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Research Article

IMPACT OF RISK FACTORS ON GROWTH OF CHILDREN FROM FAMILIES WITH ATOPY

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Nutritional and non-nutritional factors might interfere with growth of children with atopy in the first years of life and complicate even further weight gain and development. The purpose of our study is to evaluate the impact of nutrition and several environmental factors on the growth of children from families with atopy in early childhood. During the period 2017–2020, a prospective cohort study, which included 120 children 13–31 months of age (24.0±3.9 months) with family medical history for allergy was conducted in Varna, Bulgaria. The sample was followed for around 2 years. Sociodemographic data, family and personal history for smoking, pet presence, atopy and common acute infections was collected at regular intervals. Anthropometric measurements were taken at birth, 2, 4, 6 month, 1 year and 2 years. The conducted study found that factors from the living environment and nutritional nature are related to the processes of growth and development in children from families with allergy. The presence of diseases such as atopic dermatitis, acute infections of the digestive and excretory system, hospitalizations in connection with urinary infections, smoking have relation to the growth and development of children with a family history of atopy. The data resulting from our study may serve as a basis for further research so the mechanisms of atopy to be investigated better and potential preventive measures during pregnancy and early childhood to be specified. The impact of risk factors on children's growth during the first 1000 days could be modified by targeted behavioral interventions of the whole family. ***Biomed Rev*** **2022; 33: 67-75**

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INTRODUCTION

The first 1000 days, the time spanning between conception and beginning of the third year of child's life, are critical time for ensuring healthy development of the child and prevention of chronic non-communicable diseases in adulthood. Prevalence of allergic diseases has been increasing significantly over recent decades, involving up to 20% of the world's population (1), as 60% of allergies manifest themselves during the first year of life (2).

Urbanization and modern life style are potential factors contributing to increase in atopy. They include microbial exposure, diet and exposure to pollutants, as their effects start during intrauterine fetal development (3). The passive smoking and living in an industrially polluted environment also contribute to increase in prevalence of allergies (4). Family history of atopy, high humidity in child's home and passive smoking are associated with the development of atopic dermatitis (AD) in early childhood, as the family history is an overriding risk factor for the development of AD.

In recent years, the incidence of AD in developing countries has gradually reached the incidence of AD in developed countries, resulting from the environmental factors influencing the onset of the disease, such as hygiene, intestinal microbiota, exposure to bacterial endotoxins, air pollution, contact with animals, climate changes and unhealthy diet (5).

Food allergy (FA) usually manifests itself in children under 3 years of age. What the children diagnosed with FA have in common is that most of them are from industrial areas, they usually have other manifested sensitivity and mainly come from developed countries (6).

Epidemiological studies have shown that in respect of FA there are protective and risk factors resulting from the environment and lifestyle. Favorable factors include a rural upbringing in the presence of farm animals („Farming effect"), eating a varied high-fiber diet and early contact with other children in the family. The environmental factors mentioned above favour/facilitate the establishment of a very diverse microbiota on barrier organs – the skin and mucous membranes of the digestive, respiratory and urogenital tracts (7). Harmful environmental factors include obesity and lack of physical activity, eating mostly an industrially processed food diet, urban upbringing in a single-child family, frequent use of antibiotics. All these factors are associated with reduced microbial diversity and a more or less pronounced dysbiosis in the body's barrier organs (8). There is epidemiological evidence that malnutrition and allergic diseases in childhood result from similar protective and risk factors (9). Rapid weight gain in the first 2 years of life is associated with twice the risk of school-age asthma development, as especially rapid weight gain in the first 3 months is associated with an increased risk of asthma development (10). Macrosomia at birth is also a prerequisite for the development of asthma, particularly in combination with a high body mass index later in life (11).

Elimination diets in FA are a very important risk factor in the growth and development of children suffering from allergies due to the reduced intake and deficiency of micronutrients from food, nutritional deficiencies and possible growth disorders. Poor weight gain and reflux in children are associated with increased difficulties in eating (particularly in non-IgE-mediated food allergies). This is particularly relevant for cow's milk protein allergy. In young children, the factors listed above can have a considerable impact on their future long term health(12).

The purpose pf our study is to evaluate the impact of nutrition and several environmental factors on the growth of children from families with atopy in early childhood.

