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From infancy to school age – a retrospective study of breastfeeding duration and early childhood health in a cohort of 6–7-year-olds

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Abstract

Introduction and Objective. Breastfeeding, particularly in early infancy, plays a crucial role in child health. While its benefits are well documented, few studies have examined how maternal characteristics and sources of breastfeeding knowledge relate to long-term child health outcomes. The aim of the study is to assess associations between the duration of any breastfeeding and maternal socio-demographic factors, breastfeeding information sources, frequency of childhood infections, motor development, and chronic disease occurrence in children aged 6–7 years.

Materials and Method. The study included 560 mother-child pairs from a family medicine clinic. Eligible children were aged 6–7 years, born after an uncomplicated perinatal course. Data were collected through maternal questionnaires, interviews, and chart reviews. Children were grouped by breastfeeding duration: G1 (0–3 months), G2 (4–6 months), G3 (7–12 months), G4 (>12 months). Outcomes included infection rates, motor milestones, and chronic disease prevalence.

Results. Longer breastfeeding (G3-G4) was associated with older maternal age, higher education, professional counselling, and a non-significant trend related to place of residence. Children in G3-G4 had fewer respiratory, otitis media, and gastrointestinal infections ($p < 0.05$), and lower overall infection rates. No differences were found for UTIs or skin infections. A non-significant trend toward earlier standing was noted in G3-G4 ($p = 0.06$). Chronic disease prevalence was highest in G1 (41.5%) and lowest in G3 (17%) and G4 (16%) ($p < 0.05$).

Conclusions. Longer duration of any breastfeeding was linked to lower rates of infections and chronic conditions in early childhood. Targeted support for younger and less-educated mothers may help improve breastfeeding outcomes and child health.

Key words

chronic diseases, socio-demographic factors, infections, child health, breastfeeding duration.

INTRODUCTION

Breastfeeding is widely recognised as an essential component of early-life nutrition, with a growing body of evidence confirming its profound and multifaceted impact on child health. In addition to offering optimal nourishment, human milk provides a complex array of bioactive components that contribute to immune system development, regulate inflammation, and support gut microbiota composition. Key protective elements, such as secretory IgA, lactoferrin, lactadherin, lysozyme, cytokines, and human milk oligosaccharides, have been shown to reduce the risk of respiratory, gastrointestinal, and urinary tract infections (UTIs) in infancy [1]. Breast milk also contributes to the development of immune tolerance and may lower the risk of allergic conditions such as asthma, although findings across studies remain inconsistent [2]. By shaping the gut microbiota and facilitating maternal microbial transfer, breastfeeding helps establish microbial and immunological homeostasis [3]. Additionally, bioactive molecules including microRNAs, growth factors, and long-chain polyunsaturated fatty acids such as DHA, play roles in neurodevelopment and metabolic programming, although some mechanisms remain unclear due to methodological variability [4].

Despite extensive research, most studies have concentrated on the short-term benefits of breastfeeding, particularly during infancy. Fewer have explored how early feeding practices influence health in later childhood, such as at school entry – an important window when long-term effects may begin to manifest more clearly. Moreover, limited studies have examined the interplay between breastfeeding duration, maternal socio-demographic factors, access to professional counselling, and multidimensional health outcomes in children.

The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life,

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followed by continued breastfeeding with complementary foods for up to two years or longer [5]. However, in Poland, exclusive breastfeeding rates remain below the European average, and many mothers discontinue breastfeeding earlier than recommended, citing various challenges [6]. Understanding how breastfeeding patterns relate to later child health, particularly infections, chronic conditions, and motor development, may help address barriers to sustained breastfeeding and inform more effective public health interventions.

To address this gap, the present retrospective study investigated associations between breastfeeding duration and selected health outcomes in children aged 6–7 years. In addition to infection frequency, chronic disease prevalence, and motor milestone achievement, maternal characteristics and sources of breastfeeding knowledge were analysed. This multidimensional approach aims to broaden our understanding of how early-life nutrition and maternal support factors influence child health trajectories, with implications for future policy and clinical guidance.

