

Research Article

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Association between Breast Feeding and Development of Atopy

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ABSTRACT

Background: Childhood atopic diseases are becoming more prevalent over time, making it an issue to investigate. One of the possible associated factors that has been studied is breastfeeding, which remains a controversial subject. A number of studies show a protective role of breastfeeding against atopic diseases such as asthma, allergic rhinitis, atopic dermatitis, food allergy, and others. However, other research could not find a positive relationship between breastfeeding and some types of allergies. Accordingly, we set out to investigate the relationship between breastfeeding and the development of atopy in our study.

Methods: A hospital based cross-sectional study. The study was conducted in the Maternity and Children Hospital (MCH) in Hail region, between November 2022 and February 2023, targeting mothers with at least one child over the age of one month in the paediatrics and obstetrics/gynaecological clinics' waiting areas and admission wards.

Results: A sample of 423 children from Hail were studied in our research. Most of them were over twelve months old. Although most of the participants believed that breastfeeding reduces the incidence of atopic skin disease, the most prevalent type of feeding was formula feeding, followed by mixed feeding and exclusive breastfeeding. The study showed no significant effects of breastfeeding type on the development of allergies in children, as well as breastfeeding type and duration. However, there was a significant association between formula feeding and the development of allergic rhinitis, as it increases the incidence.

Conclusion: The findings of this study demonstrated that no definitive link could be made between breastfeeding duration and the development of atopy or between breastfeeding type and the occurrence of atopy in children. However, the study shows that formula feeding is a significant risk factor for the development of allergic rhinitis.

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Received: February 24, 2024; **Accepted:** February 26, 2024; **Published:** January 10, 2025

Introduction

The prevalence of childhood allergic diseases such as asthma has been increasing in recent years, and the protection provided by breastfeeding in its development has remained controversial for a long time. From 1997 to 2011, there seems to have been a rise in the occurrence of atopic diseases in children, specifically those related to skin and food allergies [1]. There has been a significant increase in the prevalence of conditions such as asthma, eczema, allergic rhinitis, and food allergy over the past few decades. This increase has been observed to occur gradually over time, specifically with food allergy peaking over the last 10-15 years [2-4]. On the other hand, some studies have shown that breastfeeding is considered a protective factor against infections and contains numerous factors that modulate and promote the development of the infants' immune system. Breastfeeding is the most favourable way to nourish infants. According to the World Health Organization, breastfeeding should be initiated within the first hour of a newborn a life and infants should be exclusively breastfed for the first 6 months of life. Breast milk is a complex solution in terms of its immunological composition. It contains numerous components

that aid in the growth of infants and support the development of their defence mechanisms; most of these components are not found in artificial formula [5]. Additionally, it contains elements that stimulate the baby's immune system by increasing regulatory T cells and reducing inflammatory cytokines [6]. Breast milk also contains IgA antibodies, which may protect against many health problems in infancy, such as atopic diseases. However, the effect of breastfeeding on the development of allergies remains unclear.

Numerous studies have aimed to evaluate the effect of breastfeeding on the development of allergic diseases, but their findings have been inconsistent. Reasons for this controversy include methodological differences and the fact that each study has different measurable factors, the immunologic complexity and the components of breast milk itself, and possibly genetic differences among patients that would affect whether breastfeeding is a protective factor against the development of allergies or is in fact sensitizing. Although the majority of these studies have reported a protective effect of breastfeeding against allergic diseases [7,8]. For example, a previous cohort study found that exclusive breastfeeding for

more than 3 months showed a significant reduction in the risk of childhood asthma. Another study showed a reduction in wheezing episodes (up to the age of four years) and atopic dermatitis if a child has been breastfed for at least 4 months, particularly in children at high risk of atopic disease by virtue of a family history of atopic disease. On the contrary, several studies have found no correlation between breastfeeding and the development of allergic disease, especially when the mother is atopic or asthmatic [9,10].

