeding. This requires the teaching of evidence-based knowledge and its practical application in the initial and continuing training of health professionals.

OBJECTIVES

- To explore the relationship between maternal birth and childbirth as an exploratory study.
- To assess the interventions used during maternal delivery and their rates, and to explore the relationship between the use of synthetic oxytocin, epidural anaesthesia and mode of delivery, and early breastfeeding and the prevalence of supplementary feeding in hospital.
- To assess the association of the mode of delivery with postpartum conditions (mother-newborn skin-to-skin contact, time of newborn placement on the mother's chest after delivery, newborn supplementary feeding in hospital and rooming-in).
- Assess the relationship of mode of delivery with exclusive breastfeeding and length of breastfeeding.
- To assess the relationship of postpartum hospital conditions (mother-newborn skin-to-skin contact, time of newborn placement on mother's chest after delivery, timing of feeding, newborn supplementary feeding in hospital and rooming-in) with each other and with the duration of exclusive breastfeeding and breastfeeding.
- To assess and compare the prevalence of the implementation of the Baby Friendly Hospital Initiative: 'Ten Steps to Successful Breastfeeding' among breastfeeding and non-breastfeeding mothers in Hungary and to explore the relationship between the number of steps experienced and the rate and duration of breastfeeding.
- To assess and compare the nutritional habits of breastfeeding and non-breastfeeding mothers during the puerperium in terms of dietary diversity, energy, vitamin and mineral intake, and fibre intake

TEST MATERIAL AND METHOD

In our quantitative cross-sectional study, we assessed in detail the circumstances and events of the perinatal and postpartum periods in maternity hospitals, highlighting the nature and prevalence of obstetric interventions, the mode of delivery, the home obstetric and neonatal care protocols, the characteristics of infant feeding (during hospital stay and after discharge, according to age), and the mothers' feeding habits in the postpartum period.

The survey was conducted in Hungary, useing an online self-completion questionnaire with a Google questionnaire editor, through social platforms (Facebook) targeted at gravid mothers and mothers, from 26/03/2021 to 18/07/2021. A non-random, purposive, convenience sample selection was conducted, with inclusion criteria being met by mothers who, at the time of completing the questionnaire, were raising at least one child of their own biological age, not older than 60 months (5 years). Mothers who were not of age at the time of the survey, who were gravid with their first child, and who completed the mandatory questions incompletely or unintelligibly, thus potentially skewing the results, were excluded from the data. In addition, there was also a report of a congenital or acquired physical or mental illness of the child or mother that made breastfeeding impracticable. After the exclusions, 2172 subjects met the inclusion criteria, from which we removed the preterm infants after conducting our exploratory study. For further analyses, the total number of elements was finally 2008. Completion was anonymous and voluntary. The final questionnaire contained 74 questions. In the first phase of the questionnaire, sociodemographic data were collected. The questions listed in the second and third sections of the questionnaire were identical, except that in the second section of the questionnaire we asked questions about the mother's birth, while in the third section we asked questions about the mother's delivery, the mode of delivery, the interventions performed, the events of the delivery and the conditions of hospital care. In the fourth phase, we asked mothers about the timing and method of breastfeeding, the use of pacifiers and bottles and other feeding aids, as well as about the advice they received in hospital, exclusivity and personal attitudes towards breastfeeding. In the fifth section, we asked questions about infant and young child feeding. In the last, sixth stage, mothers were asked about their dietary habits during the puerperium; variety, energy, vitamin and mineral intake, and fibre intake.

RESULTS

Relationships between maternal birth and childbirth

There was a significant difference ($p<0.001$) between the mode of birth of the mother and the mode of birth of her baby. The highest proportion of mothers who gave birth vaginally was vaginally delivered. The highest proportion of mothers who delivered by elective caesarean section gave birth naturally. The highest proportion of mothers who delivered by emergency caesarean section also delivered vaginally, but they had a high proportion of emergency caesarean sections (almost 40%) (Table I).

Table I: Relationship between mother's and child's mode of birth (n=2155)

Mother \ Child	Vaginal delivery (n (%))	Elective caesarean section (n (%))	Emergency caesarean section (n (%))	$\chi^2(4)$	p
Vaginal delivery	1201 (63.6%)	237 (12.6%)	449 (23.8%)	24.873	<0.001
Elective caesarean section	54 (59.3%)	13 (14.3%)	24 (26.4%)		
Emergency caesarean section	88 (49.7%)	17 (9.6%)	72 (40.7%)		

Based on gestational age, there was a significant difference between the mother's date of birth and the date of birth of her child ($p<0.001$). The highest proportion of mothers born before 37 weeks' gestation gave birth between 37 and 40 weeks' gestation. The largest proportion of mothers born between 37 and 40 weeks' gestation, almost two-thirds, also had their babies between 37 and 40 weeks' gestation. The largest proportion of mothers born after 40 weeks of gestation, one-twelfth, also had children after 40 weeks of gestation (Table II).

