

SELECTED INDICES OF HEALTH STATUS IN PRESCHOOL CHILDREN FROM PIŁA AND THEIR FAMILIES AS A RISK FACTOR OF DIET-RELATED DISEASES¹

*Sylwia Merkiel, Wojciech Chalcarz**

Food and Nutrition Department, *Eugeniusz Piasecki* University School of Physical Education in Poznań, Królowej Jadwigi Street 27/39, 61-871 Poznań, Poland

ABSTRACT

Background. Diet-related diseases have their origin as early as in childhood; therefore, preventing them should start from the first years of life. Each assessment of dietary intake should be preceded by assessment of health status indices, especially familial diet-related diseases prevalence.

Objective. The objective of this study was to analyse selected indices of health status in preschool children from Piła and their families in order to assess the risk of developing diet-related diseases.

Material and methods. The studied population comprised 128 children aged 4 to 6 years, 63 girls and 65 boys, who attended two preschools in Piła. Parents filled in questionnaires concerning selected indices of health status of the children and their families. Statistical analysis was carried out by means of the IBM SPSS Statistics 21.0 computer programme. The studied children were divided according to gender.

Results. Statistically significantly higher percentage of boys than girls took medicines, 41.5% vs 21.0%. As many as 49.6% of mothers and 33.1% of fathers had higher education and most of the parents assessed the economic status of the family either as good or very good. Most of the studied children took dietary supplements. The highest percentage of both girls and boys, 34.2% and 33.8%, respectively, took vitamin and mineral supplements. The prevalence of familial diet-related diseases ranged from 3.2% in the case of hyperlipidaemia to 65.6% in the case of hypertension.

Conclusions. The high percentage of the studied preschoolers who took dietary supplements shows the need to educate parents about the adverse effects of excessive intake of these nutrients and about the necessity to take such supplements only on recommendation of the paediatrician. The analysed indices of health status of the studied children and their families show the need to pay much attention to balanced diet and daily physical activity in order to prevent diet-related diseases in the studied preschoolers and their families.

Key words: *health status, children, diet-related diseases, vitamin supplements, mineral supplements*

STRESZCZENIE

Wprowadzenie. Choroby dietozależne mają swój początek już w dzieciństwie, dlatego zapobieganie im powinno rozpocząć się od najwcześniejszych lat życia. Każda ocena sposobu żywienia powinna być poprzedzona oceną wskaźników stanu zdrowia, szczególnie oceną częstości występowania chorób dietozależnych w rodzinie.

Cel. Celem pracy była analiza wybranych wskaźników stanu zdrowia dzieci w wieku przedszkolnym z Piły oraz ich rodzin pod kątem ryzyka rozwoju chorób dietozależnych.

Material i metody. Badaniami objęto 128 dzieci w wieku od 4 do 6 lat, w tym 63 dziewczynki i 65 chłopców, uczęszczających do dwóch przedszkoli w Piłe. Rodzice wypełnili ankiety dotyczące wybranych wskaźników stanu zdrowia dzieci i ich rodzin. Statystyczną analizę wyników przeprowadzono przy pomocy programu komputerowego IBM SPSS Statistics 21.0. Badaną populację podzielono w zależności od płci.

Wyniki. Statystycznie istotnie większy odsetek chłopców niż dziewczynek korzystał z lekarstw, 41,5% vs 21,0%. Aż 49,6% matek i 33,1% ojców charakteryzowało się wyższym wykształceniem, a ponadto większość rodziców badanych dzieci oceniła sytuację materialną rodziny jako dobrą lub bardzo dobrą. Większość badanych dzieci stosowała suplementy diety. Największy odsetek zarówno dziewczynek, jak i chłopców, odpowiednio, 34,2% i 33,8%, zażywał suplementy witamino-

¹ This study was financed by the National Science Centre (Poland) from the resources for financing research in the years 2010-2014 as a research project N N404 140437.

***Corresponding author:** Wojciech Chalcarz, Food and Nutrition Department, *Eugeniusz Piasecki* University School of Physical Education in Poznań, Królowej Jadwigi Street 27/39, 61-871 Poznań, Poland, phone: 61 835 52 87, e-mail: chalcarz@awf.poznan.pl

wo-mineralne. Odsetek rodziców, którzy poinformowali o występowaniu chorób dietozależnych w rodzinie wahał się od 3,2% w przypadku hiperlipidemii do 65,6% w przypadku nadciśnienia tętniczego.