Methods

A hospital-based cross-sectional study was approved by the Institutional Review Board of Ha'il Health Cluster and by the Research Ethics Committee in the University of Hail (H-2022-296). The study was conducted in the Maternity and Children Hospital (MCH) in Hail City, between November 2022 to February 2023, targeting mothers with at least one child over the age of 1 month in the pediatrics and obstetrics/gynaecological clinics waiting areas and admission wards. We excluded any mother with an infant less than one month of age and mothers who were unwilling to participate. For the purpose of clarity, mothers will be referred to as participants going forward. The data collection process was done via face-to-face interviews, during which the purpose of the study was explained, and participants were read their rights. Informed consent had to be obtained. No personal identifiers were recorded, and the principles of the Declaration of Helsinki were followed to ensure the rights of the human participants. Each item of the questionnaire was explained thoroughly to the participants before their answers were recorded.

Development and Application of the Questionnaire

The items of the questionnaire were carefully sourced from the relevant literature and then reviewed by a panel of pediatric experts. A revised version was developed based on their comments. The first section of the questionnaire included sociodemographic information such as the child's age, gender, nationality, mother's age, parents' educational level, parents' employment status, and family's monthly income. The second section studied the child's feeding habits in four items; the type of feeding the child was receiving, the period for which the child was exclusively breastfed (if any), the timing for solid food introduction, and the timing of weaning. The third section explored the child's allergy history (the type of allergies, the onset of allergies, similar allergy history in parents or siblings, and the type of feeding siblings received during their childhood (if any) and antibiotic history. The questionnaire concluded with one last item exploring the participants' knowledge regarding the relationship between exclusive breastfeeding and the development of atopic diseases.

Sample Size Calculation

No recent studies regarding the prevalence of atopic diseases in Hail region were found in the literature. As the children whose information was collected were aged between 1 month and older, it was decided to calculate the data based on the entire population of Hail region for the most accurate representation possible. The minimum sample size required was 384, using the following formula: $SS = [Z^2p(1 - p)]/C^2$, where Z is 1.96, C is the 5%, SS is the population of Hail region according to the latest census, and p is 50% as the population proportion. In total, 423 participants were included in the study.

Statistical analysis

Data was analyzed using descriptive and inferential statistics via IBM SPSS version 20 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, including categorical variables such as the child's age and gender, will be presented as frequencies and percentages, n

(%). A Chi-Square test was applied to compare variables across (allergy, no allergy) groups. Logistic regression was used for significant variables in the allergy type. The results were presented as odds ratio (OR) and 95% confidence intervals (CI). A P value < .05 was considered statistically significant.

Results

Table 1 illustrates the baseline and socio-demographic characteristics of the 423 study children from Hail Region, Saudi Arabia, who were included in this study. Overall, 61.0% (258) of the children were male. Approximately 50.6% (214) of the children were aged over 12 months old, 19.4% (82) were aged between 3 and 6 months old, 15.4% (65) were aged under 3 months old, and 14.7% (62) were aged between 9 and 12 months old.

Table 1: Baseline And Sociodemographic Characteristics Of 423 Study Children, Hail Region, Saudi Arabia

Variable	n (%)
Child's age (Month)	
< 3	65 (15.4)
3-6	82 (19.4)
9-12	62 (14.6)
> 12	214 (50.6)
Child's gender	
Male	258 (61.0)
Female	165(39.0)
Nationality	
Saudi	366 (86.5)
Non-Saudi	57 (13.5)
Maternal age group (Year)	
< 20	5 (1.2)
20-30	135 (31.9)
30-40	224 (53.0)
> 40	59 (13.9)
Maternal educational level	
Illiterate	18 (4.3)
Primary school	18 (4.3)
Secondary school	18 (4.3)
High school	108 (25.5)
University	261 (61.6)
Father educational level	
Illiterate	14 (3.3)
Primary school	14 (3.3)
Secondary school	16 (3.8)
High school	112 (26.5)
University	267 (63.1)
Maternal occupation	
Housewife	302 (71.4)
Employee	121 (28.6)
Father occupation	
Employee	375 (88.7)
Un-Employee	48 (11.3)
Family income	
Low	35 (8.3)
Medium	359 (84.8)
High	29 (6.9)
Breast-feeding type	
Exclusive Breast-feeding	91 (21.5)
Mixed feeding	162 (38.3)
Formula Feeding	170 (40.2)

According to Figure 1, the most prevalent breastfeeding types were formula feeding (170, 40.2%) and mixed feeding (162, 38.3%). Figure 2 illustrates that 48% (203) of the study children had allergies. Figure 3 shows that 59.8% (253) of mothers believed that breastfeeding reduces the incidence of atopic skin diseases in children. Figure 4 illustrates the onset of allergy (in months) in 423 study children: 30.5% (129) had onset of allergy before 6 months, and 16.8% (71) had onset after 6 months.