Table II: Relationship between mothers' and their children's gestational age at birth (n=1904)

Mother \ Child	Completed before 37 weeks (n (%))	Completed between weeks 37 and 40 (n (%))	After 40 weeks completed (n (%))	$\chi^2(4)$	p
Completed before 37 weeks	22 (14.5%)	85 (55.9%)	45 (29.6%)	77.089	<0.001
Completed between weeks 37 and 40	102 (7.5%)	863 (63.7%)	390 (28.8%)		
After 40 weeks completed	21 (5.3%)	175 (44.1%)	201 (50.6%)		

The relationship between epidural anaesthesia (EDA), exogenous oxytocin, and mode of delivery

Epidural anaesthesia was used during delivery in 14.5% (n=185) of mothers who gave birth naturally and 64.9% (n=312) of mothers who delivered by emergency caesarean section (p<0.001). Epidural analgesia was used in 49.7% (n=180) of those who received synthetic oxytocin, while only 31.5% (n=518) of those who did not receive synthetic oxytocin received EDA (p<0.001). 20% (n=151) of those who received exogenous oxytocin also received EDA. In contrast, of those who did not receive synthetic oxytocin only 6.4% (n=33) received epidural analgesia (p<0.001). The highest proportion of induction of labour was for emergency caesarean section, while the lowest proportion was for natural delivery (p<0.001). More than half of both vaginal deliveries and deliveries completed by emergency caesarean section had an exogenous oxytocin induction (p<0.001). The incidence of vaginal delivery was found to be significantly higher in those in whom synthetic oxytocin was used to accelerate delivery (p<0.001). Both induction and induction were most common in mothers who had an emergency caesarean section (Table III).

Table III: Frequency and associations of synthetic oxytocin use with mode of delivery (n=2008)

Type of obstetric intervention	Vaginal Delivery (n (%))	Elective Caesarean Section (n (%))	Emergency Caesarean Section (n (%))	$\chi^2(2)$	p
Induced	263 (20.6%)	58 (22.9%)	206 (42.8%)	90.419	<0.001
Accelerated	695 (54.6%)	19 (7.5%)	253 (52.6%)	192.103	<0.001
Both Induced and Accelerated	203 (15.9%)	15 (5.9%)	144 (29.9%)	75.009	<0.001

81.9% of mothers who did not receive synthetic oxytocin during delivery (n=425) and 72.5% of mothers who did (n=547) reported that early breastfeeding in the delivery room was achieved (p<0.001). Among newborns of mothers who received epidural analgesia during delivery, 55.3% (n=365) of newborns of mothers who did not receive epidural analgesia received supplementary feeding in hospital, compared to only 40.9% (n=509) of newborns of mothers who did not receive epidural analgesia (p<0.001). The highest proportion of newborns born naturally, 61.3% (n=751), did not receive complementary feeding in addition to or instead of

breast milk, while the highest proportion of newborns born by emergency caesarean section, 61.7% (n=271), received complementary feeding ($p<0.001$). 76.3% (n=972) of mothers who delivered vaginally, compared to 35.2% (n=89) of mothers who delivered by elective caesarean section and 30.6% (n=147) of mothers who delivered by emergency caesarean section breastfed their babies in the delivery room ($p<0.001$). Infants who were breastfed early had an average age of 11.38 months (SD=8.52, min=0, max=60), while those who were not breastfed had an average age of 9.72 months (SD=8.01, min=0, max=59) ($p<0.001$).

Associations of birth mode with infant feeding mode up to six months of age

We found a significant difference between exclusive breastfeeding and the infant's mode of birth ($p=0.014$). Exclusive breastfeeding until six months of age was more than two-thirds among infants born naturally, and the proportion of infants born by caesarean section was not much lower, but was less than two-thirds for both elective and emergency caesarean sections. There was a significant difference in the proportion of breastfeeding by mode of birth ($p<0.001$), with the highest proportion of mothers who gave birth vaginally, at just over 60%. More than one in two of mothers who had an emergency caesarean section and less than 50% of mothers who had an elective caesarean section fed their infant breast milk until six months of age. There was a significant difference in mixed breast milk and formula feeding (partial breastfeeding) by mode of delivery ($p=0.017$). One-fifth of both mothers who gave birth naturally and mothers who had an emergency caesarean section fed their infants with breast milk and formula, while mothers who had an elective caesarean section had a slightly higher rate of one-quarter of mothers who mixed feeding their infants with formula during the first six months. Significant differences were found for formula feeding (artificial feeding) by mode of delivery ($p<0.001$). The highest proportion of mothers who had a planned caesarean section, nearly half, emergency caesarean section mothers, over 40%, and vaginal section mothers, nearly one third, used infant formula to feed their infant. There was a significant difference in the rate of initiation of complementary feeding and mode of delivery ($p=0.024$). Among natural parents, the highest rate of initiation of complementary feeding before the infant was six months old was above 10%, while the rate for both emergency caesarean and elective caesarean mothers was below 10%. There was also a significant difference in the initiation of complementary feeding by mode of delivery ($p<0.001$). One in ten mothers who had a caesarean section were formula fed, while the lowest proportion of mothers who had a vaginal delivery were formula fed (Table IV).

