

## BREASTFEEDING KNOWLEDGE AND EXCLUSIVE BREASTFEEDING OF INFANTS IN FIRST SIX MONTHS OF LIFE

Monika A. Zielińska, Aneta Sobczak, Jadwiga Hamulka\*

Department of Human Nutrition, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences (SGGW), Nowoursynowska 159c street, 02-776 Warsaw, Poland

### ABSTRACT

**Background.** Exclusive breastfeeding is the gold standard in infant nutrition. The maternal decision to breastfeed is affected by various factors, including breastfeeding knowledge.

**Objective.** The purpose of this study was the assessment of the breastfeeding knowledge in selected group of mothers of infants under 7 months and its relationship to the exclusivity of breastfeeding.

**Material and methods.** The study was carried out using the CAWI method from Dec 2014 till Feb 2015 among 446 mothers (aged 18-42) of infants under 7 months. The most of women lived in towns >100.000 inhabitants, had an university education and normal pre-pregnancy BMI. Breastfeeding knowledge was estimated using 15 questions (both 6 in general and child-related category and 3 in mother-related category). Results were analysed using multivariate logistic analysis and  $Chi^2$  and U-Mann Whitney tests.

**Results.** 57% (group A) of women exclusively breastfeed their infants and 43% (group B) did not. Average mean breastfeeding knowledge test score was  $11.9 \pm 3.4$  points. Higher mean was observed in group A compared with group B ( $12.9 \pm 2.8$  vs.  $10.6 \pm 3.7$  points;  $p \leq 0.001$ ). Predictors of lower score (<11 points) were professional education, overweight and living in the rural area. Each correct answer to questions in general (OR 1.93; 95%CI 1.57-2.37) or in child-related (OR 1.33; 95%CI 1.10-1.63) category improved the chance of exclusive breastfeeding. Women from group A had a better score in every question.

**Conclusion.** Breastfeeding education for mothers may improve breastfeeding rates.

**Key words:** *exclusive breastfeeding, breastfeeding knowledge, breast milk, infant formula*

### STRESZCZENIE

**Wprowadzenie.** Wyłączne karmienie piersią jest złotym standardem w żywieniu niemowląt. Na matczyną decyzję o sposobie żywienia niemowlęcia wpływa wiele czynników, w tym wiedza o karmieniu piersią.

**Cel.** Ocena wiedzy o karmieniu piersią w grupie matek niemowląt poniżej 7 miesiąca życia i jej wpływu na wyłączność karmienia piersią w momencie udziału w badaniu.

**Material i metody.** Badanie przeprowadzono metodą CAWI w okresie od grudnia 2014 r. do lutego 2015 r. wśród 446 matek (18-42 lata) niemowląt poniżej 7 miesiąca życia. Większość badanych zamieszkiwała miasta powyżej 100 tys. mieszkańców, posiadała wyższe wykształcenie oraz prawidłowe BMI przed ciążą. Wiedzę o karmieniu piersią oceniono za pomocą 15 pytań (po 6 w kategoriach ogólna i dotycząca dziecka oraz 3 dotyczące matki). Wyniki opracowano z wykorzystaniem wieloczynnikowej analizy regresji logistycznej, testu  $Chi^2$  oraz testu U-Manna Whitneya.

**Wyniki.** W badanej grupie 57% matek (grupa A) karmiło wyłącznie piersią, natomiast nie 43% (grupa B). Średni poziom wiedzy o karmieniu piersią wynosił  $11,9 \pm 3,4$  punktów (max. 15 pkt.). Wyższy wynik odnotowano w grupie A w porównaniu do grupy B ( $12,9 \pm 2,8$  vs.  $10,6 \pm 3,7$  punktów;  $p \leq 0,001$ ). Czynniki predysponującymi do niższego wyniku (<11 punktów) były: wykształcenie zawodowe, nadwaga oraz mieszkanie na terenach wiejskich. Każda prawidłowa odpowiedź w kategorii ogólnej (OR 1,93; 95%CI 1,57-2,37) lub dotyczącej dziecka (OR 1,33; 95%CI 1,10-1,63) zwiększała szansę wyłącznego karmienia piersią. Ponadto wyższy odsetek matek z grup A udzielił prawidłowej odpowiedzi na wszystkie zadane pytania.

**Wnioski.** Edukacja matek w okresie ciąży i laktacji może poprawić wskaźniki wyłącznego karmienia niemowląt piersią.

**Słowa kluczowe:** *wyłączne karmienie piersią, wiedza o karmieniu piersią, mleko kobiece, mieszanki mlekozastępcze*

\* **Corresponding author:** Jadwiga Hamulka, Chair of Nutritional Assessment, Department of Human Nutrition, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences (SGGW), Nowoursynowska Street 159C, 02-776 Warsaw, Poland, phone +48 22 59 37 112, fax +48 22 59 37 129, e-mail: [jadwiga\\_hamulka@sggw.pl](mailto:jadwiga_hamulka@sggw.pl)

## INTRODUCTION

Breastfeeding is associated with decreased risk of infectious disease and non-communicable disease during childhood and adulthood of the infant [15, 27, 28, 34]. Moreover, breastfeeding enhances psychomotor and cognitive development, which may lead to better school achievement and later a higher income [1, 32]. Breastfeeding is also related to health outcomes in women. It expedites the postpartum period, and the return to pre-pregnancy weight. In addition it decreases the risk of postpartum depression, type II diabetes, metabolic syndrome, along with breast and ovarian cancer [2, 3, 17, 28]. In many cases health benefits of breastfeeding are enhanced in accordance with the duration of and exclusivity of breastfeeding in the first six months. Unfortunately, the breastfeeding rates (especially for exclusive breastfeeding) all over the world are suboptimal. According to the last nationwide study in Poland in 1997, percentage of exclusively breastfed infants dropped from 69,8% at 1 month of life to only 9% at 6 month [20]. In acquiescence to smaller, non-representatives studies, since then this rate has not improved [24].