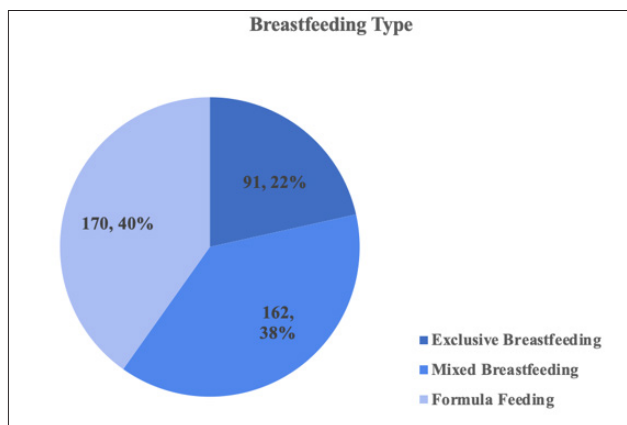


Figure 1: Breastfeeding Type of 423 Study Children, Hail Region, Saudi Arabia

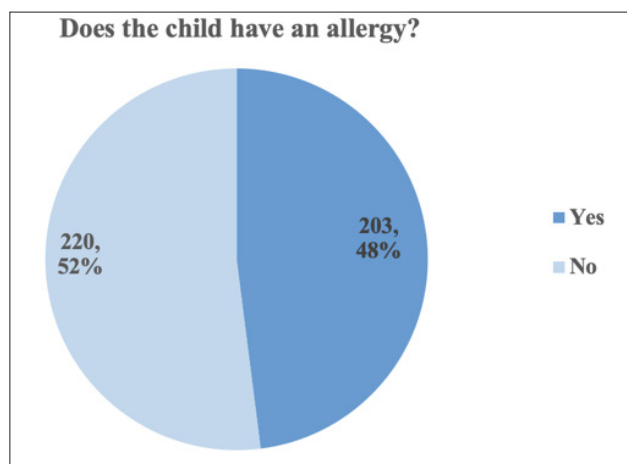


Figure 2: Child Allergy of 423 Study Children, Hail Region, Saudi Arabia

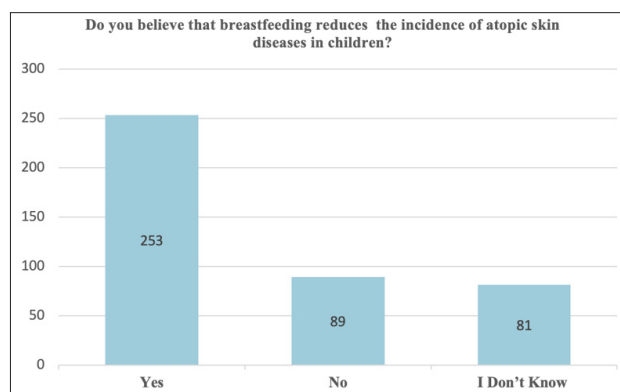


Figure 3: Believe that Breastfeeding Reducing the Incidence of Atopic Skin Diseases in Children

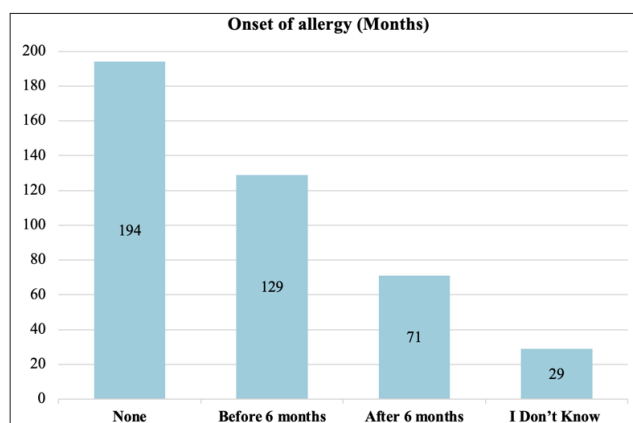


Figure 4: Onset of Allergy (Months) Of 423 Study Children, Hail Region, Saudi Arabia

Table 2 reveals that there were no variations in breastfeeding type or the development of allergies among the study children. Breastfeeding type and breastfeeding duration ($P = 0.139$, $P = 0.202$) were not associated with allergies (Table 2).