Table IV: Comparison of feeding methods by mode of delivery up to six months of age (n=2008)

Type of Feeding in the First 6 Months	Vaginal Birth (n (%))	Elective Caesarean Section (n (%))	Emergency Caesarean Section (n (%))	$\chi^2(2)$	p
Exclusive breastfeeding	883 (69.3%)	156 (61.7%)	307 (63.8%)	8.531	0.014
Another	391 (30.7%)	97 (38.3%)	174 (36.2%)		
Breastfeeding	770 (60.4%)	123 (48.6%)	267 (55.5%)	13.418	<0.001
Other	504 (39.6%)	130 (51.4%)	214 (44.5%)		
Mixed feeding	234 (18.4%)	66 (26.1%)	99 (20.6%)	8.101	0.017
Other	1040 (81.6%)	187 (73.9%)	382 (79.4%)		
Formula feeding	437 (34.3%)	125 (49.4%)	198 (41.2%)	23.431	<0.001
Other	837 (65.7%)	128 (50.6%)	283 (58.8%)		
Breast- and complementary feeding	166 (13.0%)	20 (7.9%)	47 (9.8%)	7.475	0.024
Other	1108 (87.0%)	233 (92.1%)	434 (90.2%)		
Formula and complementary feeding	84 (6.6%)	29 (11.5%)	57 (11.9%)	15.805	<0.001
Other	1190 (93.4%)	224 (88.5%)	424 (88.1%)		

*Other: any other feeding form in the table that is not within the given row

The longest duration of exclusive breastfeeding was 5.05 months on average (SD=2.133, min=0, max=24) for infants born naturally (n=1077), while the shortest duration was 4.49 months on average (SD=2.273, min=0, max=11) for infants born by planned caesarean section (n=200) (p=0.005 In the case of vaginal delivery, 91.2% of mothers (n=1157) had skin-to-skin contact with their baby immediately after delivery, while in the case of planned caesarean delivery, skin-to-skin contact occurred in 38.7% of mothers (n=96) and in even fewer mothers (27.3%) of mothers (n=131) who had an emergency caesarean delivery (p<0.001). 91.2% of

mothers who gave birth naturally (n=1157) were able to have contact with their newborn immediately after delivery, while the largest proportion of mothers who had a caesarean section [26.2% of mothers who had a planned caesarean section (n=64), 37.0% of mothers who had an emergency caesarean section (n=172)] reported having contact with their newborn more than two hours after delivery. Mothers who had an emergency caesarean section had the longest duration of mother-newborn separation, with one-third of mothers reporting being separated from their newborn for more than two hours ($p<0.001$). The highest proportion of children born by elective caesarean section, 67.6% (n=171), received infant formula/supplementary formula feeding, while the highest proportion of children born naturally, 52.1% (n=664), never received formula ($p<0.001$). The highest rate of 60.3% (n=290) of children born by emergency caesarean section had the highest rate of pacifier use, while the lowest rate of 51.6% (n=658) of children born naturally had the lowest rate of pacifier use ($p<0.001$). The highest proportion of mothers who were not breastfeeding-afraid, 94.3% (n=901), did not use a pacifier with their child, while the majority of mothers who were breastfeeding-afraid, 20.2% (n=246), used a pacifier with their child ($p<0.001$). Infants who used a pacifier were exclusively breastfed for an average of 4.38 months (SD=2.46, min=0, max=24), compared to an average of 5.51 months (SD=1.86, min=0, max=17) for infants who did not use a pacifier ($p<0.001$). Among infants who were exclusively breastfed in the first six months of life, a majority of 58.8% (n=682) did not use a pacifier, while 73.2% (n=621) of non-exclusively breastfed infants used a pacifier ($p<0.001$). Exclusive breastfeeding lasted on average more than half a month, while the duration of breastfeeding lasted on average 5 months longer among infants who did not use a pacifier ($p<0.001$) (Table V).

Table V: Association of pacifier use with the time course of exclusive breastfeeding and breastfeeding

	No Pacifer Use		**Pacifer Use**		**t(1657)**	**p**
	M	*SD*	*M*	*SD*		
Exclusie Breastfeeding (months)	5.51	1.86	4.38	2.47	10.626	<0.001
Breastfeeding (months)	13.60	8.82	8.28	7.09	14.728	<0.001

Associations of mother-newborn skin-to-skin contact with hospital-based complementary feeding of the newborn, exclusive breastfeeding and breast milk feeding

The majority of newborns who had skin-to-skin contact with their mothers, 64.5% (n=359), did not receive any complementary feeding during hospitalisation, while a higher proportion of newborns who did not have skin-to-skin contact with their mothers, 62.1% (n=830), received complementary feeding during hospitalisation ($p<0.001$). We found a significant difference between the time of skin-to-skin contact and the duration of exclusive breastfeeding ($p=0.003$). Infants who had skin-to-skin contact with their mothers within 30 minutes were exclusively breastfed for an average of 5 months, while those who had skin-to-skin contact with their mothers after more than 30 minutes were exclusively breastfed for an average of 4 months (Table VI).