The maternal decision about breastfeeding is affected by several factors, including socio-demographic, labour and child-related [20]. Also, maternal opinions and knowledge, which are easily modifiable by educational programs or peer support, have a key role. Breastfeeding knowledge plays a crucial role in maternal ability to take an informed decision on infant nutrition [19]. According to studies from developing and developed countries, pregnant women with better breastfeeding knowledge more often plan to breastfeed, which is crucial for following breastfeeding recommendations later on [22, 29]. The knowledge about breastfeeding also influences the duration of nursing among mothers, who have already started breastfeeding [9, 11, 30, 36].

Several studies from Poland assessed maternal breastfeeding knowledge, but none of them analyzed its influence on infant feeding practice [5, 7, 12, 18, 26]. The purpose of this study was to measure the relationship between maternal breastfeeding knowledge and infant feeding practice in the first 6 months after birth.

## MATERIAL AND METHODS

This questionnaire study was conducted by Computer-Assisted Web Interview (CAWI) method among mothers of infants younger than 2 years old. Participants were recruited between Dec 2014 and Feb 2015 among users of Polish portals and social media for mothers. For the purpose of this study mothers of infants aged  $\leq 6$  months (except mothers of twins and those currently pregnant) were included only.

Online questionnaire consisted questions with two type of responses: closed-ended and open-ended. Questions were about maternal, socio-demographic, anthropometric characteristics (pre-pregnancy and currently body mass index (BMI)) labour-related factors, infant feeding, (including duration of exclusive and any breastfeeding), breastfeeding knowledge and its source. The breastfeeding knowledge was assessed by determining the correct responses to the 15 statements based on literature [2, 3, 4, 15, 17, 21, 31, 34]. They were grouped into three categories: general (6 questions), child-related (6 questions) and mother-related (3 questions). The level of knowledge was defined as insufficient if woman responds correctly to 7 or less questions, sufficient if the response was 8 – 10 questions, good (11 – 13 questions) or very good ( $\geq 14$  questions). Women classified to the group with a low level of breastfeeding knowledge had a total score below the overall mean ( $\leq 11$  correct responses – Table 2). Sentences are present in Table 3. Exclusive breastfeeding was defined according to the WHO and Polish recommendations [31, 33]. The purpose of this study was to require binary categorization of exclusive breastfeeding, where 1 was attributed to current (at the moment of participation at the study) exclusive breastfeeding (A group,  $n=255$ ) and 0 to non-exclusive breastfeeding (B group,  $n=191$ ). All of the infants were aged  $4.12 \pm 1.54$  months and according to the group: A –  $3.97 \pm 1.52$  and B –  $4.32 \pm 1.53$  ( $p \leq 0.01$ ).

All analyses were performed using STATISTICA version 10.0 and STATISTICA Plus programs (Stat Soft Inc., 2011). Statistical analysis included the evaluation of statistical significance of the differences between groups (using the *Chi-square* and the *U Mann-Whitney* tests) and multivariate regression analysis. Two multivariate models were carried out: the first of them examined prediction of socio-demographic characteristics influence on low level of breastfeeding knowledge (Table 1) and the second of them the influence of level of breastfeeding knowledge on exclusive breastfeeding (Table 2). *P* values  $\leq 0.05$  were considered statistically significant.

## RESULTS

The study group was composed of 446 women aged 18-42. Socio-demographic characteristics of the study group are shown in Table 1. In the study sample ( $n=446$ ) showed that 57% ( $n=255$ ) of mothers exclusively breastfed their infants (A group), and 43% ( $n=191$ ) of them did not exclusively breastfeed (B group) at the moment of participation in the study. In the B group 47% of the infants were formula fed (including 10% never breastfed), and 53% of infants were given any breastfeeding (39% were mixed fed and 14% were introduced to solid food without milk formula).

Table 1. Socio-demographic characteristics of the studied population and its impact on breastfeeding knowledge below the group's mean ( $\leq 11$  point)