On the other hand, Table 3 shows that there is a difference in breastfeeding type and allergy types among children with allergies ($n = 203$). formula feeding was found to be a significant risk factor for the development of allergic rhinitis ($P = 0.043$; OR: 0.34; 95% CI: [0.11–1.04]; $p = 0.059$) (Table 4).

Table 2: Breastfeeding Type and the Development of Allergy in 423 Children, Hail Region, Saudi Arabia

Variable	Allergy 203(48.0)	No allergy 220(52.2)	Total 423(100.0)	P-Value ^a
Breast-feeding type				
Exclusive Breast-feeding	39(42.9)	52(57.1)	91(100.0)	.139 ^b
Mixed feeding	77(47.5)	85(52.5)	162(100.0)	
Formula feeding	87(51.2)	83(48.8)	170(100.0)	
Feeding duration (Month)				
≤ 4	34(41.0)	49(59.0)	83(100.0)	.202 ^b
5-6	28(49.1)	29(50.9)	57(100.0)	
7-12	35(47.3)	39(52.7)	74(100.0)	
> 12	104(51.2)	99(48.8)	203(100.0)	
Don't remember	2(33.3)	4(66.7)	6(100.0)	
How long the baby breastfed exclusively without foods or liquids (Month)				
Not breastfed	22(41.5)	31(58.5)	53(100.0)	.091 ^b
≤ 2	35(46.1)	41(53.9)	76(100.0)	
3-4	20(40.8)	29(59.2)	49(100.0)	
5-6	43(46.2)	50(53.8)	93(100.0)	
> 6	73(56.2)	57(43.8)	130(100.0)	
Don't remember	10(45.5)	12(54.5)	22(100.0)	
When did you start introducing foods into Child's diet (Month)				
4-5	13(52.0)	12(48.0)	25(100.0)	.411 ^b
5-6	28(44.4)	35(55.6)	63(100.0)	
> 6	105(52.2)	96(47.8)	201(100.0)	
Don't remember	57(42.5)	77(57.5)	134(100.0)	
Did the child take any antibiotics during his first year				
Yes	98(51.3)	93(48.7)	191(100.0)	.191 ^b
No	99(45.6)	118(54.4)	217(100.0)	
Don't Know	6(40.0)	9(60.0)	15(100.0)	
If yes, how many times takes antibiotics				
Once	25(51.0)	24(49.0)	49(100.0)	.310 ^b
Twice	17(60.7)	11(39.3)	28(100.0)	
Three times	11(52.4)	10(47.6)	21(100.0)	
> 4 times	31(48.4)	33(51.6)	64(100.0)	
Don't remember	20(43.5)	26(56.5)	46(100.0)	

a χ^2 ,b Linear-by-linear.

Table 3: Breastfeeding Type and Allergy Type in Children with Allergy (N=203), Hail Region, Saudi Arabia