Table VI: Association of mother-newborn skin-to-skin contact within and beyond 30 minutes with exclusive breastfeeding

	Skin-to-skin contact within 30 minutes		**Skin-to-skin contact after 30 minutes**		**t(1638)**	**p**
	M	*SD*	*M*	*SD*		
Exclusie breastfeeding (moths)	5.05	2.16	4.64	2.49	3.205	0.003

Babies who had skin-to-skin contact with their mothers within two hours of birth were breastfed for an average of almost 11 months, while babies who had skin-to-skin contact with their mothers more than two hours later were breastfed for an average of 9.5 months ($p=0.021$) (Table VII).

Table VII: Associations of mother-newborn skin-to-skin contact within and beyond 2 hours with duration of breastfeeding

	Skin-to-skin contact within 2 h		**Skin-to-skin contact after 2 h**		**t(1913)**	**p**
	M	*SD*	*M*	*SD*		
Breastfeeding (moths)	10.95	8.42	9.67	8.05	2.309	0.021

On average, mothers who fed on demand continued to breastfeed their infants for 4.12 months ($p<0.001$). On average, infants fed on demand continued to breastfeed for 12.22 months (SD=8.39, min=0, max=60), while infants fed on a schedule continued to breastfeed for 8.10 months (SD= 5.68, min=0, max=31).

Relationship of 24-h rooming-in with skin-to-skin contact, complementary feeding of the newborn and timing of feeding

The highest proportion of mothers who had a natural birth and the lowest proportion of mothers who had an emergency caesarean section had 24-hour rooming-in with their newborn ($p<0.001$). Nearly half of mothers not in rooming-in had more than two hours of postpartum separation from their newborns, whereas three quarters of mothers in rooming-in had no postpartum separation from their newborns ($p<0.001$). More than half of the newborns who were co-housed for 24 hours did not receive breastmilk substitution/supplementary feeding in the maternity facility, while almost four-fifths of the newborns separated from their mothers received supplementary feeding ($p<0.001$). Nearly 10% more mothers in rooming-in had a higher rate of feeding according to the newborn's needs ($p=0.007$) (Table VIII).

Table VIII: Relationship between type of positioning and mode of delivery, time of skin-to-skin contact, complementary feeding and timing of feeding

	Rooming-in (n (%))	No rooming-in (n (%))	$\chi^2(2)$	p
Mode of Delivery				
Vaginal birth	1200 (94.8%)	66 (5.2%)	15.220	<0.001
Elective caesarean section	229 (91.2%)	22 (8.8%)		
Emergency caesarean section	431 (89.8%)	49 (10.2%)		
Time of placing the newborn on the mother's chest				
Immediately	1031 (74.8%)	23 (2.9%)	1248.625(5)	<0.001
After 10 min	173 (12.6%)	34 (5.8%)		
After 30 min	98 (7.1%)	76 (12.9%)		
After 1 h	52 (3.8%)	116 (19.7%)		
After 2 h	14 (1.0%)	73 (12.4%)		
After more than 2 h	10 (0.7%)	268 (45.4%)		
Complementary feeding of infants				
Present	1001(56.6%)	26 (20.8%)	60.123(1)	<0.001
Absent	769 (43.4%)	99 (79.2%)		
Timing of feeding				
On Demand	1468 (90.0%)	84 (81.6%)	7.241	0.007
Schedule	164 (10.0%)	19 (18.4%)		0.007

The Baby Friendly Hospital Initiative - The Hungarian implementation rate of the "Ten Steps to Successful Breastfeeding" among breastfeeding and non-breastfeeding mothers

Step 1: No significant difference was found between breastfeeding mothers (n=1346) and non-breastfeeding mothers (n=662) in terms of breastfeeding promotion of the Baby Friendly Steps ($p=0.624$).

Step 2: There was a significant difference between the two groups in terms of the health worker's recommendations for breastfeeding. Nearly twice as many breastfeeding mothers in the group reported that they were allowed to remain in skin-to-skin contact with their newborn or were advised to provide formula feeding after delivery than in the group of non-breastfeeding mothers ($p=0.006$). However, 10% more breastfeeding was reported by those who were advised by a health professional to take breastfeeding supportive steps.

Step 3: There was a significant difference between breastfeeding mothers and non-breastfeeding mothers in terms of the importance of breastfeeding, with those who considered it important to breastfeed actually breastfeeding at a rate almost 40% higher ($p<0.001$).