| Variable                      | Total<br>% (n=466) | Multivariate analysis<br>aOR (95%CI) | P-value |
|-------------------------------|--------------------|--------------------------------------|---------|
| Maternal age, y               |                    |                                      |         |
| ≤ 20                          | 4.3 (19)           | 0.52 (0.19 – 1.39)                   | 0.19    |
| 21 – 25                       | 25.1 (112)         | 1                                    |         |
| 26 – 30                       | 47.5 (212)         | 1.34 (0.87 – 2.05)                   | 0.18    |
| 31 – 35                       | 18.8 (84)          | 1.08 (0.63 – 1.84)                   | 0.77    |
| > 35                          | 4.3 (19)           | 1.07 (0.46 – 2.49)                   | 0.88    |
| Maternal place of residence   |                    |                                      |         |
| Rural area                    | 16.4 (73)          | 1.48 (1.02 – 2.13)                   | ≤0.05   |
| City <100.000 inhabitants     | 31.4 (140)         | 1                                    |         |
| City >100.000 inhabitants     | 52.2 (233)         | 0.83 (0.63 – 1.11)                   | 0.21    |
| Marital status                |                    |                                      |         |
| Married or concubinage        | 97.5 (435)         | 1                                    |         |
| Single                        | 2.5 (11)           | 1.31 (0.69 – 2.50)                   | 0.41    |
| Maternal education            |                    |                                      |         |
| Lower secondary               | 2.0 (9)            | 0.58 (0.17 – 1.92)                   | 0.37    |
| Vocational                    | 3.4 (15)           | 4.96 (1.73 – 14.20)                  | ≤0.001  |
| Secondary general             | 21.3 (95)          | 1                                    |         |
| University                    | 73.3 (327)         | 0.51 (0.27 – 0.96)                   | ≤0.05   |
| Occupation situation          |                    |                                      |         |
| Maternity or parental leave   | 77.6 (346)         | 0.57 (0.41 – 0.80)                   | ≤0.001  |
| Unemployed and/or no studying | 10.5 (47)          | 1                                    |         |
| Employed and/or studying      | 11.9 (53)          | 1.50 (0.96 – 2.36)                   | 0.08    |
| Parity                        |                    |                                      |         |
| Primiparous                   | 73.1 (326)         | 1                                    |         |
| Multiparous                   | 26.9 (120)         | 1.06 (0.83 – 1.36)                   | 0.63    |
| Pre-pregnancy BMI category    |                    |                                      |         |
| Underweight                   | 10.5 (47)          | 0.59 (0.33 – 1.07)                   | 0.08    |
| Normal                        | 67.3 (300)         | 1                                    |         |
| Overweight                    | 18.6 (83)          | 1.75 (1.09 – 2.80)                   | ≤0.05   |
| Obesity                       | 3.6 (16)           | 0.96 (0.42 – 2.19)                   | 0.92    |

aOR - adjusted odds ratio; 95%CI - 95% confidence interval; BMI - body mass index

Table 2. The level of breastfeeding knowledge in the studied group

| Questions' category      | Score        | Total<br>% (n=446)          | A group <sup>a</sup><br>% (n=255) | B group <sup>b</sup><br>% (n=191) | P-value             |
|--------------------------|--------------|-----------------------------|-----------------------------------|-----------------------------------|---------------------|
| General                  | 0 – 2        | 4.5                         | 1.2                               | 8.8                               | <0.001 <sup>a</sup> |
|                          | 3 - 4        | 40.1                        | 28.3                              | 56.0                              |                     |
|                          | 5 - 6        | 55.4                        | 70.6                              | 35.0                              |                     |
| Child-related            | 0 – 2        | 8.0                         | 2.8                               | 15.2                              | <0.001 <sup>a</sup> |
|                          | 3 - 4        | 31.1                        | 22.5                              | 38.8                              |                     |
|                          | 5 - 6        | 60.8                        | 69.8                              | 46.1                              |                     |
| Mother-related           | 0 - 1        | 35.4                        | 27.1                              | 46.6                              | <0.001 <sup>a</sup> |
|                          | 2            | 36.3                        | 40.8                              | 30.4                              |                     |
|                          | 3            | 28.3                        | 32.2                              | 23.0                              |                     |
| Mean score ± SD (95% CI) |              | 11.9 ± 3.4<br>(11.6 – 12.2) | 12.9 ± 2.8<br>(12.5 – 13.2)       | 10.6 ± 3.7<br>(10.1 – 11.1)       | <0.001 <sup>b</sup> |
| Total score              | insufficient | 12.6                        | 5.5                               | 22.0                              | <0.001 <sup>a</sup> |
|                          | sufficient   | 15.2                        | 11.0                              | 20.9                              |                     |
|                          | good         | 35.7                        | 38.0                              | 32.5                              |                     |
|                          | very good    | 36.5                        | 45.5                              | 24.6                              |                     |

Group A - exclusive breastfeeding; Group B - non-exclusive breastfeeding; SD - standard deviation; 95%CI - 95% confidence interval

<sup>a</sup>– results of the *Chi-square* test; <sup>b</sup> – results of the *U-Mann Whitney* test

Table 3. Percentage of mothers with correct answers to questions about breastfeeding