MATERIALS AND METHOD

A retrospective study was conducted at a family medicine clinic providing paediatric primary care services. Initially, 600 mother-child pairs were recruited. After excluding cases with incomplete data, such as missing medical records or partially completed maternal questionnaires, the final analysis included 560 pairs with complete datasets. All participating mothers were between 25–40 years of age, and their children were aged 6–7 years at the time of data collection. Data were collected over a 6-month period, January-June 2025, at the 'Świat Zdrowia' Family Medicine Center, which serves suburban areas near Poznań within the municipality of Czerwonak in western Poland, and provides care for over 20,000 patients.

To ensure the homogeneity of the study population, specific inclusion criteria were applied. Eligible participants were children aged 6–7 years, with complete medical documentation available. Only children considered generally healthy were included. This was defined as the absence of major congenital anomalies, diagnosed neurological disorders (e.g., epilepsy, cerebral palsy, autism spectrum disorder), medically established and widely accepted contraindications to breastfeeding, or significant perinatal complications (e.g. perinatal asphyxia, or low Apgar scores <7 at 5 minutes). Children with common chronic conditions, such as obesity or asthma, as well as those with a history of acute infections, were not excluded.

The study design included 3 components: (1) review of children's medical records, (2) structured maternal questionnaire, and (3) in-depth medical interview with the mother.

Data sources and variables. Socio-demographic information, including maternal age, education level, marital status, and place of residence, was obtained through a structured questionnaire. Mothers also provided data on their obstetric history (e.g., gestational age at delivery, mode of delivery), infant feeding practices (including breastfeeding duration), and sources of breastfeeding information or support. These included: professional breastfeeding counselling, internet and social media, popular science publications, other sources (e.g., friends, family members, parenting groups).

Any breastfeeding was defined as the provision of breast milk to an infant, irrespective of the introduction of additional liquids or complementary foods (such as formula, water, or solids). This definition aligns with commonly accepted standards in epidemiological research and was adopted due to the retrospective nature of the study, which precluded reliable assessment of exclusive breastfeeding status. In many cases, medical records did not specify whether breastfeeding was exclusive or supplemented, and maternal recall several years later may not have provided sufficiently accurate information to make this distinction.

The analysis focused primarily on the overall duration of any breastfeeding as the exposure variable, aimed at determining whether breastfeeding length of time alone had a measurable impact on child health and developmental outcomes. This pragmatic approach supports public health messaging that encourages prolonged breastfeeding regardless of exclusivity.

Information on the duration of breastfeeding was obtained retrospectively from medical records and maternal self-report. Data were collected from documentation of routine healthcare visits conducted in accordance with the national vaccination schedule, as well as from consultations related to childhood illnesses. During these visits, paediatricians routinely recorded breastfeeding status as part of standard medical documentation, which served as the basis for verifying reported breastfeeding practices.

Health-related outcomes were extracted from the children's medical documentation and included:

a) duration of breastfeeding (verified retrospectively in months);
b) frequency and type of common acute infections: respiratory tract infections, gastrointestinal infections (with or without diarrhoea), otitis media, UTIs, and skin conditions of infectious origin (e.g., rash of bacterial or viral origin);
c) motor development milestones, specifically the age at which the child achieved sitting with support, standing with support, and walking while holding hands.

These milestones represent key sequential stages of gross motor development, typically occurring between 4–13 months of age. Information was obtained retrospectively from 2 sources: paediatric medical records and maternal self-report during structured interviews. In some cases, paediatric documentation included elements of the Denver Developmental Screening Test, particularly during scheduled well-child visits; when available, this information was incorporated. In other cases, developmental data were extracted from routine paediatric records and supplemented by maternal recall.

The selected milestones are commonly used in both clinical and research settings, are clearly defined, and are generally well remembered by parents – making them appropriate for retrospective analysis. The objective was not to conduct full developmental screening, but rather to assess the timing of key gross motor milestones in relation to breastfeeding duration: presence of chronic conditions diagnosed by a physician, including overweight and obesity, asthma, atopic diseases, coeliac disease, type 2 diabetes, hypertension, and dyslipidaemia.