Variable	EBF 40(19.7)	Mix-F 77(37.9)	FF 86 (42.4)	Total 203(100.0)	P-Value ^a
Allergy type ^b					
Atopic dermatitis	8(16.7)	22(45.8)	18(37.5)	48(100.0)	.474
Allergic rhinitis	4(12.1)	9(27.3)	20(60.6)	33(100.0)	.043*
Asthma	17(17.2)	42(42.4)	40(40.4)	99(100.0)	.426
Food Allergy	9(20.0)	17(37.8)	19(42.2)	45(100.0)	.947
Other	6(35.3)	8(47.1)	3(17.6)	17(100.0)	.125
When did you start introducing foods into Child's diet (Month)					
4-5	1(7.7)	8(61.5)	4(30.8)	13(100.0)	.050 ^c
5-6	6(24.4)	15(53.6)	7(25.0)	28(100.0)	
> 6	27(25.7)	32(30.5)	46(43.8)	105(100.0)	
Don't remember	5(8.8)	22(38.6)	30(52.6)	57(100.0)	
Did the child take any antibiotics during his first year?					
Yes	10(10.2)	44(44.9)	44(44.9)	98(100.0)	.059 ^c
No	27(27.3)	32(32.3)	40(40.4)	99(100.0)	
Don't Know	2(33.3)	1(16.7)	3(50.0)	6(100.0)	
If yes, how many times takes antibiotics					
Once	1(4.0)	10 (40.0)	14(56.0)	25(100.0)	.117 ^c
Twice	3(17.6)	6(35.3)	8(47.1)	17(100.0)	
Three times	1(9.1)	5(45.5)	5(45.5)	11(100.0)	
> 4 times	2(6.5)	14(45.2)	15(48.4)	31(100.0)	
Don't remember	3(15.0)	12(60.0)	5(25.0)	20(100.0)	
Do you believe that breastfeeding reducing the incidence of atopic skin diseases in children					
Yes	30(23.3)	47(36.4)	52(40.3)	129(100.0)	.246 ^c
No	3(8.1)	15(40.5)	19(51.4)	37(100.0)	
Don't Know	6(16.2)	15(40.5)	16(43.2)	37(100.0)	

EBF: exclusive breast-feeding, Mix-F: mixed feeding, FF: formula feeding, χ^2 ,^b Multiple response, ^c Linear-by-linear, * $p < 0.05$ was considered significant.

Table 4: Logistic Regression for Risk of Develop Type of Allergy in Children with Formula Feeding

Variable	OR (95% CI)	P-Value
Allergy type: Allergic rhinitis	0.345 (0.114-1.042)	.059

OR: odds ratio, CI: confidence interval

Discussion

Our study revealed that most of the children were males, Saudi Arabian, and over 12 months old. We studied the relationship between the parent's age, education levels, occupation, and family incomes with the development of allergy in children in our retrospective study. The results of our study displayed that some factors such as maternal age and occupation, may play a role in breastfeeding and in its duration. Qatar revealed that the length of breastfeeding was associated with maternal age, whereas Greece claimed that maternal age, education levels, and family income were not associated with breastfeeding [1,2]. There is a very apparent contrast between these results and others who have shown that young mothers are at a higher risk of not initiating breastfeeding [3,4]. Breastfeeding is the ideal nutrition for growth,

development, social, and psychological outcomes [5]. In addition to breast milk being the prime nutrition for children, it is readily available and low-cost in comparison to other types of feeding [6]. 84.8% in our study were considered to have medium incomes; we believe that family incomes have some sort of influence on a preferred type of breastfeeding. In our study, we discovered no correlation between breastfeeding and the different varieties of atopic diseases, which was reported by 52% of our participants. In contrast, formula feeding showed a significant likelihood of allergy by 87%. Previous meta-analysis studies have that shown the risk and protective associations between breastfeeding (neither total nor exclusive) and atopic diseases were found to be absent in earlier research [7]. Moreover, an analysis of the American Academy of Pediatrics 2012 Breastfeeding report shows that

the ideal infant feeding schedule is for a baby to be breastfed exclusively for at least the first six months of life and for the next two years. Breastfeeding supports a child's healthy development and has many advantages for the mother's health as well, since human milk is uniquely adapted to the human infant in terms of its nutritional content and bio-activity [8,9]. According to our study's findings, there is no increased risk of allergies due to prolonged nursing.

When comparing the effects of exclusive breastfeeding for 3 to 4 months against 6 months or longer, the authors of a prior study meta-analysis found no difference in atopic outcomes such as atopic eczema, asthma, or other atopic conditions [10]. According to data from the fifth to sixth months of a child's life, there is no increased chance of atopic disease developing (55.6%). Furthermore, recent clinical trials (CT), randomized clinical trials (RCT), and population-based (cohort) studies mentioned earlier in this review point out that introducing allergenic foods to children at a young age may actually lower their risk of developing food allergies [11].