| No                       | Sentence   | Ans <sup>a</sup> | Correct responses (%) |                 |                 | P-value <sup>b</sup> |
|--------------------------|--|------------------|-----------------------|-----------------|-----------------|----------------------|
|                          |  |                  | Total (n=446)         | A group (n=255) | B group (n=191) |                      |
| GENERAL QUESTIONS        |  |                  |                       |                 |                 |                      |
| 1                        | The quantitative composition of human milk is adjusted to the infant's demand            | Y                | 96.9                  | 99.2            | 93.7            | <0.001               |
| 2                        | The composition of infant formula is the same as human milk                              | N                | 95.5                  | 98.0            | 92.2            | <0.01                |
| 3                        | Infant formula are better source of nutrients than human milk                            | N                | 95.1                  | 99.2            | 89.5            | <0.001               |
| 4                        | Drinking milk during lactation increase amount of produced human milk                    | N                | 79.8                  | 86.3            | 71.2            | <0.001               |
| 5                        | Breastfeeding mother should avoid potential allergens, e. g. peanuts, fish, strawberries | N                | 55.6                  | 67.5            | 39.8            | <0.001               |
| 6                        | Eating of gas-producing food by breastfeeding mother is the cause of colic in infant     | N                | 39.7                  | 54.1            | 20.4            | <0.001               |
| CHILD-RELATED QUESTIONS  |  |                  |                       |                 |                 |                      |
| 1                        | Breastfed infants develop at a slower rate   | N                | 95.3                  | 96.5            | 93.7            | 0.174                |
| 2                        | Breastfeeding improve infant brain development   | Y                | 93.7                  | 96.9            | 89.5            | <0.05                |
| 3                        | For children health there is no difference between breastfeeding and formula-feeding     | N                | 85.2                  | 92.9            | 74.9            | <0.001               |
| 4                        | Breast-fed infants have a greater risk for development of the type I diabetes            | Y                | 72.7                  | 80.0            | 62.8            | <0.001               |
| 5                        | Formula-fed infants have a greater risk to become obese                                  | Y                | 59.4                  | 67.1            | 49.2            | <0.001               |
| 6                        | Breastfwd infants are less likely to get diarrhea  | Y                | 54.0                  | 63.5            | 41.4            | <0.001               |
| MOTHER-RELATED QUESTIONS |  |                  |                       |                 |                 |                      |
| 1                        | Breastfeeding decreases risk of breast and ovarian cancer in mother                      | Y                | 79.4                  | 87.0            | 69.1            | <0.001               |
| 2                        | Successful breastfeeding may decrease risk of postpartum depression                      | Y                | 66.4                  | 74.1            | 56.0            | <0.001               |
| 3                        | Breastfeeding decreases risk of type II diabetes in mother                               | Y                | 35.2                  | 38.4            | 30.9            | 0.099                |

Group A - exclusive breastfeeding; Group B - non-exclusive breastfeeding; Y - yes; N - no

<sup>a</sup>Ans – correct answer; <sup>b</sup>- results of the *Chi*-square test

Table 4. The impact of maternal breastfeeding knowledge on exclusivity of breastfeeding

| Questions' category | Univariate analysis OR (95%CI) | P-Value | Multivariate analysis aOR (95%CI) | P-Value |
|---------------------|--------------------------------|---------|-----------------------------------|---------|
| General             | 2.17 (1.79 – 2.64)             | <0.001  | 1.93 (1.57 – 2.37)                | <0.001  |
| Child-related       | 1.69 (1.44 – 1.99)             | <0.001  | 1.33 (1.10 – 1.63)                | <0.01   |
| Mother-related      | 1.59 (1.31 – 1.95)             | <0.001  | 1.19 (0.93 – 1.51)                | ≥0.05   |

OR - odds ratio; 95%, CI - 95% confidence intervals; aOR - adjusted odds ratio

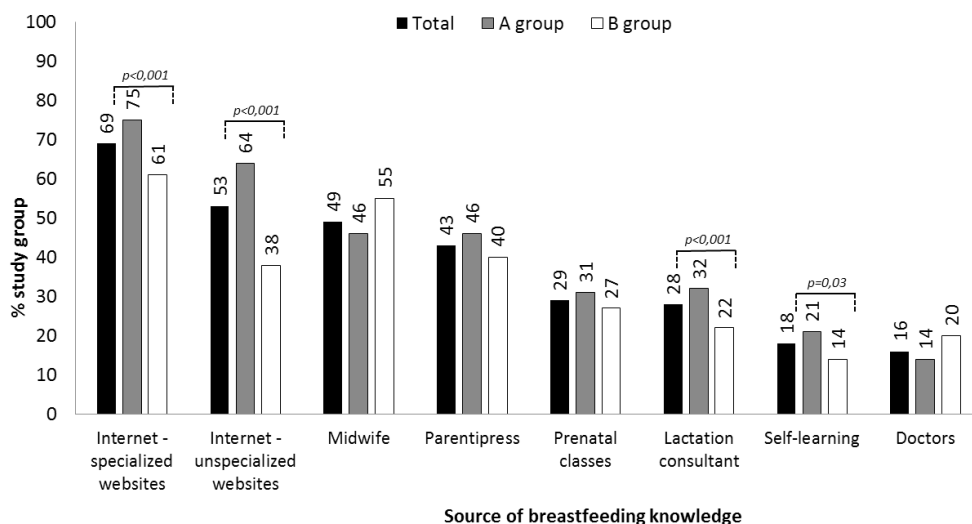
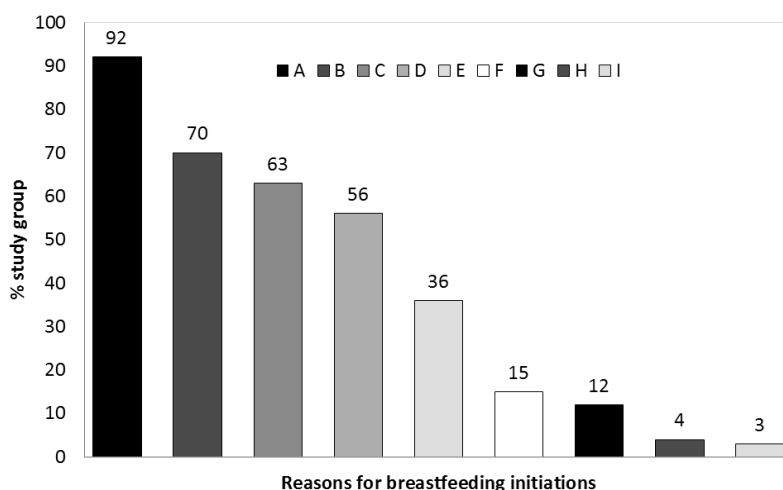
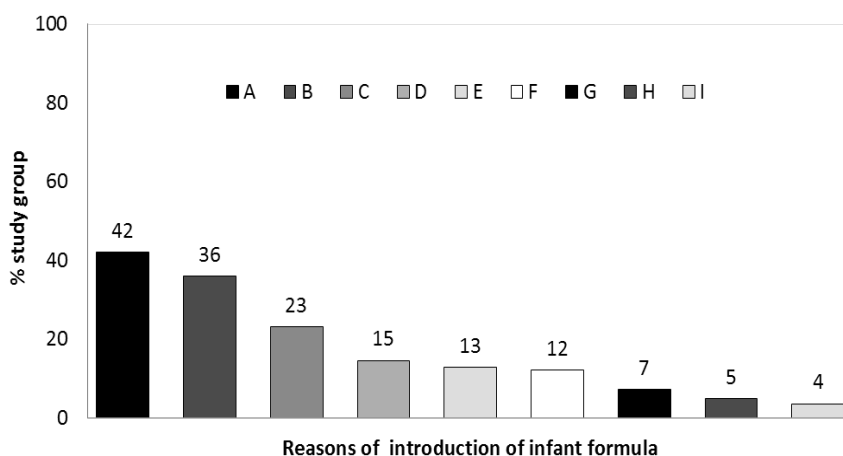