Study Groups. Participants were categorized into 4 groups based on the reported and confirmed duration of any breastfeeding: group G1: 0–3 months; group G2: 4–6 months; group G3: 7–12 months; group G4: more than 12 months. The categorization was based on a combination of practical, clinical, and methodological considerations, as well as precedents established in previous epidemiological research. Dividing breastfeeding duration into 4 categories facilitated the identification of key timeframes commonly discussed in the literature. The 0–3 month group reflects short-term breastfeeding, often associated with limited health benefits and early weaning due to factors such as maternal return to work, lactation difficulties, or insufficient breastfeeding support. The 4–6 month period, while falling short of the WHO's recommendation for exclusive breastfeeding for 6 months, is frequently used in retrospective studies on any breastfeeding to represent an intermediate duration of exposure. It also coincides with a transitional feeding phase, during which some infants begin receiving complementary foods. The 7–12 month and >12 month categories enabled examination of the effects of prolonged breastfeeding, consistent with WHO recommendations for continued breastfeeding alongside complementary feeding up to 2 years or beyond.

This stratification has also been employed in other studies examining associations between breastfeeding duration and child health outcomes, including recent publications [7], which support both the comparability and relevance of this approach. Moreover, this classification allowed for a more nuanced understanding of how variations in breastfeeding duration may relate to child health, making it possible to explore potential time-dependent associations, while remaining feasible within the constraints of retrospective data collection.

Statistical analysis. All data were anonymized and entered into a dedicated database for statistical processing. Descriptive statistics were used to summarize maternal socio-demographic characteristics and selected child health outcomes. Group comparisons were conducted using the Chi-squared (χ^2) test for categorical variables (e.g., presence of chronic conditions, frequency of infections) and one-way analysis of variance (ANOVA) for continuous variables (e.g., maternal age, age at achieving motor milestones). Where ANOVA indicated statistically significant differences between groups, Tukey's *post hoc* test was applied to identify specific pairwise group differences. Assumptions of normality and homogeneity of variances were verified using the Shapiro–Wilk and Levene's tests, respectively. For categorical variables with significant overall differences, *post hoc* pairwise comparisons were performed using z-tests for proportions with Bonferroni correction to control for multiple testing. A p-value of <0.05 was considered statistically significant. All analyses were performed using STATISTICA 13 (TIBCO Software Inc., Palo Alto, CA, USA) for Windows (Microsoft Corporation, Redmond, WA, USA).

Ethical considerations. The study was conducted in accordance with the ethical standards outlined in the Declaration of Helsinki. Participation was voluntary, and respondents retained the right to withdraw from the study at any time without providing a reason. Personal data were anonymized and processed in compliance with applicable data protection regulations, including the General Data Protection Regulation (GDPR, Regulation (EU) 2016/679). For the retrospective part of the study involving medical record review, appropriate authorization was obtained from the healthcare provider. Medical records were accessed exclusively for research purposes and handled with strict confidentiality.

RESULTS

Significant differences in maternal characteristics were observed across breastfeeding duration groups. Mothers who breastfed longer (groups G3 and G4) were significantly more likely to be aged 36 or older, married or cohabiting, and have higher levels of education (all $p < 0.05$). These mothers also more frequently reported professional counselling as their main source of breastfeeding knowledge, and were less likely to rely on the internet or popular science publications ($p = 0.02$). In contrast, mothers in the shortest breastfeeding group (G1) were more often younger (aged 20–25), single, and had lower educational attainment (Tab. 1).