Our study found that there was an association between taking antibiotics in the first years of life and developing allergies (51.3%). Another cohort study by McKeever TM, et al. show that, despite the association between exposure to antibiotics early in infancy and the development of asthma, asthmatic children experienced more respiratory tract infections prior to diagnosis than healthy controls [12,13]. According to a preliminary retrospective study by Farooqi et al., exposure to antibiotics during the first and second year of life was linked to eczema [14]. Similar trends in cohort studies have been seen in Japanese children, where antibiotic usage in the first two years of life increases the chance of developing atopic illnesses such as asthma, atopic dermatitis, and allergic rhinitis by the age of five [15]. In contrast to our findings, a study in New Zealand revealed that using antibiotics early in life does not increase the risk of developing eczema, even in children with a history of atopy in their parents [16].

According to the findings of our retrospective study, breastfeeding offers a variable degree of protection against various forms of allergies. When compared to other forms of breastfeeding, these findings show that exclusive breastfeeding has a strong protective effect against food allergies and allergic rhinitis. This is consistent with previous studies showing that exclusive breastfeeding reduces the risk of acquiring allergic rhinitis or food allergy [17-19]. Breastfeeding protects against allergies depending on the type of allergy, according to a study conducted in the United States, Finland, Germany, and Sweden. They've concluded that the short duration of exclusive breastfeeding relates to an increase in the risk of developing allergic rhinitis but not for food allergy [20]. Previous systematic review and meta-analysis also revealed that breastfeeding had no effect on food allergy, contradicting our findings [21]. Some studies revealed various disagreements between breastfeeding and formula milk in connection to food allergies, with a variation of which has the most protective impact. This could be attributable to a lack of data and the late introduction of complementary food. Exclusive breastfeeding has a protective effect against asthma, which is consistent with other studies [21-23]. This defence is related to the presence in maternal milk of bioactive enzymes, growth factors, hormones, and anti-inflammatory substances that disrupt the development of atopic diseases [24]. In contrast to this conclusion, a Taiwanese cohort study found that exclusive breastfeeding does not reduce the risk of asthma or allergic rhinitis in children under the age of two [25]. In the United Kingdom, breastfeeding does not have a

great effect on the risk of developing asthma [26].

Our study found that exclusive breastfeeding is more likely to protect against atopic dermatitis than other feeding methods. A randomized field trial in Brazil claimed that discontinuing breastfeeding in the first 6 months would increase the risk of atopy by 70% [27]. Furthermore, breastfeeding has a higher protective effect against atopic dermatitis compared to cow's milk formula [28]. In opposition to our findings, a study revealed that breastfeeding contributes to increasing the risk of atopic dermatitis. This finding was attributed to the fact of the possibility of breastfeeding contamination [26]. Moreover, irrespective of whether breastfeeding is exclusive or not, some studies have shown a weak effect in the protection against atopic dermatitis [7,21]. In this current study, we have established that formula feeding is strongly linked to the development of allergic rhinitis compared to other atopic conditions. This relation is not fully understood due to the lack of supporting evidence. A study found that formula feeding increases the incidence of allergies, primarily owing to the plastic bottle component, which is a greater threat when compared to breastfeeding [29].

Formula milk cannot replace the composition of human milk, so for this reason, the World Health Organization recommends starting nursing immediately with exclusive breastfeeding for 6 months due to the benefits to both mother and child. Only breast milk transfers a specific microbiota to the infant, which promotes the child's immune development, intestinal barriers, and acts on gut-brain axis stimulation [30,31]. Almost half of the participants who had mixed or formula feeding their children had taken antibiotics during their first year of life. Furthermore, the majority of them have received antibiotics more than four times a year. In a review summarizing the effect of breast milk, they reported that breastfeeding plays a major role in the child's immunity development [32]. This is consistent with our findings that exclusively breastfed children received fewer antibiotics. Likewise, antibiotic exposure in childhood increases the risk of necrotizing enterocolitis and antibiotic-associated diarrhoea [32]. According to our findings, regardless of feeding type, a large number of participants began food introduction after 6 months. A cohort study found that introducing milk, fish, cereal, and eggs after 6 months may increase the probability of an atopic disorder [33]. In contrast, a Korean study found no association between the time of food introduction and atopic dermatitis or asthma in children under the age of three [34]. Despite the fact that more than half of the participants in our study who have a child with allergies believe that breastfeeding reduces the incidence of atopic skin illnesses, more than half of the participants preferred bottle-feeding or mixed feeding. This highlights the significance of community campaigns aimed at educating people about recommended feeding type [30].