METHODOLOGY

During the period 2017–2020, a prospective cohort study, approved by the Ethics committee for Scientific Research of the Medical University of Varna "Prof. Dr. P. Stoyanov", which included 120 children 13–31 months of age (24.0±3.9 months) with family medical history for allergy was conducted at the General hospital for active treatment St. Anna – Varna.

During the sample recruitment an invitation was directed to 1210 young mothers/women who had given birth, 156 of them accepted to participate in the monitoring, and 120 met the requirements of the study protocol.

The inclusion criteria in the research study were: healthy newborns with birth weight 2500 g or more, morphological maturity (over 37 weeks of gestation), aged 0 to 4 days at the beginning of the study, family history of allergic diseases of the parents or siblings, signed informed consent given by parents/guardians, consent by parents to participate in the study and follow-up of the health status of their child.

The exclusion criteria in the research study were: accompanying diseases at the beginning of the study, prematurity and immaturity at birth, birth trauma, birth asphyxia, genetic diseases, presence of malformations, parents' refusal to monitoring the health status of their child.

A direct individual survey for gathering information was applied including course of pregnancy, number of births, mode of

birth delivery, child's upbringing environment (urban or rural), as well as socio-demographic data for the parents. Keeping a pet, the type of atopic diseases in the family (asthma, allergic rhinoconjunctivitis, urticaria, food allergy, atopic dermatitis – diagnosed by a doctor) and smoking were studied as well.

The following clinical methods were applied – collecting information about a participant's medical history, taking anthropometric measurements, clinical examination, evaluation of possible manifestation of allergy in the child until the end of the study period.

The anthropometric indicators of children – weight, length/height and head circumference were measured at birth and at 2, 4, 6 months of age. The children's weight was measured after taking off their clothes and diaper by means of a digital baby scale Seca 354, in kilograms with accuracy of 0.005 kg. Height was measured with a SECA 210 infantometer in centimeters with accuracy of 0.1 cm, and head circumference – with a non-stretchable SECA 211 soft head circumference tape, passing anteriorly through the glabella, laterally just above the ears, and posteriorly through the protuberantia occipitalis externa in centimeters with accuracy of 0.1 cm.

At the age of the children between 2 and 3 years information on breastfeeding and feeding practices was obtained through a survey (duration on exclusive breastfeeding, total duration of breastfeeding, partial and complementary feeding), data on the height and weight of the child at the age of 1 year; height and weight of the child at the time of follow up survey was measured.

For the assessment of the children's growth Z-score for the weight-for-age indices (WAZ), length/height-for-age (L/HA), body mass-for-age index (BMIAZ), weight-for-height (WHZ) were calculated and the WHO 2006 Growth Standards and Criteria were applied.

Through a validated questionnaire Development Profile-3 (DP-3) neurological and cognitive development of the cohort was assessed and a comparison with the standards for the respective age was made. The methodology enabled quick and accurate assessment of children's typical development and the identification of delays in one or more of the five assessed areas (physical development, adaptive behavior, social-emotional development, cognitive development and communication).

The incidence and duration of acute illnesses of the respiratory, digestive systems, urinary tract, sensory organs, etc. in children were studied. Multiple clinical examinations were also performed using visual tools for the assessment of atopic dermatitis (SCORAD) and questionnaires for potential occurrence of allergies (COMISS) until the end of the follow-up.

Descriptive statistics, parametric and non-parametric methods for hypotheses confirmation, logistic regression analysis were applied. The data were analyzed by means of statistical package SPSS v. 21.0. Differences with a level of significance $p<0.05$ were considered statistically significant.

RESULTS

General characteristics of the respondents

The 120 studied children at high risk for developing allergy were at a mean age of 24.01±3.87 months (range 13 to 31 months). About half of children were born through the vaginal canal and 50.8% – by Caesarean section, the gestational age at birth was 38.8±1.08 gestational weeks. Male respondents predominated – 55%, babies with Bulgarian ethnicity – 90.8 % and with urban residence – 95.8%. Around half (46.7%) of the children attended nursery, and more than half have a sibling, families with two children were 47.5%, and families with three children were 5.0 %. There was a high relative share for allergic mothers (56.7%) and fathers (45.8%) and less for allergic siblings (33.3%). More than half of the parents smoked (53.3%), as mothers smokers were more (53.3 %) than fathers (43.3%). Even during pregnancy 13.3% of women smoked cigarettes. Children living together with a pet were a quarter of the studied cohort (n=30, 25.0 %). A detailed description of participants' characteristics is presented in Table 1.