Table 1. Maternal characteristics according to duration of any breastfeeding

	Breastfeeding period (G1–G4)					
	Total (n=560)	G1 (n=196)	G2 (n=142)	G3 (n=118)	G4 (n=104)	*p*
Age at delivery (years), n (%)						0.02
20–25	123	62 (31.6)	41 (28.9)	10 (8.5)[a,b]	10 (9.6)[a,b]	
26–30	202	76 (38.8)	34 (23.9)[a]	50 (42.4)	42 (40.4)[b]	
31–35	112	39 (19.9)	39 (27.5)	23 (19.5)	11 (10.6)[a,b,c]	
≥36	123	19 (9.7)	28 (19.7)	35 (29.7)	41 (39.4)[a,b]	
Timing of birth						0.04
Term and post-term	454	188 (95.9)	100 (70.4)	92 (78.0)	74 (71.1)[a]	
Pre-term	106	8 (4.0)	42 (29.6)	26 (22.0)	30 (28.8)[a]	
Marital status at time of delivery, n (%)						0.04
Married or cohabiting	470	141 (71.9)	121 (85.2)	110 (93.2)	98 (94.2)[a]	
Single or divorced	84	55 (28.1)	21 (14.8)	8 (6.8)[a,b]	6 (5.8)[a,b]	
Place of residence, n (%)						0.06 (NS)
Urban	352	110 (56.1)	92 (64.8)	83 (70.3)	67 (64.4)	
Rural	208	86 (43.9)	50 (35.2)	35 (29.7)	37 (35.6)	
Education level at time of delivery, n (%)						0.05
Primary education	|36	10 (5.1)	14 (19.9)[a,c]	6 (5.1)	6 (5.8)[b]	
Secondary education	266	61 (31.1)	95 (66.9)[a]	65 (55.1)[a]	45 (43.3)	
Higher education	258	125 (63.8)	33 (23.2)[a]	47 (39.8)	53 (51.0)	
Main source of knowledge about breastfeeding, n (%)						0.02
Breastfeeding counselling	101	38 (19.4)	16 (11.3)	21 (17.8)	26 (25.0)[a,b,c]	
Internet and social media	342	116 (59.2)	96 (67.6)	77 (65.3)	53 (50.1)[a,b,c]	
Popular science publications and other sources	117	42 (21.4)	30 (21.1)	20 (16.9)	25 (24.0)	
No. of other children at time of delivery	551	0.91±1.22	1.42±0.90	0.71±0.93	0.93±1.12	NS

G1–G4 – groups defined by duration of any breastfeeding: G1: 0–3 mo, G2: 4–6 mo, G3: 7–12 mo, G4: >12 mo.
Percentages in the table represent the proportion of mothers within each breastfeeding duration group (G1–G4).
NS – not significant; significantly different when p <0.05.
[a]significantly different from G1, [b]significantly different from G2, [c]significantly different from G3

Children in the longer breastfeeding groups (G3 and G4) experienced significantly fewer infections compared to those in the shorter breastfeeding groups (G1 and G2). Specifically, they had a lower number of acute respiratory tract infections during the first 3 years of life ($p = 0.03$), fewer episodes of otitis media in early childhood ($p = 0.01$), and fewer gastrointestinal infections between the ages of 4–6 ($p = 0.02$). They also had a significantly lower total number of infections per year across all age ranges ($p = 0.02$). No significant differences were observed between groups in the incidence of urinary tract infections (UTIs) or infectious skin rashes (Tab. 2).

Table 2. Incidence of childhood infections by duration of breastfeeding

	Breastfeeding period (G1–G4)				
	G1 (n=196)	G2 (n=142)	G3 (n=118)	G4 (n=104)	*p*
Acute respiratory tract infections per year (mean ± SD)					0.03
Age (years)					
up to 3	4.82 ± 2.11	4.91 ± 1.81	3.30 ± 1.10[a,b]	3.41 ± 2.11[a,b]	
4–6	3.61 ± 1.40	3.92 ± 1.90	3.84 ± 2.21	4.10 ± 2.33[a]	
>6	2.64 ± 0.82	3.02 ± 1.41	2.59 ± 1.32	2.46 ± 0.91	
Acute urinary tract infections per year (mean ± SD)					NS
Age (years)					
up to 3	1.53 ± 0.42	1.47 ± 0.82	1.44 ± 0.94	1.51 ± 0.83	
4–6	1.50 ± 0.31	1.34 ± 0.91	1.51 ± 0.70	1.47 ± 0.72	
>6	1.03 ± 0.33	1.08 ± 0.62	1.21 ± 0.86	1.10 ± 0.51	
Acute otitis media per year (mean ± SD)					0.01
Age (years)					
up to 3	1.01 ± 0.52	1.00 ± 0.76	0.51 ± 0.25[a,b]	0.63 ± 0.40[a]	
4–6	0.82 ± 0.41	0.76 ± 0.52[a]	0.78 ± 0.55	0.81 ± 0.40	
>6	0.50 ± 0.14	0.52 ± 0.22	0.49 ± 0.12	0.51 ± 0.20	
Acute gastrointestinal infections per year (mean ± SD)					0.02
Age (years)					
up to 3	0.98 ± 0.95	0.85 ± 0.75	0.90 ± 0.55	0.89 ± 0.68	
4–6	1.75 ± 0.98	1.16 ± 1.00	0.92 ± 0.65	0.77 ± 0.53[a]	
>6	0.65 ± 0.25	0.62 ± 0.42	0.55 ± 0.38	0.59 ± 0.45	
Skin rash of infectious origin per year (mean ± SD)					NS
Age (years)					
up to 3	0.21 ± 0.08	0.17 ± 0.11	0.20 ± 0.15	0.18 ± 0.13	
4–6	0.19 ± 0.10	0.15 ± 0.08	0.17 ± 0.12	0.17 ± 0.09	
>6	0.11 ± 0.09	0.13 ± 0.09	0.12 ± 0.08	0.12 ± 0.10	
All types of infections per year (mean ± SD)					0.02
At any age	5.32 ± 2.20	5.18 ± 1.98	4.49 ± 2.14[a,b]	4.50 ± 1.85[a]	