Conclusion

In conclusion, the findings of this study established no differences with regards to breast-feeding type and allergy development in the study children. On the other hand, there were differences in breastfeeding type and type of allergy, particularly in formula feeding, which is a significant risk factor for the development of allergic rhinitis.

The relationship between breastfeeding type and duration was not substantially connected to the progression of allergies.

However, our study found that formula feeding women who had introduced food into their child's diet at an age of more than 6

months were significantly associated with the evolution of allergy, confirming our suspicions of an association between the type of breastfeeding and the age of introducing food.

Another relationship that was between antibiotics and the breastfeeding type, and our data has shown that most of the children who take antibiotics during the first year of life their mothers were feeding them either mixed-feeding or formula feeding which considers significant to develop allergies in such children.

References

1. Ehlaye MS, Bener A (2008) Duration of breast-feeding and the risk of childhood allergic diseases in a developing country. *Allergy asthma Proc* 29: 386-391.
2. Tavoulari EF, Benetou V, Vlastarakos PV, Psaltopoulou T, Chrousos G, et al. (2016) Factors affecting breastfeeding duration in Greece: What is important? *World J Clin Pediatr* 5: 349.
3. Grammatikopoulou MG, Pritsa AA, Badeka S, Aggelaki I, Giantsiou I, et al. (2013) A pilot study on the prevalence of maternal obesity in selected Greek counties. *Endocrinol y Nutr* 60: 507-512.
4. Bolling K, Grant C, Hamlyn B, Thornton A (2005) Infant Feeding Survey <https://digital.nhs.uk/data-and-information/publications/statistical/infant-feeding-survey/infant-feeding-survey-2005-main-report>.
5. BREASTFEEDING SO, Eidelman AI, Schanler RJ, Johnston M, Landers S, et al. (2012) Breastfeeding and the Use of Human Milk. *Pediatrics* 129: 827-841.
6. Wahn U, Von Mutius E (2001) Childhood risk factors for atopy and the importance of early intervention. *J Allergy Clin Immunol* 107: 567-574.
7. Lin B, Dai R, Lu L, Fan X, Yu Y (2020) Breastfeeding and Atopic Dermatitis Risk: A Systematic Review and Meta-Analysis of Prospective Cohort Studies. *Dermatology* 236: 345-460.
8. Eidelman AI (2012) Breastfeeding and the use of human milk: an analysis of the American Academy of Pediatrics 2012 Breastfeeding Policy Statement. *Breastfeed Med* 7: 323-324.
9. Executive summary - WHO Recommendations on Postnatal Care of the Mother and Newborn - NCBI Bookshelf Available from: <https://www.ncbi.nlm.nih.gov/books/NBK190090/>.
10. Kramer MS, Kakuma R (2012) Optimal duration of exclusive breastfeeding. *Cochrane Database Syst Rev* <https://doi.org/10.1002/14651858.CD003517.pub2>.
11. Danielewicz H (2022) Breastfeeding and Allergy Effect Modified by Genetic, Environmental, Dietary, and Immunological Factors. *Nutrients* 14: 15.
12. McKeever TM, Lewis SA, Smith C, Hubbard R (2023) The Importance of Prenatal Exposures on the Development of Allergic Disease A Birth Cohort Study Using the West Midlands General Practice Database <https://www.atsjournals.org/doi/full/10.1164/rccm.200202-158OC>.
13. McKeever TM, Lewis SA, Smith C, Collins J, Heatlie H, et al. (2002) Early exposure to infections and antibiotics and the incidence of allergic disease: A birth cohort study with the West Midlands General Practice Research Database. *J Allergy Clin Immunol* 109: 43-50.
14. Farooqi IS, Hopkin JM (1998) Early childhood infection and atopic disorder. *Thorax* 53: 927-932.
15. Yamamoto-Hanada K, Yang L, Narita M, Saito H, Ohya Y (2017) Influence of antibiotic use in early childhood on asthma and allergic diseases at age 5. *Ann Allergy Asthma Immunol* 119: 54-58.
