

The incidence of some civilization diseases in families of children with food allergy/intolerance

Mikołuc B, Motkowski R, Krasnow A, Białokoz-Kalinowska I,
Piotrowska-Jastrzębska J

Propaedeutics of Pediatrics Department, Medical University of Białystok, Poland

Abstract

Purpose: The aim of the study was to evaluate the incidence of chosen civilization diseases in families of children with food allergy/intolerance. We also wanted to indicate the need for developing and implementing activities preventing these diseases among children.

Material and methods: On the basis of information from questionnaires, two groups of children were distinguished: a group of 80 children suffering from food allergy/intolerance on elimination diet (GR1) and a group of 67 healthy children (GR2) on regular diet. In GR1, the elimination diet with soya bean preparations or casein hydrolysates was introduced before the age of 6 months and continued for at least 12 months. A high risk of hypercholesterolemia according to extended American Academy of Pediatrics criteria including hypertension, diabetes and obesity was determined for children in both groups.

Results: The research showed that 31.25% of children examined according to AAP criteria and 46.25% according to extended criteria had a positive family history of premature diseases of the circulatory system. The study proved that hypertension was the most frequent cause of morbidity in families of children from a high risk group and it was found in 67.7% of families with children on elimination diet and with a positive family history and in 78.7% of families with children from GR2 with a positive family history. Obesity, coronary heart disease, hypercholesterolemia, atherosclerosis and diabetes were listed consecutively.

Conclusions: Once a positive family history of cardiovascular diseases is discovered, systematic education

promoting health in a family and complex evaluation of physical and psychomotor development of the children should follow. Arterial blood pressure and lipid profile in serum ought to be monitored to eliminate risk factors of these diseases for children.

Key words: elimination diet, civilization diseases, risk factors.

Introduction

Epidemiological studies have confirmed that infectious diseases, cardiovascular diseases and malignant tumors are the main causes of morbidity and mortality in the world. The published epidemiological reports also show a dramatic increase in the number of allergic diseases. Currently, this problem affects 10 to 35% of the population and there is a constant rising tendency [1].

The high incidence of allergic diseases in Europe, such as hay fever (10-20% of population), asthma (2.5-10%) [2], dermatitis atopica and other dermatoses (10-12%) [3], necessitates an introduction of an effective systematic preventive program to reduce their occurrence. In Poland, the number of people with allergic diseases doubled in the last seven years. Today, one-fifth of the overall Polish population suffers from some type of allergy. This number is even greater in large cities, where it affects one out of every four people.

Food allergy and food intolerance are most frequent at the developmental age. Food allergy is a hypersensitivity to certain foods and substances that have been ingested [4,5]. The term "hypersensitivity to foods" refers to a dietary intolerance conditioned by immunological mechanisms usually of an early hypersensitivity type (type I according to Gell and Coombs), late hypersensitivity caused by allergic lymphocytes (type IV) or immunological complexes (type III). The combination of these three types of allergic reaction is frequently reported. Food intolerance, unlike allergy, is conditioned by non-immu-

ADDRESS FOR CORRESPONDENCE:

Bożena Mikołuc
Propaedeutics of Pediatrics Department,
Medical University of Białystok, Children Teaching Hospital
ul. Waszyngtona 17, 15-274 Białystok, Poland
tel.: +48 85 7-450-622 fax.: +48 85 7-450-642
e-mail: bozenam@mp.pl

Table 1. The number of children in particular groups, their age and sex.

		number of children		boys		girls		average age	
		n	%	n	%	n	%	x (month of life)	SD
GR1 (n=80)	family history (+)	37	46.2	25	67.5	12	32.4	46.3	15.1
	family history (-)	43	53.8	23	53.5	20	46.5	45.1	14.5
GR2 (n=67)	family history (+)	33	49.3	15	45.4	18	54.6	50.5	14.9
	family history (-)	34	50.7	15	44.1	19	55.9	48.9	14.3

Table 2. Body weight at birth and birth term.