G1–G4 – groups defined by duration of any breastfeeding; G1: 0–3 mo; G2: 4–6 mo; G3: 7–12 mo; G4: >12 mo.
NS – not significant; significantly different when p <0.05
[a] significantly different from G1; [b] significantly different from G2

Although no statistically significant differences were observed in motor development milestones (sitting, standing, walking) across breastfeeding duration groups ($p > 0.05$), a non-significant trend (p = 0.06) suggested that children breastfed for 6 months or longer (G3 and G4) tended to achieve these milestones slightly earlier and more consistently, particularly in the case of standing with support. Findings related to motor development milestones by breastfeeding duration are presented in Table 3.

As shown in Table 4, the prevalence of chronic diseases was significantly lower among children who were breastfed for 6–12 months (G3: 17%) and over 12 months (G4: 16%), compared to those breastfed for less than 3 months (G1: 41.5%; $p < 0.05$).

Table 3. Motor development milestones by duration of breastfeeding

Development milestone	Breastfeeding period (G1–G4)				*p*
	G1 (n=196)	G2 (n=142)	G3 (n=118)	G4 (n=104)	
Sitting with support *(months, mean ± SD)*	6.02 ± 1.12	6.14 ± 1.25	5.19 ± 2.00	5.29 ± 1.14	NS
Standing with handrail support *(months, mean ± SD)*	9.25 ± 1.33	9.22 ± 1.36	8. 01 ± 2.11	8. 12 ± 1.64	0.06
Walking with one hand held *(months, mean ± SD)*	11.00 ± 2.05	11.15 ± 1.45	10.95 ± 1.50	10.84 ± 1.70	NS

G1–G4 – groups defined by duration of any breastfeeding; G1: 0–3 mo; G2: 4–6 mo; G3: 7–12 mo; G4: >12 mo.
NS – not significant; significantly different when p <0.05

The most frequently diagnosed conditions included asthma and/or atopic diseases, accounting for approximately 68% of all chronic cases, followed by overweight and obesity (25%). Less commonly reported conditions were coeliac disease (2%), type 2 diabetes (2%), hypertension (3%), and dyslipidaemia (0.1%).

Table 4. Chronic diseases by duration of breastfeeding

	Breastfeeding period (G1–G4)				*p*
	G1	G2	G3	G4	<0.05
No. of chronic disease diagnoses per group (%)	44 (41.5)	27 (25.5)[a]	18 (17)[a,b]	17 (16)[a,b]	

G1–G4 – groups defined by duration of any breastfeeding: G1: 0–3 mo, G2: 4–6 mo, G3: 7–12 mo, G4: >12 mo.
Percentages represent the proportion of all chronic disease diagnoses (n = 106) observed within each breastfeeding duration group. Diagnoses were reported for children aged 6 years and older, based on available medical history.
NS – not significant; significantly different when p <0.05
[a] significantly different from G1; [b] significantly different from G2

DISCUSSION

Breastfeeding has long been recognized as a key determinant of child health and development, with substantial evidence supporting its protective effects against infections and chronic diseases [8]. While many studies have confirmed these benefits, the present study offers a broader perspective by integrating socio-demographic characteristics, detailed age-specific infection data, motor development, and the prevalence of chronic conditions in relation to breastfeeding duration. This multidimensional approach, combined with an analysis of maternal sources of breastfeeding information, provides valuable insights with direct implications for both public health strategies and clinical counselling.