In conjunction with the growth evaluation of children from high-risk families for developing atopy in early infancy, the association between the existence of atopy and several exogenous non-nutritional and nutritional variables was investigated.

MORBIDITY

Morbidity was studied by analyzing the incidence, duration and repeatability and hospitalizations of atopic dermatitis, acute infections of the respiratory, digestive, excretory systems and the skin in the studied children.

Atopic dermatitis

Data on the incidence of allergic diseases in the families of the studied children are presented in Figure 1. Atopic dermatitis was reported in the families of 1/3 of the examined children (n= 34; 28.3%). The relative share of AD in the sibling is the highest – 16.7 %, followed by AD in mothers – 5.8%, and AD in fathers – 3.3%. At the time of the study, 13.3% (n= 16) of the studied children had a clinical manifestation of atopic dermatitis.

Anthropometric indicators and indices reflecting the quan-

Table 1. *Socio-demographic and health characteristics of the sample*

	Boys	Girls	t/ Ch-square	p
Characteristics of the child				
Gestational age, mean (SD)	38.7 (1.0)	38.9 (1.2)	0.64	0.52
Birth weight (g)	3462.1 (374.9)	3270.4 (383.1)	-2.76	0.007
Ethnicity, n (%) Bulgarian Turkish Partial Another	 57 (86.4) 6 (9.1) 2 (3.0) 1 (1.5)	 52 (96.3) 1(1.9) 1(1.9) 0	3.97	0.26
Allergies, n (%)	29 (43.9)	21 (38.9)	0.31	0.58
Nursery attendance, n (%)	31 (47)	25 (46.3)	0.005	0.94
Mean age at the time of questionnaire completion (SD)	23.8 (3.9)	24.2 (3.9)	0.49	0.62
Mother				
Age (SD)	31.3 (4.6)	29.7 (4.3)	-1.92	0.06
Education, n (%) Primary Secondary Bacholar Master and higher	 0 (0.0) 24 (36.4) 2 (3.0) 40 (60.6)	 0 (0.0) 16 (29.6) 1 (1.9) 37 (68.5)	0.86	0.65
Mode of delivery, n (%) Normal Section	 29 (43.9) 37 (56.1)	 30 (55.6) 24 (44.4)	1.60	0.21
Smoking, n (%)	19 (28.8)	17 (31.5)	0.10	0.75
During pregnancy, n (%)	8 (12.1)	8 (14.8)	0.19	0.67
Number of cigarettes per day, n (%)	2.4 (5.11)	3.3 (6.4)	0.89	0.37
Allergies yes/no, n (%)	36 (54.5)	32 (59.3)	0.27	0.61
Father				
Age (SD)	34 (4.3)	32.9 (4.9)	-1.34	0.18
Education, n (%) Primary Secondary Bachelor Master and higher	 2 (3.0) 33 (50.0) 4 (6.1) 27 (40.9)	 0 (0.0) 26 (48.1) 4 (7.4) 24 (44.4)	1.83	0.61
Smoking, n (%)	29(43.9)	23(42.6)	0.02	0.89
Number of cigarettes per day, n (%)	6.1 (8.5)	6.93 (11)	0.47	0.64
Allergies yes/no, n (%)	26 (39.4)	29 (53.7)	2.45	0.12
Additional information for the family				
Pet, n (%)	16 (24.2)	14 (25.9)	0.05	0.83
Type of residence - city, n (%)	62 (93.9)	53 (98.1)	1.32	0.25
Data on allergy in another child, n (%)	24 (36.4)	16 (29.6)	0.61	0.44

titative changes in body parameters related to the growth and development of children from families with atopy were dynamically tracked. At birth, at the age of 2, 4 and 6 months, at the age of 1 and 2 years, data were collected on the main indicators of weight and length/height, calculating the anthropometric indicators weight-for-age (WAZ), height-for-age (HAZ), weight-for-height (WHZ) and body mass-for-age z-scores (BMIAZ).

The outcomes resulting from the growth assessment of children at the age of 2 years showed lower weight and height, measured by the indices WAZ, WHZ, BMIAZ and HAZ, in children with atopic dermatitis in comparison with those without AD, as a significant difference was reached in WAZ (0.09 vs. 0.68; p=0.02) and HAZ (-0.1 v. 0.5; p=0.05) (Figure 2).