		body weight at birth (g)								birth term					
		<2500		>2500 <3000		>3000 <3500		>3500		premature		at term		post-term	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
GR1 (n=80)	family history (+) (n=37)	2	5.4	5	13.5	11	29.7	19	51.3	0	0.0	34	91.8	3	8.2
	family history (-) (n=43)	5	11.6	6	13.9	16	37.2	16	37.2	6	13.9	32	74.4	5	11.6
GR2 (n=67)	family history (+) (n=33)	0	0.0	5	15.1	15	45.4	13	39.3	1	3.0	28	84.8	4	12.1
	family history (-) (n=34)	1	2.9	4	11.7	15	44.1	13	38.2	3	8.8	28	82.3	2	5.8

nological mechanisms, e.g. food indigestion or intolerance to lactose [4,6].

Undesirable alimentary reactions are observed in about 5-10% of population in North America, affecting 13% of children. In Europe, this problem affects 0.3 to 7.5% of children and this estimate increases to 10-20% for the children with a positive atopy family history [1,3]. In 1997, Polish experts under the supervision of Professor Kaczmarski presented a report on food allergy and food intolerance. It indicated that food allergy affects 5-8% of children and is the main reason of their complaints [6]. Every food product can be an allergen, especially if it contains proteins. For children in their first three years of life, hypersensitivity is usually caused by cow milk proteins. Clinical symptoms appear in 2.2-2.3% of the whole developmental age population [4,6,7].

In spite of many clinical and laboratory studies, it is often still difficult to confirm food allergy/intolerance, as there is no an ideal conclusive diagnostic test. According to the recommendations introduced in 1993 by the ESPACI (European Academy of Allergology and Paediatric Immunology) Congress, the diagnosis of food allergy requires an affirmative, double blind placebo-controlled food challenge (DBPCFC) performed with a given food product. The oral stimulus test done according to the DBPCFC recommendation is conducted mainly in clinical centres that do research into food allergy/intolerance [6].

In everyday medical practice, the diagnosis of food allergy is based on a case and family history and a medical examination of a child. It is reported that 30-40% of cases with suspected food allergy are confirmed after performing DBPCFC [4,6].

The chosen treatment in such cases is an elimination diet which permanently or temporarily eliminates harmful food and simultaneously introduces other components of equivalent nutritional value.

The aim of the study was to evaluate the incidence of chosen civilization diseases in families of children with food allergy/intolerance and to point to the need for working out and introducing activities which would prevent these diseases among children.

Material and methods

The study involved 670 children attending 5 infant nurseries, 10 kindergartens and also the children under the care of the Psychosomatic Out-Patient Clinic of the Propaedeutics of Pediatrics Department, Białystok Medical University.

The questionnaire consisted of questions referring to the child's term of birth, its body weight at birth, breast-feeding period, the age at which elimination diet was introduced and the intake of chosen food groups. The detailed family history took into account the incidence and the age at which such diseases as hypertension, atherosclerosis, diabetes, obesity, high cholesterol level and smoking occurred in the family back to the second generation. Children from families where morbid problems mentioned above were reported before the age of 55, were included in a high risk group.

On the basis of the data from the questionnaires, two groups were distinguished: a group of 80 children with food

allergy/intolerance on elimination diet (GR1) and a group of 67 healthy children (GR2) on regular diet with a positive family history of circulatory system diseases, who constituted the control group.

In GR1, the elimination diet with soya bean preparations or casein hydrolysates was introduced before the age of 6 months and continued for at least 12 months. Children at high risk according to extended AAP criteria including hypertension, diabetes and obesity were separated in both groups.

Statistics. Statistical analysis was performed by means of descriptive statistics and an independence test χ^2 with Yates and Fisher's correction using STATISTICA computer program.

Results

The number of children in particular groups, their age and sex are presented in *Tab. 1*. The average age of the children was similar in both groups and equalled $3\frac{9}{12}$ - $4\frac{7}{12}$ years (*Tab. 1*). The values of BMI were also comparable: GR1=15.48 (SD=1.65) and GR2=15.65 (SD=2.32). No differences regarding body weight at birth and birth term were noted in both groups (*Tab. 2*).