Consistent with previous research, the current study found that longer breastfeeding duration was associated with a lower incidence of common childhood infections, particularly respiratory and gastrointestinal illnesses [9]. Children who were breastfed for more than 6 months experienced significantly fewer episodes of acute respiratory infections, gastrointestinal infections, and acute otitis media in early childhood. When all infection types were combined, the overall infection rate was also significantly lower among children breastfed for more than 6 months, and especially among those breastfed for over one year, compared to children who were not breastfed or breastfed for shorter durations. These findings align with global evidence highlighting the

role of breast milk in supporting immune system maturation during critical early-life periods [10]. Although most studies support a protective role of breastfeeding against UTIs (particularly when breastfeeding is prolonged), the current findings did not confirm this association.

A retrospective analysis was conducted covering a 6-year period among children currently aged 6–7 years, based on medical records in which UTIs were verified through urine culture. While this extended time-frame reflected real-world medical data more accurately than shorter follow-ups, it also increased the likelihood of unmeasured confounders affecting the outcome. The results obtained were consistent with those of Li et al., who found no association between breastfeeding and UTI occurrence in 6-year-olds during the preceding year [11]. Similarly, Cho et al. observed no significant associations in younger paediatric populations [12].

One possible explanation for the absence of a clear protective effect in all these findings is that, beyond infancy, UTI risk may be more strongly influenced by non-nutritional factors, such as hygiene habits, anatomical anomalies, or environmental exposures. It is also important to note that the current analysis did not differentiate between exclusive and partial breastfeeding, which may have attenuated potential associations. Previous studies suggest that exclusive breastfeeding offers stronger immunological benefits than mixed feeding, particularly in the first months of life [13]. Future research should therefore consider more granular distinctions in feeding patterns to better assess their role in UTI prevention.

In interpreting these findings, the possibility of reverse causality should also be considered, that is, children who experienced more frequent illnesses in early life may have been breastfed for a shorter duration due to feeding difficulties, medical advice, or maternal concern. However, the retrospective and observational design of the study limits the ability to establish causal relationships, and efforts were made to minimize this limitation. First, children with perinatal complications that could predispose them to early health problems and potentially influence breastfeeding duration, were excluded. Second, although infection incidence was analyzed across different age intervals (including the first 3 years of life, which may overlap with the breastfeeding period for some children), participants were grouped according to breastfeeding duration, and infection rates were examined at multiple time points to assess patterns beyond early infancy.

These steps aimed to reduce bias, although reverse causality cannot be entirely excluded. Another factor that may have influenced the findings is variability in healthcare access and utilization, which could affect the frequency of infection diagnoses recorded in medical documentation. However, all participants received care within the same Family Medicine Centre ('Świat Zdrowia'), which operates several outpatient clinics across the municipality of Czerwonak and surrounding areas. This shared healthcare environment ensured uniform access to services and minimized disparities in healthcare utilization across the cohort. Moreover, infection data were collected both during scheduled well-child visits (aligned with the national vaccination programme) and during illness-related consultations. This dual-source approach reduced the likelihood that differences in parental healthcare-seeking behaviour significantly biased the recorded infection rates. Although the exact number of illness-related medical visits per child was not quantified, the large sample size (n = 560) provided sufficient statistical power, and helped mitigate the potential influence of such confounding factors.

Motor development is a key indicator of overall child development during the early years, enabling the acquisition of skills essential for active engagement with the environment and prevention of sedentary behaviours. While the beneficial effects of prolonged breastfeeding on cognitive outcomes are well established [14], evidence regarding its influence on motor development remains limited and somewhat inconclusive. Some studies suggest a positive association between longer breastfeeding duration and earlier attainment of motor milestones [15], yet the overall body of evidence lacks consistency. In the presented cohort, no statistically significant differences were observed in most of the assessed motor milestones between breastfeeding duration groups. However, a non-significant trend toward earlier standing with support was noted among children breastfed for longer periods. This finding may point to a modest, yet not robust, influence of breastfeeding on early motor development. It is likely that motor development outcomes are shaped by a multifactorial interplay involving genetic predispositions, environmental stimulation, and socio-economic conditions. Therefore, while breastfeeding may contribute to early motor skills, its effect should be interpreted within the broader developmental context. Further longitudinal studies with larger and more diverse samples are warranted to explore these associations and to control for relevant confounders.