In children from families with atopy, a statistically significant difference was established (Independent Student T-test) between female and male children in regard to the indicators WHZ (mean of 0.17 vs. 0.70; p=0.02) and BMIAZ (mean of 0.15 vs. 0.69; p=0.03).

Acute infections and hospitalizations

Evaluation of infectious factors reflecting the healthy condition of children with atopic predisposition (incidence and duration of acute infections by systems – respiratory, digestive, excretory, skin, general infections; number of hospitalizations) and their impact on growth, showed a correlation between the number of acute infections of the digestive and excretory systems and anthropometric indices reported for children at the age of 2 years. The registered number of acute gastroenteritis and the weight, calculated as he indices WAZ (r= -0.22; p=0.02), WHZ (r= -0.24 ; p=0.01) and BMIAZ (r= -0.23 ; p=0.01) had a negative statistically significant correlation.

The number of acute urinary infections was also negatively correlated with the WAZ index reported at 2 years of age (r=-0.21; p=0.022). Hospitalizations due to urinary infections similarly correlated negatively with children‘s weight measured at the same age (WAZ at 2 years) (r=-0.26; p=0.004).

No associations of health factors like acute ongoing diseases of the respiratory system (rhi-

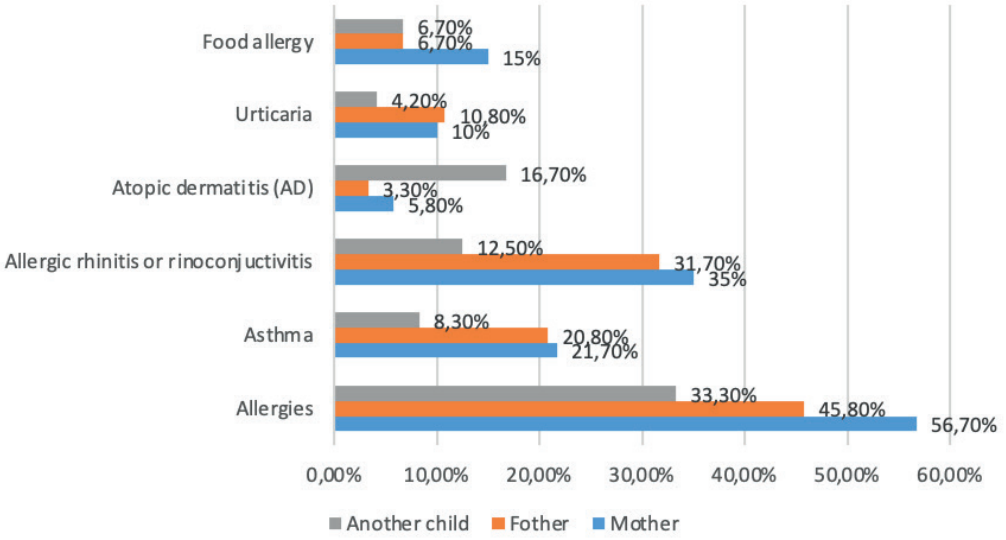

Figure 1. *Relative share (%) of allergic diseases in the families of the studied children*

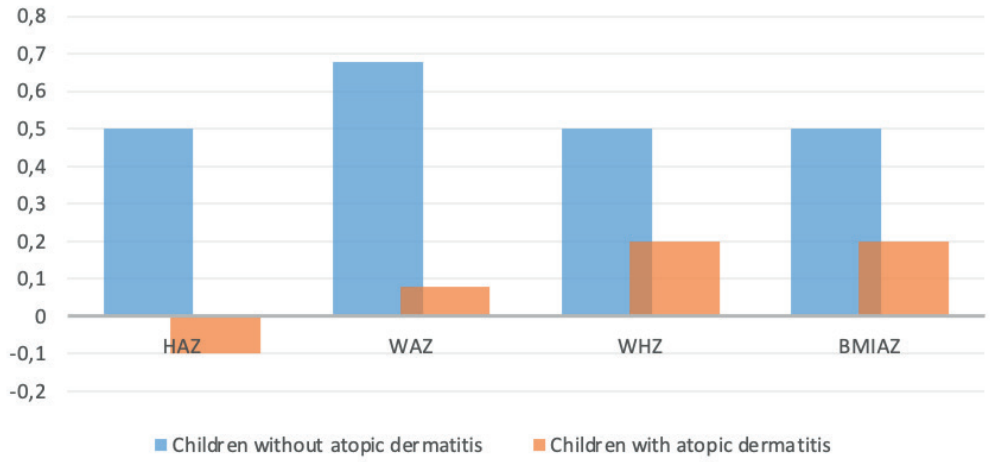

Figure 2. *Comparison between anthropometric indices in 2-year-old in children with and without atopic dermatitis*

nopharyngitis, laryngitis, bronchiolitis, pneumonia), skin, total number of infections and hospitalizations with growth indices were established.