The study shows, that 38% of the children on the elimination diet were breast-fed only for 2-3 months. The period of exclusive breast-feeding for 47% of children in GR2 was longer and equalled 4-6 months ($p<0.005$). In both groups, total breast-feeding period (5.2 and 5.7 months) was far too short (*Tab. 3*).

Dairy products were introduced in the case of 80% of children in GR2 (on average in the 5.15th month of life, SD=2.73, at the earliest in the 1st month of life, in the 12th month at the latest). These products were present in the diet of only 25% of children in GR1. On average they were introduced later, in about 24th month of life (SD=9.31) – at 6 months of life at the earliest and, at the latest, at 42 months of life. The difference in the number of children who were never given dairy products is statistically significant with $p<0.001$ (*Tab. 3*).

No differences were found in fish, fried food or meat intake in the tested groups. Significant differences concerned butter and margarine intake ($p<0.05$). In the group of children on elimination diet, unlike in the control group, 'soft' margarine was used more frequently than butter (*Tab. 4*).

The study shows that in families of children from both groups (GR1 and GR2) the main morbid problems concern the cardiovascular system (*Tab. 5*). Particular diseases, their incidence back to the second generation and the age at which they started, are presented in *Tab. 6*. The average value, standard deviation and minimum and maximum values are shown in each case.

The research proved that hypertension was the most frequent morbid problem in families of children from a high risk group. It was found in 67.7% of families with children on the elimination diet and a positive family history and in 78.7% of families with children from GR2. Obesity, coronary heart disease, hypercholesterolemia, atherosclerosis and diabetes were listed consecutively. The average age for the occurrence of these diseases (except for diabetes) was before the age of

Table 3. Exclusive breast-feeding period, total breast-feeding time and age at which dairy products were introduced.

	Age at which dairy products were introduced																			
	exclusive breast-feeding period						total breast-feeding time													
	<1 m	2-3 m	4-6 m	>6 m	<3 m	3-6 m	7-12 m	>12 m	not introduced	<12 month of life	>12 month of life									
GR1 (n=80)	n	8	14	15	40.5	0	0.0	11	29.7	16	43.2	8	21.6	2	27	72.9	0	0.0	10	27.1
	%	21.6	37.8	37.8	40.5	0	0.0	11	29.7	16	43.2	8	21.6	2	27	72.9	0	0.0	10	27.1
	family history (+)	8	14	15	40.5	0	0.0	11	29.7	16	43.2	8	21.6	2	27	72.9	0	0.0	10	27.1
	(n=37)																			
GR2 (n=67)	n	7	10	13	44.1	1	0.0	13	30.2	22	51.1	5	11.6	3	33	76.7	1	2.3	9	20.9
	%	21.2	29.4	29.4	44.1	1	0.0	13	30.2	22	51.1	5	11.6	3	33	76.7	1	2.3	9	20.9
	family history (+)	7	10	13	44.1	1	0.0	13	30.2	22	51.1	5	11.6	3	33	76.7	1	2.3	9	20.9
	(n=33)																			
GR2 (n=34)	n	7	10	13	38.2	4	11.7	7	20.5	10	29.4	17	50	0	8	23.5	25	73.5	1	2.9
	%	20.5	29.4	38.2	38.2	4	11.7	7	20.5	10	29.4	17	50	0	8	23.5	25	73.5	1	2.9
	family history (-)	7	10	13	38.2	4	11.7	7	20.5	10	29.4	17	50	0	8	23.5	25	73.5	1	2.9
	(n=34)																			

50, and obesity, hypercholesterolemia and hypertension even before the age of 45 (*Fig. 1*).

Additionally, the study made it possible to find the age when the first health problems started for each family member from the group with children on elimination diet (*Fig. 2*).

It is interesting that cardiovascular system diseases occurred earlier in case of parents than grandparents. On average, the disease symptoms manifested themselves at the age of 38 for the parents (in the case of mothers sometimes as early as 30 and for the fathers even at 21). In the second generation,

Figure 1. The mean age of the onset of chosen diseases in families in GR1 (box=mean and ±1 SD; bars=maximum and minimum).