Wnioski. Wysoki odsetek badanych dzieci przedszkolnych, które spożywały suplementy witaminowe i mineralne wskazuje na potrzebę prowadzenia edukacji rodziców w zakresie niekorzystnych skutków nadmiernego spożycia mikroskładników oraz konieczności stosowania suplementów tylko po konsultacji z lekarzem pediatrą. Analizowane wskaźniki stanu zdrowia badanych dzieci i ich rodzin świadczą o potrzebie zwrócenia większej uwagi na zbilansowaną dietę i regularną aktywność fizyczną, aby zapobiec chorobom dietozależnym w badanej grupie przedszkolaków i ich rodziców.

Słowa kluczowe: stan zdrowia, dzieci, choroby dietozależne, suplementy witaminowe, suplementy mineralne

INTRODUCTION

Diet-related diseases have their origin as early as in childhood, therefore, preventing them should start from the first years of life [15, 18]. However, effective prevention should be tailored to the needs of specific groups. That is why it is of greatest importance to investigate indices of health status of various groups of people in the society. Among the crucial factors which may influence nutrition recommendations for a specific group, is the history of diet-related diseases in the family. It is well recognised that a child is at elevated risk of developing atherosclerosis, hypertension, osteoporosis, diabetes, obesity or cancer, if members of his or her family suffered from these diseases. Thus, each assessment of dietary intake should be preceded by assessment of health status indices, especially familial diet-related diseases prevalence. Therefore, the objective of this study was to analyse selected indices of health status in preschool children from Piła and their families in order to assess the risk of developing diet-related diseases.

MATERIAL AND METHODS

The studied population comprised 128 children aged 4 to 6 years, 63 girls and 65 boys, who attended two preschools in Piła. The preschools were selected randomly and the study was carried out after receiving approval from the directors. Parents filled in questionnaires which included eight questions concerning socio-demographic characteristics and twelve questions concerning selected indices of health status of the children and their families. The indices of health status included: child's birth weight, child's food allergies and other allergies, taking medicines, as well as vitamin and mineral supplements by the child, familial diabetes, obesity, myocardial infarction, hyperlipidaemia, hypertension, osteoporosis and cancer. From among the positive answers to the questions about the members of the family who suffered from diet-related diseases, we included only the following answers: mother, father, grandmother, grandfather, great-grandmother, great-grandfather, aunt

(but only the mother's or father's sister) and uncle (but only the mother's or father's brother), similarly to the previous study [20]. The questionnaire was worked out by the authors and was used in our previous studies [5, 17, 20, 21, 22, 23]. The study was approved by the Bioethics Committee of the Poznan University of Medical Sciences.

Statistical analysis was carried out by means of the IBM SPSS Statistics for Windows computer programme, version 21.0 (Armonk, NY: IBM Corp.). All the results were analysed according to gender. Means and standard deviations were calculated for children's age and birth weight, as well as mothers' and fathers' age. The results of the *Shapiro-Wilk* statistic showed that all of these variables were skewed and so the non-parametric *Mann-Whitney U* test was used to investigate statistically significant differences. The level of significance was set at $P \leq 0.05$. Qualitative variables were presented in contingency tables. Statistical significance was determined using *Pearson's chi-square* test, except for the variables with more than 20% of cells with an expected frequency of less than five. In this case, the *Mann-Whitney U* test was used. The level of significance was set at $P \leq 0.05$.

RESULTS

Table 1 and 2 show socio-demographic characteristics and selected indices of health status of the studied children and their families. Statistically significantly higher percentage of boys than girls took medicines, 41.5% vs 21.0%.

It is noteworthy that as many as 49.6% of mothers and 33.1% of fathers had higher education and that most of the parents assessed the economic status of the family either as good or very good. Most of the studied children took dietary supplements. The highest percentage of both girls and boys, 34.2% and 33.8%, respectively, took vitamin and mineral supplements. The prevalence of familial diet-related diseases ranged from 3.2% in the case of hyperlipidaemia to 65.6% in the case of hypertension.