Step 4: Skin-to-skin contact was significantly higher in the breastfeeding mothers group. Two-thirds of breastfeeding mothers achieved skin-to-skin contact with their newborn within one hour of delivery, while the rate of skin-to-skin contact was less than one-third in the group of non-breastfeeding mothers ($p=0.002$). In addition, mothers who had skin-to-skin contact with their newborn within one hour of delivery had a 10% higher breastfeeding rate.

Step 5: No significant difference was found between the two groups in terms of breastfeeding assistance or recommended breastfeeding positions during hospitalisation ($p=0.413$). Within the group of breastfeeding mothers who received assistance with correct breastfeeding and learning different breastfeeding positions during hospitalisation, only 2.2% of mothers breastfed at a higher rate.

Step 6: Significant differences were found between breastfeeding mothers and non-breastfeeding mothers in the provision of complementary feeding to their newborns ($p<0.001$). The breastfeeding group reported significantly higher rates of not providing their newborn with breast milk substitutes or complementary feeding while in hospital than the non-breastfeeding group. Furthermore, 20% higher proportions of newborns who were not given complementary feeding were breastfed.

Step 7: There was a significant difference in rooming-in between the two groups. A significantly higher proportion of 24-hour co-location was achieved in the group of

breastfeeding mothers - almost 70% - compared to just over 30% in the group of non-breastfeeding mothers ($p<0.001$). Furthermore, a 15% higher proportion of breastfeeding was achieved in the group of mothers who received 24-hour co-location.

Step 8: A significantly higher proportion of mothers in the breastfeeding group reported responsive feeding and/or being taught in the hospital how to recognise hunger signs in their child than in the non-breastfeeding group ($p<0.001$). Nearly 30% higher rates of breastfeeding were found in mothers who were responsively fed and/or taught to recognise hunger signs. Nearly three quarters of mothers who were instructed to feed on demand or to recognise their child's hunger signs breastfed their child, while less than half of mothers who were not instructed to feed on demand or to recognise their child's hunger signs breastfed their child.

Step 9: Breastfeeding mothers were significantly more likely than non-breastfeeding mothers not to use a pacifier/bottle with their child ($p<0.001$). However, children who used neither a bottle nor a pacifier were 10% more likely to be breastfed than those who used either device.

Step 10: Significantly higher proportions of breastfeeding mothers reported that they were given contact information on discharge from hospital in case they had difficulty breastfeeding than non-breastfeeding mothers ($p=0.005$). In addition, 6.5% more breastfeeding mothers in the breastfeeding group were given contact information for breastfeeding support than those who were not (Table IX).

The breastfeeding mothers' group and the group of non-breastfeeding mothers showed a significant difference in baby-friendly steps ($p<0.001$). Non-breastfeeding mothers had an average of 6.92 (SD=1.35, min=2, max=10), while breastfeeding mothers had 7.12 (SD=1.208, min=1, max=10) baby-friendly steps ($p<0.001$).

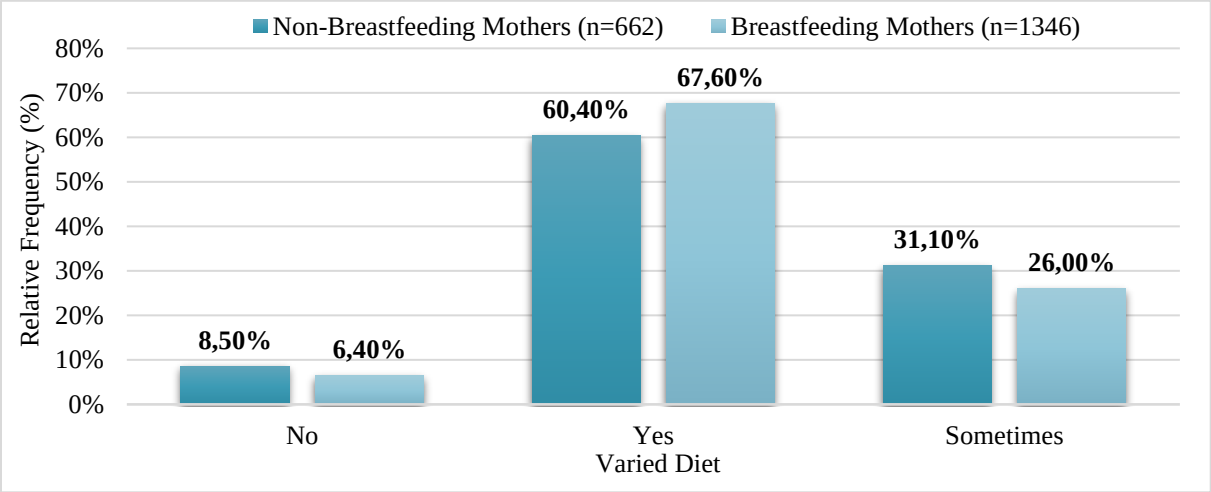
Table IX: Comparison between breastfeeding mothers (n=1346) and non-breastfeeding mothers (n=662) based on baby-friendly steps (n (%))