Figure 1. Source of breastfeeding knowledge in studied group and among exclusive breastfeeding (group A, n=255) and non –exclusive breastfeeding (group B, n=191) mothers



A – infant health outcomes; B – convenience of breastfeeding; C – easy use and availability of breast milk; D- maternal health outcomes; E – economic benefits of breastfeeding; F – positive experience with breastfeeding; G – desire for weight reduction; H – others; I – family tradition

Figure 2. Reasons of breastfeeding initiation in breastfeeding mothers (n=427)



A – breastfeeding problems; B – concern that infant were not eating enough milk; C – concern that infant were not gaining enough weight; D – feeding infant during mother’s absence; E – medical contraindication to breastfeeding for mother; F – infant hospitalization; G – medical contraindication to breastfeeding for infant; H – convenience of non-breastfeeding; I – others.

Figure 3. Reasons of introduction of infant formula to infant diet (n=164)

As shown in Table 2, most women had good (35.7%) or very good (36.5%) knowledge about breastfeeding. The mean of overall score of the women was  $11.9 \pm 3.4$ , and 38.3% women achieved the total score below. Women from group A achieved significantly better scores, both in overall and each statement and question category, compared to group B (Table 2 and 3). Socio-demographic predictors of low breastfeeding knowledge (i.e. score lower than the study group's score) were: maternal vocational education (odds ratio (OR) 4.96, 95% confidence interval (CI) 1.73-14.20), excess weight pre-pregnancy (OR 1.75, 95%CI 1.09-2.80) and living in rural areas (OR 1.48, 95%CI 1.02-2.13). The risk of low breastfeeding knowledge was decreased if woman had an university education, (OR 0.51, 95%CI 0.27-0.96) or had currently been on maternal or parental leave (OR 0.57, 95%CI 0.41-0.80) – Table 1.

The analysis of the statement results revealed that maternal breastfeeding knowledge were the highest in the general and child-related categories whereas the lowest was for maternal health outcomes (Table 2 and 3). In the general category, the most frequently correct responses were obtained in questions about breast milk's composition and the least frequently correct responses to the questions about diet during lactation. Also, the highest percentage of correct answers were about child development and the least about correct were that breastfed infants are less likely to have diarrhea or obesity. The participating women have been most knowledgeable about the decreased risk of breast and ovarian cancer in breastfeeding women, and least knowledgeable about the decreased risk of type II diabetes.

The univariate and multivariate regression analysis revealed that each correct answer in the general or child-related categories significantly increased the chance of women exclusively breastfeeding (Table 4).

Most of the study group received information about breastfeeding from the Internet (both specialized and unspecialized websites, 69.1 and 53.4%, respectively); significantly more in group A than in group B ( $p \leq 0.001$ ; Figure 1). 49.4% of women gained knowledge from midwives, whereas only 16% from doctors – group B declaring this more than group A ( $p \geq 0.05$ ).

The reasons for breastfeeding initiation among ever breastfeeding women ( $n=427$ ) are shown in Figure 2. Significantly ( $p \leq 0.001$ ) more women from group A compared with group B declared reasons such as infant health outcomes, (respectively 97% vs. 86%), the convenience of breastfeeding (77% vs. 60%), the easy use and availability of breast milk (69% vs. 53%), maternal health outcomes (64% vs. 44%), and the economic benefits of breastfeeding (41% vs. 27%). Figure 3 presents declared causes of the introduction of infant-formula ( $n=164$ ). Most women introduced

formula on their own decision (59%), whilst a lot of them indicated that they had been advised to introduce formula by a pediatrician (24%), midwife (20%), their partner (8%) or mother and/or mother-in-law (7%). In the group B 90 women were never initiated or already ceased breastfeeding due to breastfeeding problems (53%), declared lack of milk (48%), self-wean of infant (13%), infant (11%) or mother (9%) medical contraindication to breastfeeding, difficulties in dieting during lactation (8%), convenience of non-breastfeeding (6%), lack of willingness towards breastfeeding (4%) and/or other reasons (7%).