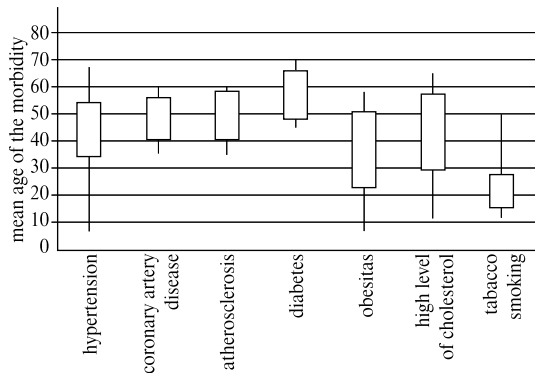
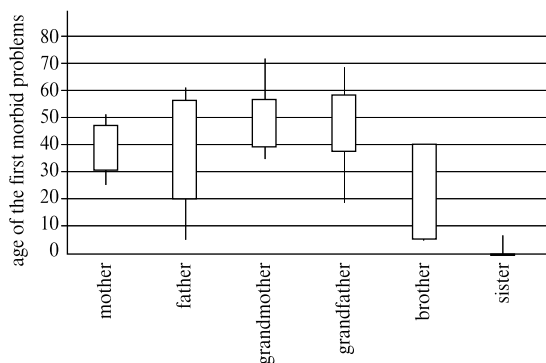


Figure 2. The age, at which the first morbid problems occurred for different family members in families of children on elimination diet (box=mean and ±1 SD; bars=maximum and minimum).



they occurred on average at the age of 46-47, at the earliest about 40. This points to a deterioration in the state of health of the middle-aged population.

The analysis of the results shows that tobacco smoking is particularly harmful. It was found that in 65% of families of children from GR1 with a positive family history, at least one person smoked, and the same was true for 100% of comparable families from GR2. There was a statistically significant difference in the occurrence of smoking addiction in the groups – it was much more frequent in the groups with the positive family history than in the groups with the negative one.

Discussion

The study indicates an urgent need for the preventive action among both groups of children: those with food allergy/ intolerance as well as the healthy ones. The measures should be aimed at improving the state of health in the society. It was found that 31.25% of children examined according to AAP criteria and 46.25% according to the extended criteria including hypertension, obesity and diabetes had a positive family history of premature civilization diseases, mainly the diseases

Table 4. Butter intake and margarine intake.

	butter intake				margarine intake			
	< 1 a week	1-2 a week	>2 a week	lack of data	< 1 a week	1-2 a week	>2 a week	lack of data
	n	n	n	n	n	n	n	n
GR1 (n=80)	22	1	14	0	9	2	26	0
family history (+)	59.4	2.7	37.8	0.0	24.3	5.4	70.2	0.0
GR1 (n=80)	14	11	17	1	19	5	18	1
family history (-)	32.5	25.5	39.5	2.3	44.1	11.6	41.8	2.3
GR2 (n=67)	9	3	21	0	15	4	14	0
family history (+)	27.2	9.0	63.6	0.0	45.4	12.1	42.4	0.0
GR2 (n=67)	9	4	20	1	18	5	10	1
family history (-)	26.4	11.7	58.8	2.9	52.9	14.7	29.4	2.9

of the circulatory system. Therefore, a detailed interview with a patient should accompany a medical examination, to identify the children from the high risk group and to undertake early prevention activities. This opinion is supported by epidemiological analyses which predict that in 2020 about 1.5 million people out of 60 million children now living in the USA will suffer from cardiovascular diseases [8].

It is known that risk factors connected with the early occurrence of some diseases are mostly the same both for the adults and for the developmental age population. Obesity, high con-

Table 5. The main morbid problems in families of both tested groups.