Questions Measuring BFHI's Steps			Non-Breastfeeding Mothers (n (%))	Breastfeeding Mothers (n (%))	Total (n (%))	$\chi^2(1)$	*p*
Step 1	Used formula recommended by staff	No	630 (33.1%)	1274 (66.9%)	1904 (100%)	0.24	0.624
		Yes	32 (30.8%)	72 (69.2%)	104 (100%)		
Step 2	Had skin-to-skin contact or were advised by staff to breastfeed responsively	No	97 (41.6%)	136 (58.4%)	233 (100%)	7.572	0.006
		Yes to either	551 (32.5%)	1142 (67.5%)	1693 (100%)		
Step 3	Considered breastfeeding important	No	98 (68.1%)	46 (31.9%)	144 (100%)	86.419	<0.001
		Yes	564 (30.3%)	1300 (69.7%)	1864 (100%)		
Step 4	Had skin-to-skin contact and breastfed her child within one hour of birth	No	145 (39.4%)	223 (60.6%)	368 (100%)	9.74	0.002
		Yes	499 (31.0%)	1113 (69.0%)	1612 (100%)		
Step 5	Was helped in proper positioning OR was advised to use different breastfeeding positions in the hospital	No	139 (35.4%)	254 (64.6%)	393 (100%)	0.671	0.413
		Yes to either	514 (33.2%)	1035 (66.8%)	1549 (100%)		
Step 6	The newborn received supplementary feeding beside or instead of breast milk after birth	No	240 (23.3%)	791 (76.7%)	1031 (100%)	90.703	<0.001
		Yes	383 (43.8%)	491 (56.2%)	874 (100%)		
Step 7	Got rooming-in placement in the hospital	No	65 (47.4%)	72 (52.6%)	137 (100%)	14.206	<0.001
		Yes	591 (31.8%)	1269 (68.2%)	1860 (100%)		
Step 8	Breastfed responsively OR was informed about hunger cues	No	58 (53.2%)	51 (46.8%)	109 (100%)	39.268	<0.001
		Yes to either	400 (25.5%)	1166 (74.5%)	1566 (100%)		
Step 9	The child received bottle OR pacifier	No	41 (25.0%)	123 (75.0%)	164 (100%)	6.131	0.013
		Yes to either	612 (34.6%)	1159 (65.4%)	1771 (100%)		
Step 10	Was given contact in case of breastfeeding difficulties	No	473 (35.7%)	852 (64.3%)	1325 (100%)	7.903	0.005
		Yes	180 (29.2%)	436 (70.8%)	616 (100%)		

A study of the dietary habits of breastfeeding and non-breastfeeding mothers

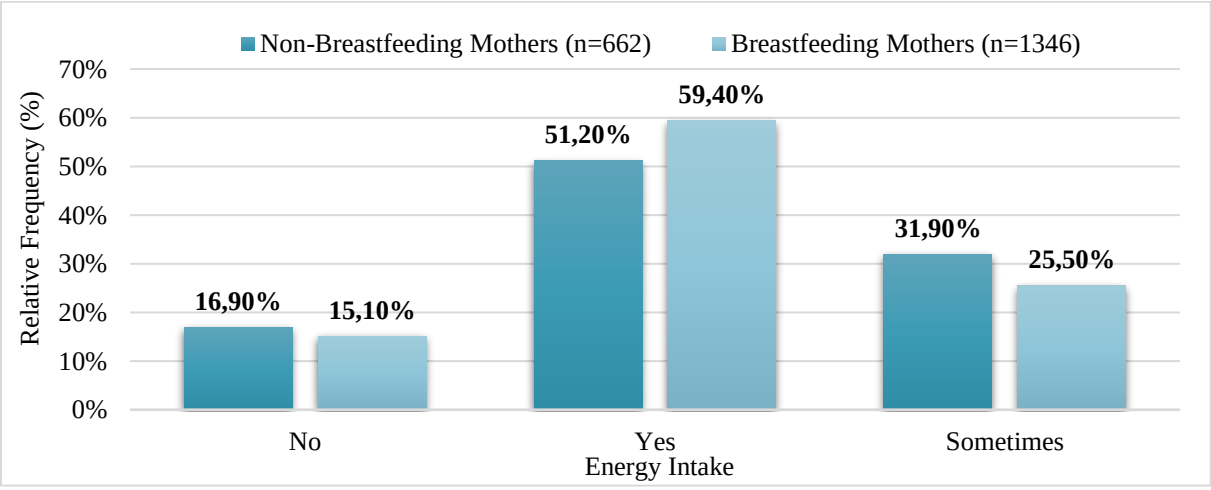
The highest proportion of breastfeeding mothers, more than two-thirds, paid attention, a quarter sometimes and just under 6% did not pay attention to eating a varied diet in the first six weeks after giving birth. Non-breastfeeding mothers were also overwhelmingly, albeit less so, with less than two-thirds attentive to varied feeding, almost a third sometimes and less than 10% not aware of varied feeding during the postnatal period (p=0.006) (Figure 1).