Regarding chronic conditions, the current study found that children breastfed for longer durations, particularly beyond 6 or 12 months, had a significantly lower prevalence of such diseases compared to those breastfed for less than 3 months. These findings align with prior research suggesting protective effects of breastfeeding against non-communicable diseases later in childhood [16]. Among the chronic conditions assessed (based on data derived from both participant questionnaires and medical records) – asthma, atopic diseases, overweight and obesity, coeliac disease, type 2 diabetes, hypertension, dyslipidaemia, asthma and atopy – were the most frequent, accounting for about 68% of non-infectious diagnoses in affected children. Given the high prevalence of allergic diseases in the current cohort, the potential protective effect of breastfeeding against these conditions is particularly relevant.

A growing body of evidence supports breastfeeding's role in reducing the risk of asthma and atopy [17], and to a lesser extent, food allergies, in early childhood [18]. However, the relationship with food allergy remains complex and influenced by factors such as maternal diet, genetics, and environment.

Breast milk contains bioactive components (e.g., secretory IgA, TGF-β, soluble CD14) that support mucosal immunity, promote oral tolerance, and help modulate the infant's immune response. It also fosters gut colonization with beneficial bacteria linked to immune regulation. These mechanisms may partly explain the protective effects of breastfeeding on asthma and atopy, although evidence is mixed, especially for food allergies [19].

In the present study, overweight and obesity were the second most common chronic conditions (about 25% of cases). Although this association was not analyzed separately, the lower prevalence of excess weight among longer breastfed children may have contributed to the observed inverse relationship between breastfeeding duration and chronic

disease prevalence. This is consistent with previous findings [20]. Potential mechanisms include bioactive compounds in breast milk (miRNAs, signalling lipids, metabolites) influencing metabolic programming and gut microbiota development [21], as well as the promotion of infant-led breastfeeding that helps regulate the intake, and thus prevent overfeeding [22]. Emerging evidence also suggests epigenetic effects of breastfeeding on genes related to metabolism, potentially affecting long-term metabolic health [23].

Socio-demographic factors are well-established determinants of breastfeeding practices. In line with previous research [24], the findings of the current study indicate that older maternal age, higher education, and being married or cohabiting, are associated with prolonged breastfeeding. Maternal education, in particular, enhances access to evidence-based information and builds maternal confidence, while partner-support can offer both emotional and practical benefits. Interestingly, some Brazilian studies have reported a paradoxical trend, where cohabitation was not associated with longer breastfeeding and may even increase the likelihood of early cessation [25]. These discrepancies likely reflect cultural, economic, or policy-related differences. For instance, Brazil's relatively short paid maternity leave – 16 weeks, with limited access to a 180-day extension under the *Citizen Company Program* – may hinder the continuation of breastfeeding [26]. Other challenges, such as informal employment, limited workplace support, and early return to work, further compound the issue. In contrast, Poland offers more comprehensive structural support: 52 weeks of paid leave (20 weeks maternity and 32 weeks parental), followed by up to 36 months of unpaid childcare leave. These entitlements likely contribute to more favourable breastfeeding outcomes and should be considered when interpreting the current results. Additionally, the rise of hybrid and remote work in the post-pandemic era may improve work–life integration, enabling more women to breastfeed for longer. This evolving occupational landscape warrants further exploration in the context of breastfeeding promotion and support policies.

Although no statistically significant association between place of residence and breastfeeding duration was found ($p = 0.06$), the observed trend suggests that urban residence may be linked to longer breastfeeding periods. This pattern could be attributed to better access to breastfeeding support services, higher maternal health literacy, and more favourable workplace policies in urban settings [27]. However, the lack of statistical significance indicates that place of residence alone may not fully explain differences in breastfeeding duration. Other factors, such as maternal education level, or sources of breastfeeding knowledge – including access to counselling – likely play more substantial roles.

Moreover, in the present study, participants were recruited from a region located near a major urban centre, where many administratively rural areas are functionally integrated into suburban zones. In Greater Poland (Wielkopolska) – one of the most economically developed regions in the country – ongoing urbanization has resulted in the gradual incorporation of rural villages into the metropolitan area of Poznań. As a result, traditional administrative classifications of residence (urban vs. rural) may not adequately reflect actual lifestyle, access to services, or exposure to health-promoting resources. This complexity should be taken into account in the interpretation of findings and the design of future research.