## DISCUSSION

In our study we found that a large percentage of mothers (43%) did not exclusively breastfeed at the moment of participation. Also, we showed that a higher level of breastfeeding knowledge protects against early cessation of exclusive breastfeeding. Knowledge about health benefits for infants and general breastfeeding information were stronger predictors of exclusive breastfeeding. Among non-exclusive breastfeeding mothers, lower scores were observed at each category and overall. *Susin et al.* has also found that level of maternal, and less paternal, breastfeeding knowledge improved its duration and exclusivity at the first 6 months after birth [30]. The present findings also support *Majchrzak et al.* who concluded that most of non-exclusively breastfeeding mothers had a lower knowledge about health benefits of breastfeeding, as well as *Stuebe & Bonuck* who reported that they are more likely to intend to breastfeed exclusively [18, 29]. It may suggest that most of non-exclusive breastfeeding women did not make the informed decision with full knowledge of its implications.

Similar to other domestic studies, our study found the overall level of breastfeeding knowledge to be good or very good [5, 7, 12, 18, 26]. Higher scores were noticed in questions about health benefits for infants, which reflects the opinion of 92% of respondents in this study and 94% in *Plagens-Rotman et al.*, that it is an important reason for breastfeeding initiation [26]. The insufficient knowledge about diet during lactation is rather disturbing – 44.6% of women believe that breastfeeding women should avoid allergens, and 60.3% believe that they should avoid the gas-producing foods because it causes colic. According to the Experts Group's recommendation, the consumption of allergens by breastfeeding women does not increase the risk of allergies or eczema, and that colic is a common disorder during infancy. Hence, the preventive elimination diet is not recommended during lactation [4]. Consistent with the findings of *Odom et al.* [25] as well as *Majchrzak et al.* [18], we found that difficulties in dieting could be one of causes

of breastfeeding cessation (declared by 8% of women in our study and 14% in *Majchrzak et al.*). Also, it is disturbing that a lot of breastfeeding women do not meet dietary recommendation [35].

Breastfeeding is also associated with substantially reduced costs of healthcare. These findings highlight the importance of a public health policy that should take initiatives supporting and promoting breastfeeding [6, 13, 19, 27]. However, such programs during prenatal or even pre-pregnancy period could be expensive and logistically difficult [13]. Other way of supporting breastfeeding is by making it possible to offer prenatal classes. Unfortunately, in Poland a low percentage of women attended or reported those classes as a source of information about breastfeeding, which was also confirmed in this study [5, 7, 31]. Postpartum intervention, (e.g. a video film discussing basic topics in breastfeeding) could also improve parental knowledge and breastfeeding rates, which was reported by *Susin et al.* [30]. The Innocenti Declaration implemented by Poland, as well as the Baby Friendly Hospital Initiative [BFHI], obligate hospitals and medical staff to follow the “Ten steps to successful breastfeeding” produced by WHO and UNICEF [6, 14, 16]. Their effectiveness was confirmed in several studies, including the PROBIT Trial [13, 16].

Since 1994 to 2010, the BFHI accreditation was achieved by 52 healthcare organizations in Poland, which is approximately 11% of hospitals and maternities [14]. According to the “10 steps...”, health care providers should support breastfeeding, and include technical advice [6, 14]. Most of the respondents in *Plagens-Rotman et al.* study regarded that kind of support as essential, however 11.6% considered this information as contradictory [26]. *Cierpka et al.* [5] conducted their study in a (BFH accredited) hospital, and 80% of their participants considered health care providers as good source of breastfeeding knowledge, including detailed information about breastfeeding techniques. Unfortunately, in our study doctors and midwives were declared as a source of knowledge about breastfeeding only by 16% and 49% of mothers respectively. Disturbingly, the mothers who did not breastfeed exclusively more often declared doctors and midwives as a source of information than those who breastfed exclusively. Similar results were obtained by *Klejewski et al.* [12] and *Majchrzak et al.* [18] who conducted their research in hospitals without BFHI accreditation. Several studies found that a lot of formula-fed mothers regretted the decision about milk formula introduction [6, 18]. According to literature and this study, common reasons of the introduction of infant formula were lactation difficulties, anxiety over breast milk supply or concern that the infants were not gaining enough weight [6, 18, 25]. A lot of these problems and concerns can be alleviated by

professional lactation support. Also, ours and others studies have indicated that mothers who agree with statement “formula is the same or better than breast milk” are more likely to use mixed or formula feeding [10]. Lactation education of health care providers’ significantly increases their breastfeeding knowledge and may be crucial for the better support of mothers, especially because systemic lactation education for medical staff in Poland is rather poor [16, 23]. It is particularly important because a lot of formula feeding mothers (44%) from our study declared that they had been advised to introduce infant formula by pediatrician or midwife.

As we have shown in our study, this kind of support and educational program, should be directed to women from the at risk groups, including those who are less educated, from rural areas and those that are overweight or obese pre-pregnancy. Results from the Infant Practices Study II revealed that women who were obese pre-pregnancy, had a poorer psychosocial characteristics, as well as lower prevalence of breastfeeding initiation, and if they initiated breastfeeding – a shorter duration compared with non-obese women. However, these problems can be alleviated by support from a physician or nonphysician health professional [8, 10, 23].

Despite these findings, our study has several limitations. First, the study samples were limited to only mothers with Internet access. Second, this study probably only involved mothers who had the most motivation for participating. Third, there is not a known percentage of mothers who had started this survey without completing it. Hence, in the general population the overall breastfeeding knowledge may have been lower. It is possible that mothers who had an interest in the study’s subject, and thus had a greater knowledge of breastfeeding, were more likely to complete the survey.