Feeding of children

The analysis of the obtained data one type of early feeding (exclusive breastfeeding/predominant breastfeeding; formula and partial breastfeeding) of children from families with atopy showed that only average birth weight (g) of children on exclusive/predominant breastfeeding had a lower absolute value (3325±329) compared to children on formula/partial breastfeeding (3396 ± 410.4), whereas according to the measurements at the age of 2, 4 and 6 months, the weight was higher, although at statistically insignificant levels ($p>0.05$) (Table 2).

In the further monitoring of the children's growth from families with atopy (at the age of 1 year and 2 years) the comparative analysis depending on the type of feeding (exclusive/predominant breastfeeding, formula and partial breastfeeding) found higher values of the anthropometric indexes WHZ ($t= -2.54$; $p < 0.01$) , WAZ ($t = -2.56$; $p < 0.01$) and BMIAZ ($t = -2.47$; $p < 0.02$), reported at the age of 2 years in children on formula/partial breastfeeding in comparison to the children on exclusive/predominant breastfeeding (Unpaired samples Student's t-test) (Table 3).

Table 2. *Comparative analysis of the mean values of weight and body length of the recruited children depending on the type of nutrition at birth, at the age of 2, 4 and 6 months (Unpaired samples Student's t - test)*

Anthropometric indicators	Exclusive/ predominant breastfeeding Mean (SD)	Formula and partial breastfeeding Mean (SD)	Student's t	p
Weight at birth (g)	3325 (329)	3396 (410.4)	-0.89	0.37
Weight at the age of 2 months (g)	5233.7 (552.7)	5208 (551.3)	0.21	0.83
Length at the age of 2 months (cm)	57.1 (2.3)	57.5 (2.2)	-0.87	0.38
Weight at the age of 4 months (g)	6784 (726.6)	6676 (735)	0.64	0.52
Length at the age of 4 months (cm)	63 (2.4)	63.5 (2.4)	-1.00	0.32
Weight at the age of 6 months (g)	7840 (1004.8)	7805 (840.5)	0.17	0.87
Length at the age of 6 months (cm)	67.4 (2.2)	68 (2.7)	-1.09	0.28

Table 3. *Comparative analysis of the anthropometric indices depending on the type of feeding, according to the age of the children (at the age of 1 year and 2 years) (Unpaired samples Student's t-test)*

Anthropometric indices	Exclusive/ predominant breastfeeding Mean (SD)	Formula and Partial breastfeeding Mean (SD)	Student's t	p
WHZ (1 year)	0.53 (1.46)	0.54 (1.35)	-0.02	0.98
HAZ (1 year)	0.88 (1.06)	0.86 (1.17)	0.09	0.93
WAZ (1 year)	0.77 (1.05)	0.78 (1.02)	-0.03	0.98
BMIAZ (1 year)	0.38 (1.58)	0.39 (1.46)	-0.04	0.97
WHZ (2 years)	0.02 (1.25)	0.65 (1.21)	-2.54	0,01
HAZ (2 years)	0.40 (1.29)	0.48 (1.23)	-0.29	0.77
WAZ (2 years)	0.26 (1.08)	0.74 (0.86)	-2.56	0.01
BMIAZ (2 years)	-0.02 (1.31)	0.64 (1.32)	-2.47	0.02

Factors which have an impact on growth and development of children from families with atopy, the effect of total breastfeeding duration (in months), the type of milk used (breast milk, standard formula, hydrolyzed formula), the type of feeding during infancy (exclusive/ predominant breastfeeding vs. formula and formula feeding) were sought.

A positive, moderate and statistically substantial correlation was established between the total duration of breastfeeding (in months) and the boys' weight measured at the age of 4 months (r= 0.41; p = 0.01). In girls such a positive correlation was found at the age of 1 year, between the total duration of breastfeeding (in months) and the indices WHZ (r= 0.28 ; p= 0.0 5) and BMIAZ (r= 0.304; p= 0.03).