The current analysis underscores the critical importance of professional breastfeeding counselling. Mothers who identified healthcare professionals as their main source of information were more likely to breastfeed longer, supporting previous evidence on the effectiveness of structured education in promoting both breastfeeding duration and exclusivity [28]. Despite this, only 18% of mothers in the presented sample (101 out of 560) reported receiving professional counselling. Among them, the highest proportion breastfed for over 12 months (calculated within each duration group), suggesting a positive association between counselling and prolonged breastfeeding. These findings mirror those from countries such as Sweden and the UK, where lactation support is integrated into standard post-natal care, and often provided free of charge by trained professionals, including International Board Certified Lactation Consultants (IBCLCs).

In Poland, however, access remains limited. As of August 2025, there were 1,013 Certified Breastfeeding Counsellors (CDLs) nationwide [29], which is insufficient for a national birth rate exceeding 244,000 live births annually (2023 data). While initiatives such as the WHO/UNICEF Baby-Friendly Hospital Initiative have improved early postpartum support, many women still rely on informal networks or private services due to the lack of universally accessible counselling [6]. Public healthcare does not routinely guarantee professional lactation support, resulting in inconsistent service delivery. Supporting breastfeeding among younger and less-educated mothers remains a key public health priority, as these groups are more likely to discontinue breastfeeding early. Effective strategies include structured, individualized counselling by trained professionals, peer support networks, and ante-natal and post-natal education tailored for different literacy levels.

In Poland, there is growing recognition of the need to formally integrate lactation counselling as a reimbursed service within the public healthcare system. Expert reports recommend a 3-tiered model: basic support from all providers, intermediate from trained staff, and specialist care for complex cases. Expanding access to certified lactation consultants (e.g., IBCLC, CDL), ensuring fair remuneration, and increasing service visibility, are essential to address inequalities. These efforts should be supported by workplace accommodations, public campaigns, and strengthened community services.

CONCLUSIONS

The study demonstrates that targeted, high-quality breastfeeding counselling, particularly for younger and less-educated mothers, can significantly extend breastfeeding duration, contributing to lower rates of childhood infections and chronic diseases. Integrating structured breastfeeding education into both pre-natal and post-natal care, alongside family engagement, represents a powerful strategy for improving child health outcomes. The findings support a multidimensional approach to breastfeeding promotion, incorporating clinical, socio-demographic, and behavioural factors. Future research should involve larger and more diverse populations to elucidate the biological mechanisms underlying the protective effects of breastfeeding, and to develop tailored interventions suitable for different social contexts. Furthermore, the need for prospective longitudinal

studies is underscored, as such designs would allow for more precise tracking of breastfeeding practices, child health outcomes, and relevant confounders over time, thereby strengthening the evidence base for clinical and public health recommendations.

Strengths and limitations of the study. A key strength of the study is its comprehensive approach, linking breastfeeding duration with multiple dimensions of child health, including infection incidence, motor development, and chronic disease prevalence. The inclusion of socio-demographic data – such as maternal age, education, and marital status – adds depth to the analysis, while the exploration of the mothers sources of information provides actionable insight for healthcare policy. The use of medical records to verify infection and chronic disease diagnoses enhances data accuracy and reduces recall bias. Additionally, appropriate statistical analyses support the robustness of the findings. However, as an observational study, causality cannot be established. Some variables, including breastfeeding duration and developmental milestones, relied partly on parental report. Moreover, although potential confounders such as socio-economic status, childcare arrangements, or healthcare access were not adjusted for in multivariate analyses, some were addressed descriptively. Place of residence was considered as a proxy for socio-economic status, and all participants received care from the same Family Medicine Centre, ensuring comparable healthcare access.

All children had attended pre-school, and the majority (81%) had previously been enrolled in nursery care, reflecting a broad access to early childhood education in the study region. However, detailed socio-economic variables (e.g., household income or employment status) were not included, as accurate retrospective collection of such data referring to a period 6–7 years earlier – was not feasible without prospective data collection and additional ethics approval. Finally, the regional sample may have limited the generalizability of results to other populations.

Despite these limitations, the study contributes important evidence on how breastfeeding practices are shaped by maternal and systemic factors, offering practical implications for clinical care and public health planning.

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