Important strengths of this study compared with others domestic studies are that the mothers were not limited to patients of the specific hospital, but were recruited from all over the country. The study samples were also bigger (n=446 compared with n=671 overall from 5 studies) [5, 7, 12, 18, 26]. Also, this study assessed the complexity of breastfeeding knowledge in several different areas (general, child and mother related), so we were able to measure which of these categories is the strongest predictor of exclusive breastfeeding. Therefore, our results could be used in the development of educational breastfeeding programs for women. Further studies should focus on determining whether paternal breastfeeding knowledge has an impact on breastfeeding rates and also focus on the development, introduction and assessment the efficiency of breastfeeding support programs.

## CONCLUSIONS

Our study strengthens the evidence that maternal knowledge about breastfeeding is a crucial and easily modifiable factor which influences exclusive breastfeeding rates. Hence, the main goal of public health policies should be breastfeeding educational programs that are intended especially for mothers from risk groups, e.g. lower educated, from rural areas and overweight and obese before the pregnancy.

### Conflict of interest

The authors declare no conflict of interest.

## REFERENCES

1. Anderson J.W., Johnstone B.M., Remley D.T.: Breastfeeding and cognitive development: a meta-analysis. *Am J Clin Nutr* 1999;70(4):525-535.
2. Aune D., Norat T., Romundstad P., Vatten L.J.: Breastfeeding and maternal risk of type 2 diabetes: a systematic review and dose-response meta-analysis of cohort studies. *Nutr Metab Cardiovasc Dis* 2014;24(2):107-115.
3. Borra C., Iacovou M., Sevilla A.: New evidence on breastfeeding and postpartum depression: the importance of understanding women's intentions. *Maternal and Child Health Journal* 2015;19(4):897-907.
4. Borszewska-Kornacka M.K., Rachan-Janicka J., Wesołowska A., Socha P., Wielgoś M., Żukowska-Rubik M., Pawlus B.: Stanowisko Grupy Ekspertów w sprawie zaleceń żywieniowych dla kobiet w okresie laktacji. [The Expert's Group recommendations of the Dietary Guidelines for lactating women]. *Standardy Medyczne. Pediatria* 2013;10:265-279 (in Polish).
5. Cierpka A., Żuralska R., Olszewski J., Gaworska-Krzemińska A.: Wiedza położnic na temat karmienia piersią. [Knowledge of breastfeeding among midwives]. *Problemy Pielęgniarstwa* 2007;15(2,3):172-178.
6. Cleminson J., Oddie S., Renfrew M.J., McGuire W.: Being baby-friendly: evidence-based breastfeeding support. *Arch Dis Child Fetal Neonatal Ed* 2015;100(2):F173-178.
7. Gebuza G., Gierszewska M., Kaźmierczak M., Michelska E., Kotzbach R.: Przygotowanie kobiet do karmienia piersią. [Preparation of women for breastfeeding]. *Problemy Pielęgniarstwa* 2010;18(4):406-412.
8. Hauff L.E., Leonard S.A., Rasmussen K.M.: Associations of maternal obesity and psychosocial factors with breastfeeding intention, initiation, and duration. *Am J Clin Nutr* 2014;99(3):524-534.
9. Inoue M., Binns C.W., Katsuki Y., Ouchi M.: Japanese mothers' breastfeeding knowledge and attitudes assessed by the Iowa Infant Feeding Attitudes Scale. *Asia Pac J Clin Nutr* 2013;22(2):261-265.
10. Jarlenski M., McManus J., Diener-West M., Schwarz E.B., Yeung E., Bennett W.L.: Association between support from a health professional and breastfeeding knowledge and practices among obese women: evidence from the Infant Practices Study II. *Womens Health Issues* 2014;24(6):641-648.
11. Kang N.M., Choi Y.J., Hyun T., Lee J.E.: associations of breastfeeding knowledge, attitude and interest with breastfeeding duration: a cross-sectional web-based study. *J Korean Acad Nurs* 2015;45(3):449-458.
12. Klejewski A., Urbaniak T., Baczyk G., Cichocka E.: Wiedza o zaletach karmienia naturalnego, wśród kobiet rodzących pierwsze dziecko. [Knowledge about breast feeding advantages among primiparas]. *Przegląd Lekarski* 2012;69(1):1021-1025 (in Polish).
13. Kramer M.S., Chalmers B., Hodnett E.D., Sevkovskaya Z., Dzikovich I., Shapiro S., Collet J.P., Vanilovich I., Mezen I., Ducruet T., Shishko G., Zubovich V., Mknuk D., Gluchanina E., Dombrowskiy V., Ustinovitch A., Kot T., Bogdanovich N., Ovchinikova L., Helsing E., PROBIT Study Group: Promotion of Breastfeeding Intervention Trial (PROBIT): a randomized trial in the Republic of Belarus. *JAMA* 2001;285(4):413-420.
14. Lobbok M.H.: Global baby-friendly hospital initiative monitoring data: update and discussion. *Breastfeed Med* 2012;7(4):210-222.
15. Lamberti L.M., Fischer Walker C.L., Noiman A., Victora C., Black R.E.: Breastfeeding and the risk for diarrhea morbidity and mortality. *BMC Public Health* 2011;11(3S):15-27.
16. Li C.M., Li R., Ashley C.G., Smiley J.M., Cohen J.H., Dee, D.L.: Associations of hospital staff training and policies with early breastfeeding practices. *J Hum Lact* 2014;30(1):88-96.
17. Li D.P., Du C., Zhang Z.M., Li G.X., Yu Z.F., Wang X., Cheng C., Liu Y.P., Zhao Y.S.: Breastfeeding and ovarian cancer risk: a systematic review and meta-analysis of 40 epidemiological studies. *Asian Pac J Cancer Prev* 2014;15(12):4829-4837.
18. Majchrzak M., Stawicka K., Jenczura A., Czajkowska M., Pyrczek A., Mann A., Ociepa K., Płonka J.: Czynniki determinujące sposoby karmienia noworodków i małych dzieci. [Factors determining ways of feeding infants and young children]. *Zdrowie i Dobrostan* 2014;3:79-87 (in Polish).
19. Meedya S., Fahy K., Kable A.: Factors that positively influence breastfeeding duration to 6 months: a literature review. *Women Birth* 2010;23(4):135-145.
20. Mikiel-Kostyra K., Mazur J., Wojdan-Godek E.: Factors affecting exclusive breastfeeding in Poland: cross-sectional survey of population-based samples. *SozPraventivmed* 2005;50(1):52-59.
21. Mitoulas L.R., Kent J.C., Cox D.B., Owens R.A., Sherriff J.L., Hartmann P.E.: Variation in fat, lactose and protein in human milk over 24 h and throughout the first year of lactation. *Br J Nutr* 2002;88(1):29-37.
22. Mitra A.K., Khoury A.J., Hinton A.W., Carothers C.: Predictors of breastfeeding intention among low-income women. *Matern Child Health J* 2004;8(2):65-70.
23. Nehring-Gugulska M., Nehring P., Królak-Olejnik B.: Breastfeeding knowledge among Polish healthcare practitioners supporting breastfeeding mothers. *Nurse Educ Pract* 2015;15(5):381-386.
24. Nehring-Gugulska M., Szyber M.: Report on breastfeeding status in Poland 2013. The Center for Lactation Science-website. Available: <http://www.kobiety.med.pl/cnol/index.php?lang=en> (Accessed 20.08.2015)