Figure 1: Characteristics of non-breastfeeding (n=662) and breastfeeding (n=1346) mothers' attentiveness to varied feeding (n=2008)



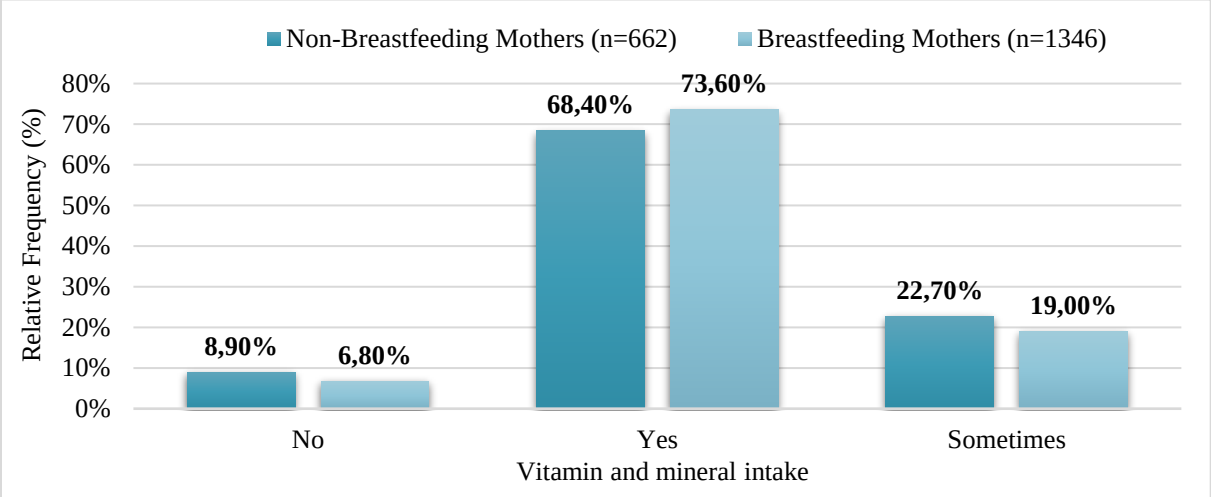
The largest proportion of breastfeeding mothers, nearly 60%, followed, one third sometimes and just over 15% did not monitor energy intake. In contrast, just over half of the non-breastfeeding mothers were only attentive, almost a third sometimes and less than a fifth did not pay attention to daily energy intake (p=0.002) (Figure 2).

Figure 2: Characteristics of non-breastfeeding (n=662) and breastfeeding (n=1346) mothers' attention to energy intake (n=2008)



Breastfeeding mothers were significantly more likely to monitor their daily vitamin and mineral intake (p=0.044). Almost three quarters of mothers in the breastfeeding group were aware, less than one fifth sometimes and less than 7% did not monitor their daily vitamin and mineral intake. In contrast, just over half of mothers in the non-breastfeeding group were aware of their micronutrient intake, almost a third sometimes and less than 9% did not (Figure 3).

Figure 3: Characteristics of non-breastfeeding (n=662) and breastfeeding (n=1346) mothers' attention to vitamin and mineral intake (n=2008)



NEW SCIENTIFIC RESULTS

1. In a study involving more than 2,000 Hungarian mothers, we found that the highest proportion of mothers born before the 37th week of gestation and between the 37th and 40th week of gestation gave birth between the 37th and 40th week of gestation, while the highest proportion of mothers born after the 40th week of gestation gave birth after the 40th week of gestat

2. In a large Hungarian sample we have shown that vaginal delivery, planned caesarean section and emergency caesarean section highest proportion of mothers born by vaginal delivery The highest rates of vaginal births were found in women who gave birth by vaginal delivery. Emergency caesarean section mothers who have a caesarean section have a higher proportion of emergency cesarean delivery than those born vaginally or by planned delivery. mothers born by planned caesarean section.

3. In a Hungarian sample, we have shown that the use of synthetic oxytocin to induce labour and to induce and accelerate labour both have a higher rate of emergency caesarean section. Domestic sample we are the first to show that the incidence of natural delivery a higher proportion of natural births in those who only have an exogenous oxytocin administration.

4. Involving more than 2,000 biological mothers in Hungary, we have shown for the first time that synthetic oxytocin administration has a higher rate of epidural anaesthesia use. Newborns of mothers who received epidural anaesthesia had a higher prevalence of complementary feeding in addition to or instead of breast milk than newborns of mothers who did not receive epidural analgesia.

5. In a large Hungarian sample, we have shown that mothers who have received synthetic oxytocin administration and have given birth vaginally have a lower rate of breastfeeding their newborns in the delivery room than mothers who have not received synthetic oxytocin.

6. In a Hungarian sample, we have shown that a higher proportion of newborns born by caesarean section receive complementary feeding in the maternity unit in addition to or instead of breast milk, and a lower proportion and shorter duration of exclusive breastfeeding than naturally born infants.