Group	No		hypertension		coronary arterial disease		atherosclerosis		diabetes		obesity		high level of cholesterol (> 240 mg/dl)		tobacco smoking	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Children on elimination diet (GR1)																
family history (+)	37	25	19	51.3	4	10.8	6	16.2	22	59.45	14	37.8	24	64.8		
family history (-)	43	0	0	0.0	0	0.0	1	2.32	0	0.00	1	2.32	12	27.9		
n.s.																
Children on normal diet (GR2)																
family history (+)	33	26	19	57.5	16	48.4	13	39.3	18	54.5	17	51.5	33	100		
family history (-)	34	0	2	5.8	0	0	3	8.8	0	0.0	2	5.8	12	35.2		
n.s.																

centration of total cholesterol and LDL-cholesterol are some of the factors that are often present already in childhood [9].

Clinical studies show that abdominal obesity is correlated with high values of arterial blood pressure, LDL-cholesterol and insulin. The area of atherosclerotic lesions in arteries depends on the scale of obesity, the arterial blood pressure and the HDL-cholesterol concentration [8].

In our study we found that arterial hypertension was the most frequent disease in the families of the examined children and that it started on average at the age of 44, at 7 at the

earliest. This shows that arterial blood pressure should be monitored permanently in the children with a positive family history of circulatory system diseases. Obesity was found to be the second most frequently reported morbid problem. On average it manifested itself at the age of 37, but, like arterial hypertension, its first signs could be noticed as early as in the 7th year of life. This confirms the need for promoting a healthy diet, establishing proper eating habits and a healthy lifestyle in every period of life. It also points to the necessity of a systematic evaluation of nutrition in the child population.

The need for periodic lipid profile control in blood serum, especially for the population at high risk of circulatory diseases was proved by the results of research conducted within the Family Cardiology Prevention Program-Szczecin 2000. It involved children before the age of 12, whose mother or father had myocardial infarction or ischemic cerebral stroke before the age of 50. Higher concentrations of LDL-cholesterol and total cholesterol were found in this group of children when compared to those with a negative family history. Similarly, higher values of these parameters were observed in smokers' families independently of a positive family history of ischemia.

The implementation of dietary recommendations of the National Cholesterol Preventive Program in the group of children with high total cholesterol and LDL-cholesterol levels resulted in a decrease in these parameters after only 3 months [10]. The American Academy of Pediatrics in 1998 published instructions which recommended education about nutrition and other risk factors. This paper concentrate on one risk factor of atherosclerosis, i.e. hypercholesterolemia and recommend, monitoring cholesterol concentration in blood serum and introducing a diet in case of its increase [11].

According to AAP, the evaluation of cholesterol concentration in serum should be performed for children who have a parental or grandparental history (before 55 years of age) of invasive cardiovascular examinations or a documented myocardial infraction, angina pectoris, peripheral vascular disease, cerebrovascular disease or sudden cardiac death. Children of parents with increased cholesterol concentration in serum (240 mg/dl or more) and children with other risk factors and unknown family history were also included in this group [11].

In our study, cholesterol level exceeding recommended age norms was found at the age of 12 at the earliest. At present, a routine testing of cholesterol concentration in blood serum is not a sufficient or a necessary prognostic factor of coronary heart disease. However, the analysis reveals that on average an increased cholesterol level occurs at the age of 43, whereas the symptoms of coronary heart disease in the 47th year of life.

Cigarette smoking, increased blood pressure, low HDL-cholesterol, obesity, diabetes and lack of physical activity are some other risk factors connected with an early onset of coronary heart disease [8,9]. In the tested group atherosclerosis was a morbid problem occurring on average at the age of 42.9 (SD=9.03) and diabetes at the age of 57 (SD=8.8).

Numerous clinical studies confirm that atherosclerotic lesions may develop even in early childhood. Berenson [8] proved fatty streaks in the aorta in 50% of autopsies and fibrous plaques in coronary arteries in 8% of autopsies of children aged 2-15. The severity of lesions was directly pro-

Table 6. Chosen diseases in families, their incidence back to the second generation and the time of their onset.