16. Purvis DJ, Thompson JMD, Clark PM, Robinson E, Black PN, et al. (2005) Risk factors for atopic dermatitis in New Zealand children at 3.5 years of age. *Br J Dermatol* 152: 742-749.
17. Hoang MP, Samuthpongton J, Seresirikachorn K, Snidvongs K (2022) Prolonged breastfeeding and protective effects against the development of allergic rhinitis: a systematic review and meta-analysis. *Rhinology* 60: 82-91.
18. Han DH, Shin JM, An S, Kim JS, Kim DY, et al. (2019) Long-term Breastfeeding in the Prevention of Allergic Rhinitis: Allergic Rhinitis Cohort Study for Kids (ARCO-Kids Study). *Clin Exp Otorhinolaryngol* 12: 301-307.
19. Nuzzi G, Di Cicco ME, Peroni DG (2021) Breastfeeding and Allergic Diseases: What's New? *Children* 8: 5.
20. Hummel S, Weiß A, Bonifacio E, Agardh D, Akolkar B, et al. (2021) Associations of breastfeeding with childhood autoimmunity, allergies, and overweight: The Environmental Determinants of Diabetes in the Young (TEDDY) study. *Am J Clin Nutr* 114: 134-142.
21. Lodge C, Tan D, Lau M, Dai X, Tham R, et al. (2015) Breastfeeding and asthma and allergies: a systematic review and meta-analysis. *Acta Paediatr* 104: 38-53.
22. Hu Y, Chen Y, Liu S, Jiang F, Wu M, et al. (2021) Breastfeeding duration modified the effects of neonatal and familial risk factors on childhood asthma and allergy: a population-based study. *Respir Res* 22: 1-11.
23. Oddy WH, Holt PG, Sly PD, Read AW, Landau LI, et al. (1999) Association between breast feeding and asthma in 6 year old children: findings of a prospective birth cohort study. *BMJ* 319: 815-819.
24. Oddy WH (2017) Breastfeeding, Childhood Asthma, and Allergic Disease. *Ann Nutr Metab* 70 Suppl 2: 26-36.
25. Chiu CY, Liao SL, Su KW, Tsai MH, Hua MC, et al. (2016) Exclusive or Partial Breastfeeding for 6 Months Is Associated With Reduced Milk Sensitization and Risk of Eczema in Early Childhood: The PATCH Birth Cohort Study. *Medicine (Baltimore)* 95.
26. Kim VHD, Reid B, Atkinson A, Upton J, Grunebaum E, et al. (2018) Long-term immune reconstitution after matched unrelated hematopoietic stem cell transplantation for immunodeficiency. *J Allergy Clin Immunol* 141: 1154-1157.
27. Strassburger SZ, Vitolo MR, Bortolini GA, Pitrez PM, Jones MH, et al. (2010) Nutritional errors in the first months of life and their association with asthma and atopy in preschool children. *J Pediatr* 86: 391-399.
28. Laubereau B, Brockow I, Zirngibl A, Koletzko S, Gruebl A, et al. (2004) Effect of breast-feeding on the development of atopic dermatitis during the first 3 years of life—results from the GINI-birth cohort study. *J Pediatr* 144: 602-607.
29. Hsu N-Y, Wu P-C, Bornehag C-G, Sundell J, Su H-J (2012) Feeding Bottles Usage and the Prevalence of Childhood Allergy and Asthma. *Clin Dev Immunol* DOI: 10.1155/2012/158248.
30. Breastfeeding (2023) https://www.who.int/health-topics/breastfeeding#tab=tab_1.
31. LaTuga MS, Stuebe A, Seed PC (2014) A review of the source and function of microbiota in breast milk. *Semin Reprod Med* 32: 68-73.
32. Cukrowska B, Bierła JB, Zakrzewska M, Klukowski M, Maciorkowska E (2020) The Relationship between the Infant Gut Microbiota and Allergy. The Role of Bifidobacterium breve and Prebiotic Oligosaccharides in the Activation of Anti-Allergic Mechanisms in Early Life 12: 946.
33. Nwaru BI, Takkinen HM, Niemelä O, Kaila M, Erkkola M, et al. (2013) Timing of infant feeding in relation to childhood asthma and allergic diseases. *J Allergy Clin Immunol* 131:

78-86.

34. Lee J, Shin M, Lee B (2021) Influence of age at complementary food introduction on the development of asthma and atopic dermatitis in Korean children aged 1–3 years. *Clin Exp Pediatr* 64: 408.

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