7. In a Hungarian sample, we have shown that there is a significant difference in the timing of mother-infant skin-to-skin contact by mode of delivery. Vaginally delivered mothers typically have the opportunity to be with their newborn immediately after delivery. The highest proportion of mothers who deliver by planned caesarean section have their first contact with

their newborn baby within more than two hours, but a slightly lower proportion within 30 minutes. Emergency caesarean sections have the longest and highest rates of mother-newborn separation, with mothers typically separated from their newborn for more than two hours.

8. In a large Hungarian sample, we have shown that infants breastfed in the delivery room have a longer duration of breastfeeding compared to infants who are not breastfed in the delivery room.

9. We are the first Hungarian sample to show that non-rooming-in placement is more common in deliveries completed by caesarean section. The prevalence of complementary feeding in addition to or instead of breast milk and of timed feeding is higher in non-rooming-in than in rooming-in.

10. In our country, we have shown for the first time that pacifier use is most common in children born by emergency caesarean section and least common in children born naturally. Mothers who fear breastfeeding are more likely to give their babies a pacifier. Infants who do not use a pacifier have a significantly longer duration of exclusive breastfeeding or breastfeeding than infants who use a pacifier.

11. In Hungary, for the first time, we measured the implementation rate of the WHO & UNICEF: Baby Friendly Hospital Initiative - "Ten Steps to Successful Breastfeeding" in Hungary and compared breastfeeding mothers with non-breastfeeding mothers based on the number of steps taken. Statistical analyses demonstrated significant differences between breastfeeding mothers and non-breastfeeding mothers in the health professional's breastfeeding-friendly recommendations (up-to-date staff knowledge and practice) for the importance of breastfeeding; skin-to-skin contact within one hour; not giving complementary feeding; rooming-in, responsive feeding and recognising signs of hunger; not using pacifiers/bottles and being available to support breastfeeding.

12. In Hungary, our study is the first survey to compare the feeding practices of breastfeeding and non-breastfeeding mothers in the puerperium. During puerperium, breastfeeding mothers have a significantly higher prevalence of varied diets and a higher attention to energy, vitamin and mineral intake than non-breastfeeding mothers.

PROPROSALS

- A significant advance in Hungary would be the creation of a single database to track interventions and postpartum events for the same delivery.
- Quantitative data collection on a representative sample, repeated per delivery, would provide an opportunity to analyse clinical parameters to study the short- and long-term effects of obstetric interventions.
- Data collection and analysis based on public and private obstetric and neonatal care could provide a new direction for conducting research on additional aspects.
- A qualitative study would provide an opportunity to understand and characterise the psychological aspects of breastfeeding refusal, while at the same time providing a basis for quantitative research to generate decision alternatives and recommendations.
- We would propose the creation of a series of interactive and informative programmes, organised by IBCLC lactation consultants, midwives, midwives, dieticians, mental health and psychology professionals, available in various online, hybrid or offline formats. During the presentations, these professionals would support the preparation for parenthood, childbirth and breastfeeding based on their individual competences and practical experience.
- In this way, (future) mothers would gain knowledge about the importance and benefits of breastfeeding and the risk factors that can adversely affect breastfeeding (e.g. possible medical and physical interventions during childbirth, delivery methods, protocols in maternity facilities, feeding methods for newborns, infants and young children, the risk of using a pacifier or bottle, etc.).
- After childbirth, during their stay in hospital, mothers would be informed during a dietetic consultation about the increased energy and nutritional needs of their body during the postnatal period and during breastfeeding. Personalised dietary advice would help them to develop a diet that meets their individual needs and requirements.
- It would be recommended that mothers should be provided with the opportunity to seek the assistance of an IBCLC lactation consultant for breastfeeding during their hospital stay or as an outpatient after delivery. As part of the counselling, breastfeeding mothers would thus receive assistance from a specialist in case of various breastfeeding difficulties (e.g. low milk production, breast inflammation, learning breastfeeding positions, physical

or mental problems, etc.).

- Targeted education and special attention is recommended for pregnant women and/or mothers who have given birth and who are affected by any of the socio-demographic factors that have been studied to be detrimental to breastfeeding, such as lower age, low population density, unmarried marital status, low educational attainment, low income status, first-time parenthood. In this context, the role of the midwives is crucial and indispensable, as they support and monitor families from the beginning of pregnancy until the end of childhood.
- We would suggest the development of apps/programmes that would give the midwife access to the examination records of pregnant women, as well as the possibility to keep an online antenatal care booklet. The interface would allow the midwives to inform the pregnant women under their care about the upcoming examinations and their importance, and would also provide them with a record of what they have said during the face-to-face consultation. A postnatal child health booklet could be added to the application to describe and record mandatory newborn, infant and early childhood examinations.
- Additional tests could help to assess the influence of twin pregnancy and prenatal and postnatal complications on breastfeeding.

PUBLICATION LIST

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