The duration of exclusive/predominant breastfeeding (in months) had a weak positive statistically significant correlation with the weight of the studied boys at the age of 6 months (r =0.34; p=0.04), and in girls at the age of 1 year with WHZ (r= 0.33 ; p=0.02) and BMIAZ (r= 0.36 ; p= 0.01).

During the examination of the relationships between the type of milk feeding – breast milk vs. standard milk vs. hydrolyzed formula, used for infant feeding, and the anthropometric outcomes, a negative, weak and statistically significant correlation between the type of milk during the breastfeeding period and the weight of the children at the age of 4 months (r = -0.39; p=0.01) was found. At the age of 2 years there is a weak positive and statistically significant correlation between the type of milk and BMIAZ (rho=0.203; p=0.04). The dispersion analysis of the anthropometric index WAZ in girls at the age of 2 years depending on the type of milk during the breastfeeding period, revealed a difference with highest values in those on standard milk (p= 0.05) (Table 4).

According to our outcomes, the pattern of feeding (exclusive/predominant breastfeeding vs. formula and partial breastfeeding) of infants had a positive statistically significant relationship with the anthropometric indices applied to assess their growth and nutritional status at the age of 2 years – WHZ (rho=0.27; p=0.003), WAZ (rho=0.23; p=0.01) and BMIAZ (rho=0.27; p=0.003).

3. LIVING CONDITIONS – SMOKING IN THE FAMILY

Smoking in the family was studied as an element of living

Table 4. *The dispersion analysis of deviations in age-adjusted anthropometric indicators in 2-year-old girls depending on the type of milk during the breastfeeding period*

Anthropometric indices Girls	Breast milk Mean (SD)	Standard formula Mean (SD)	Hydrolyzed formula Mean (SD)	F	P
WHZ (2 years)	-0.15 (1.07)	0.34 (1.34)	1.23 (0.35)	0.87	0.28
HAZ (2 years)	0.21 (1.33)	0.90 (1.50)	1.10 (0.68)	0.82	0.24
WAZ (2 years)	0.05 (0.91)	0.76 (3.40)	0.89 (0.65)	0.61	0.05
BMIAZ (2 years)	-0.14 (1.16)	0.31 (0.99)	1.32 (0.32)	0.9 4	0.38

conditions among socio-economic factors. The analysis of the results from the survey, which refer to the impact of passive smoking on the growth of children considering family burden of atopy, reported a weak, but statistically substantial relationship between the number of cigarettes smoked by the father per day and the weight of the children, assessed by the indicators WHZ (r= 0.25; p= 0.07) and BMIAZ (r = 0.26; p=0.004).

The intensity of mother's smoking, assessed by the number of cigarettes smoked per day, appeared to be negatively correlated with adaptive behavior (r=-0.25; p=0.004), cognitive development (r=-0.26; p=0.004), communicative abilities (r =-0.25; p=0.005) as well as with general development (r= -0.24; p=0.007) of the children with a family history of atopy.

DISCUSSION

The conducted study found that health and nutritional factors are related to growth and development processes in children. Certain illnesses during the first 1000 days of a child's life can slow down and impair their growth and development, and this can have long-term effects beyond infancy.

The incidence of atopic conditions as chronic conditions which affect children more and more has been increasing in recent years. This could have impact on their growth. Our results reveal that weight in children without atopic dermatitis has higher mean values compared to weight in children with atopic dermatitis at statistically significant levels and they are comparable with those data from the study of Low *et al* (13). Monitoring the growth of children with AD through a cross -sectional study conducted with 150 children between the ages of 1 and 3, taking into account their dietary restrictions, nutrition and growth, these authors found that 60.7% of children with AD avoid eating shellfish, nuts, eggs, dairy products, cow's milk (13). Children on a restricted diet had significantly lower caloric intake as well as lower serum iron, protein and albumin. The weight of this group of children was considerably lower compared to children without a restrictive diet, and in addition to lower weight, they also had a smaller head circumference as well as a smaller average forearm circumference.

More severe AD is an independent risk factor related to dietary restriction. Since the elimination diet is often applied in children with AD, it can be assumed that this is the reason for the lower growth rate measured by weight, height, head circumference, arm circumference and BMI. Such a study again illustrates the need to monitor the growth of children suffering from atopy.