	hypertension	coronary arterial disease	atherosclerosis	diabetes	obesity	high level of cholesterol (> 240 mg/dl)	tobacco smoking
Children on elimination diet (GR1)							
n	30	23	7	8	27	19	68
parents	4	3	2	1	8	6	36
grandparents	25	20	5	7	17	11	29
siblings	1	0	0	0	2	2	3
time (in years)							
x	44.06	47.47	49.28	56.62	36.85	42.94	21.54
SD	9.94	7.94	9.03	8.85	14.20	14.12	6.10
max	67	60	60	70	58	65	50
min	7	35	35	45	7	12	12
Children on normal diet (GR2)							
n	26	21	16	16	18	19	47
parents	1	0	0	0	3	1	25
grandparents	25	21	16	16	15	18	22
siblings	0	0	0	0	0	0	0
time (in years)							
x	48.92	47.19	50.75	52.56	41.06	48.79	20.36
SD	8.11	8.94	6.09	8.56	11.30	9.96	2.98
max	66	60	60	65	60	60	30
min	30	30	40	25	22	30	14

portional to the number of the discovered atherosclerotic risk factors. The elimination of risk factors leads to a decrease in morbidity and mortality caused by the diseases of the circulatory system. Our study shows that the main morbid problems in families of the examined children were connected with the diseases of the circulatory system. The incidence of arterial hypertension, obesity, increased cholesterol level, coronary heart disease, atherosclerosis and diabetes in the families of children with food allergy/intolerance is the same as in the families of healthy children.

The proper monitoring of progress in a dietary treatment of food allergy/intolerance demands a systematic periodic observation of a child as well as checking its development parameters. This creates many opportunities to promote health in families of these children. These prophylactic activities should be aimed at preventing not only allergic diseases but also other diseases of social concern, especially those of the circulatory system.

Primary and secondary prevention concerning diseases of social consequence should be undertaken at doctor's meetings

with an allergic child's family. It is vital to promote a healthy diet: breast-feeding, an appropriate diet for pregnant and breast-feeding women, hypo-allergic formulas and elimination diets in food allergy and intolerance.

Systematic, age-related physical activity, prevention of obesity, psychological support in a stressful situation and abstaining from smoking are some of the preventive activities. The earlier these measures are introduced, the more effective they are. They should ideally be adopted by the whole society, particularly people from a high risk group with a positive family history.

Disclosing a positive family history of cardiovascular diseases necessitates systematic education promoting health in a family, complex evaluation of physical and psychomotor development of the children, as well as monitoring arterial blood pressure and lipid profile in serum to eliminate the risk factors of these diseases in the child population.

Acknowledgements

This work was supported by the grant 4-26557 from Medical University of Bialystok.

References

1. Young E, Stoneham MD, Petruckevitch A, Barton J, Rona R. A population study of food intolerance. *Lancet*, 1994; 343: 1127-30.
2. Asher MI, Weiland SK. The International Study of Asthma and Allergies in Childhood (ISAAC). ISAAC Steering Committee. *Clin Exp Allergy*, 1998; 28 Suppl 5: 52-66; discussion 90-1.
3. Williams HC, Strachan DP. The natural history of childhood eczema: observations from the British 1958 birth cohort study. *Br J Dermatol*, 1998; 139: 834-9.
4. White Book of Allergy. UCB Pharma, 1997.
5. Kaczmarek M. [Allergy and food intolerance]. Sanmedia, 1993, Warsaw.
6. Kaczmarek M, editor. [Statement of Polish Expert's Group: Allergy and food intolerance.] Unimed, 1997, Warsaw.
7. Aberg N, Engstrom I. Natural history of allergic diseases in children. *Acta Paediatr Scand*, 1990; 79:206-11.
8. Berenson GS, Srinivasan SR, Bao W, Newman WP, Tracy RE, Wattigney WA. Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. *N Engl J Med*, 1998; 338: 1650-6.
9. Gaziano JM. When should heart disease prevention begin? *N Engl J Med*, 1998; 338: 1690-2.
10. Naruszewicz M. Atherosclerosis risk factors in children. [Cardiologic Prevention Family Program. Szczecin 2000]. *Czynniki Rzyka*, 1998; 5: 7-9.
11. American Academy of Pediatrics. Committee on Nutrition. Cholesterol in childhood. *Pediatrics*, 1998; 101: 141-7.