25. Odom E.C., Li R., Scanlon K.S., Perrine C.G., Grummer-Strawn L.: Reasons for earlier than desired cessation of breastfeeding. *Pediatrics* 2013;131(3):e726-e732.
26. Plagens-Rotman K., Kubiak S., Pięta B., Wszolek K., Iwanowicz-Palus G., Opala T.: Material awareness on natural feeding. *Ann Agric Environ Med* 2014;21(2):440-444.
27. Pokhrel S., Quigley M.A., Fox-Rushby J., McCormick F., Williams A., Trueman P., Dodds R., Renfrew M.J.: Potential economic impacts from improving breastfeeding rates in the UK. *Arch Dis Child* 2015;100(4):334-340.
28. Stuebe A.: The risk of not breastfeeding for mothers and infants. *Rev Obstet Gynecol* 2009;2(4):222-231.
29. Stuebe A.M., Bonuck K.: What predicts intent to breastfeed exclusively? Breastfeeding knowledge, attitudes, and beliefs in a diverse urban population. *Breastfeed Med* 2011;6 (6):413-420.
30. Susin L.R.O., Giugliani E.R., Kummer S.C., Maciel M., Simon C., DaSilveira L.C.: Does parental breastfeeding knowledge increase breastfeeding rates? *Birth* 1999;26(3):149-156.
31. Szajewska H., Socha P., Horvath A., Rybak A., Dobrzańska A., Borszewska-Kornacka M.K., Chybicka A., Czerwionka-Szaflarska M., Gajewska D., Helwich E., Książek J., Mojska H., Stolarczyk A., Weker H.: Zasady żywienia zdrowych niemowląt. Zalecenia Polskiego Towarzystwa Gastroenterologii, Hepatologii i Żywienia Dzieci. [Nutrition of healthy term infants. Recommendations of the Polish Society for Paediatric Gastroenterology, Hepatology and Nutrition]. *Standardy Medyczne. Pediatria* 2014;11(3):321-338 (In Polish).
32. Victora C.G., Horta B.L., Loret de Mola C., Quevedo L., Pinheiro R.T., Gigante D.P., Gonçalves H., Barros F.C.: Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: a prospective birth cohort study from Brazil. *Lancet Glob Health* 2015;3(4):e199-e205.
33. WHO: Division of child health and development. Indicators for assessing breastfeeding practices. Vol. 91. Geneva, Switzerland: World Health Organizations, 1991.
34. Yan J., Liu L., Zhu Y., Huang G., Wang P.P.: The association between breastfeeding and childhood obesity: a meta-analysis. *BMC Public Health* 2014;14:1267-1278.
35. Zdanowski K., Wawrzyniak A., Hamułka J., Pituch A., Araucz M., Kanigowska A.: Ocena spożycia energii oraz składników podstawowych w grupie kobiet karmiących piersią. [Assessment of energy and basic components intake in selected group of the breastfeeding women]. *Rocz Panstw Zakł Hig* 2012;63(3):305-311.
36. Zhou Q., Younger K.M., Kearney J.M.: An exploration of the knowledge and attitudes towards breastfeeding among sample of Chinese mothers in Ireland. *BMC Public Health* 2010;10:7

Received: 30.06.2016

Accepted: 28.12.2016