In other studies, for example, Mehta and co-authors (14), a relationship between growth and AD in children has not been discovered, despite the hypothesis that children with comorbid allergic disorders might have had higher caloric needs; according to these authors 65% of children with FA also have AD. However, no differences in growth have been found between them and those without AD. Also, no differences were established in the growth of 69% of the studied children with asthma and those without asthma, although the duration of steroid therapy was not taken into account.

Except atopic dermatitis, the presence of non-nutritional factors, such as acute infections of the digestive and excretory systems, hospitalizations in connection with urinary infections in the children of our study, have connection with their growth and development. We find out negative statistically significant correlation between children's weight (WAZ) and the number of acute gastroenteritis, urinary infections and hospitalizations – the lower weight of children relevant to the respective age is associated with increased acute infectious morbidity.

Our data are consistent with those of Kim who established that AD was associated with bacterial and viral skin infections as well as extracutaneous infections (otitis, sinusitis, upper and lower respiratory tract infections, uroinfections)

(15). As a result of a large prospective cohort study Health Nuts Study, involving more than 5,000 participants, Beck *et al* demonstrated that children with FA and eczema at the age of 1 year had lower percentiles for average weight and height at the age of 1 year than children who did not suffer from these conditions at the same age. There was no difference for children with FA or eczema at one year of age. By the age of 4 years, children with existing food allergy and eczema, but not those with controlled food allergy, were still shorter and underweight (16). The authors observed that elimination of less important foods, such as peanuts, from the diet was also associated with reduced growth. Therefore, this reduced growth rate is possibly due to an atopic phenotype and may be mediated by the effect of chronic allergic inflammation and increased metabolic demands (17). Eczema has been suggested to affect growth through increased metabolic demands associated with itching, sleep disturbances and the need for faster skin renewal (18).

In childhood, energy intake with food must provide the needs of the body so it can achieve optimal growth and development, which in our study were evaluated by anthropometric indices HA, WA, WH and BMIA according to the standards of World Healthcare Organization (19). The rate of growth of the studied children with a family history of atopy can be measured by the body mass-for-age index. The anthropometric information from BMIA is similar to this one on the index weight-for-height and the data we obtained for these indices in children at the age of 1 year have a statistically significant positive weak relationship with the way of feeding. The effect of duration of breastfeeding and exclusive/predominant breastfeeding on boys‘ weight at the age of 4 and 6 months, respectively, was positive and statistically significant. In girls, this positive relationship is established at the age of 1 year through the WHZ and BMIAZ indices. The study of the relationship between the nutritional value and the growth indicators of children at the age of 1 year (WHZ and BMIAZ) also establishes a positive statistically considerable correlation. During the breastfeeding period, the outcomes for the weight of children at the age of 4 months have a negative statistically significant correlation with the type of milk used (breast milk, standard milk, hydrolyzed formula), while at the age of 2 years the correlation between the type of milk and BMIAZ is positive and statistically considerable.

The study of others non-nutritional factors characterizing the upbringing environment of children with atopic predisposition registered correlations between parental smoking and anthropometric indices used to assess their growth and development. We find that in our study, children ,s physical development is related to smoking in the family. The data analysis reports a statistically significant relationship between the number of cigarettes the father smokes per day and the weight of the children, assessed by the WHZ indicators and BMIAZ. In addition, among the studied children with a family history of atopy the intensity of mother’s smoking (measured by the number of cigarettes smoked per day) is a negatively related factor with adaptive behavior, cognitive development, communicative abilities and with their general development.

Gallay *et al* found that passive smoking, family history of atopy, high humidity in home are associated with the development of AD in early childhood, as family history is the main risk factor for the development of AD, regardless of the most common genetic mutations (20). This also demonstrates the additional indirect effect of smoking on the growth of atopic children.

CONCLUSION

The conducted study found that factors from the living environment and nutritional nature are related to the processes of growth and development in children from families with allergy. The presence of diseases such as atopic dermatitis, acute infections of the digestive and excretory system, hospitalizations in connection with urinary infections, smoking have relation to the growth and development of children with a family history of atopy.

The data resulting from our study may serve as a basis for further research so the mechanisms of atopy to be investigated better and potential preventive measures during pregnancy and early childhood to be specified. The impact of risk factors on children‘s growth during the first 1000 days could be modified by targeted behavioral interventions of the whole family.

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