Table 1. Socio-demographic characteristics of the studied children and their families

Variable	Girls (n = 63)	Boys (n = 65)	All children (n = 128)
Child's age (years)	5.4±0.8 ¹	5.4±0.7 ¹	5.4±0.7 ¹
Mother's age (years)	31.5±4.4 ¹	32.3±5.0 ¹	31.9±4.7 ¹
Father's age (years)	34.3±4.7 ¹	34.4±5.4 ¹	34.4±5.1 ¹
Mother's education			
Vocational ³ (%)	8.1	4.6	6.3
Secondary ⁴ (%)	40.3	47.7	44.1
Higher ⁵ (%)	51.6	47.7	49.6
Father's education			
Primary ² (%)	3.4	0.0	1.6
Vocational ³ (%)	16.9	20.0	18.5
Secondary ⁴ (%)	47.5	46.2	46.8
Higher ⁵ (%)	32.2	33.8	33.1
Parents' assessment of the economic status of the family			
Bad	3.2	1.6	2.4
Average	33.9	37.5	35.7
Good	48.4	51.5	50.0
Very good	14.5	9.4	11.9
Number of children in the family			
One (%)	42.8	40.0	41.5
Two (%)	50.8	46.2	48.4
Three (%)	3.2	12.3	7.8
Four (%)	3.2	1.5	2.3
The sequence of the child in the family			
First (%)	69.8	71.8	70.9
Second (%)	27.0	20.3	23.6
Third (%)	1.6	6.3	3.9
Fourth (%)	1.6	1.6	1.6

¹mean ± standard deviation

²eight years of primary school

³eight years of primary school followed by three years of vocational school

⁴eight years of primary school followed by four years of secondary school

⁵eight years of primary school, four years of secondary school and three to five years of studies ending in receiving bachelor's or master's degree

DISCUSSION

Socio-demographic characteristics

The percentages of girls and boys in the studied population were 49% and 51%, respectively, that is the same as in the general Polish population of 4-6-year-olds [8]. Mothers of the studied children were within the age range of 22-45 years, while fathers were within the age range of 25-46 years. In Poland, the percentages of females aged 20-49 years with vocational, secondary and higher education are 17.4%, 34.6% and 30.2%, respectively, and the percentages of males aged 25-49 years are: 31.6%, 29.5% and 21.3%, respectively [8]. It was not possible to compare the exact age ranges due to the way of data presentation in the cited demographic yearbook [8]. This comparison shows that the studied children's parents were better educated than their peers

Table 2. Selected indices of health status of the studied children and their families

Variable	Girls (n = 63)	Boys (n = 65)	All children (n = 128)
Birth weight (kg)	3.3±0.5 ¹	3.4±0.5 ¹	3.3±0.5 ¹
Food allergies (%)	11.1	6.2	8.6
Other allergies (%)	12.7	21.5	17.2
Taking medicines (%)	21.0*	41.5*	31.5
<i>Taking dietary supplements</i>			
Vitamin C supplements	10.5	9.6	10.1
Multivitamin supplements	11.8	12.0	11.9
Vitamin C and multivitamin supplements	3.9	6.0	5.0
Vitamin and mineral supplements	34.2	33.8	34.0
None	39.6	38.6	39.0
<i>Familial diabetes</i>			
Total (%)	49.2	47.7	48.4
Parent(s) (%) ²	1.6	3.1	2.3
Grandparent(s) (%) ²	34.9	33.8	34.4
Great-grandparent(s) (%) ²	15.9	13.8	14.8
Aunt and/or uncle (%) ²	3.2	1.5	2.3
<i>Familial obesity</i>			
Total (%)	27.0	30.8	28.9
Parents (%) ²	4.8	7.7	6.3
Grandparents (%) ²	17.5	26.2	21.9
Great-grandparents (%) ²	1.6	1.5	1.6
Aunt and/or uncle (%) ²	4.8	3.1	3.9
<i>Familial myocardial infarction</i>			
Total (%)	38.1	33.8	35.9
Grandparents (%) ²	34.9	24.6	29.7
Great-grandparents (%) ²	4.8	10.8	7.8
<i>Familial hyperlipidaemia</i>			
Total (%)	3.2	3.1	3.2
Parents (%)	0.0	3.1	1.6
Grandparents (%)	1.6	0.0	0.8
Great-grandparents (%)	1.6	0.0	0.8
<i>Familial hypertension</i>			
Total (%)	61.9	69.2	65.6
Parents (%) ²	4.8	15.4	10.2
Grandparents (%) ²	58.7	60.0	59.4
Great-grandparents (%) ²	4.8	7.7	6.3
Aunt and/or uncle (%) ²	3.2	3.1	3.1
<i>Familial osteoporosis</i>			
Total (%)	6.3	18.5	12.5
Grandparents (%)	6.3	13.8	10.2
Great-grandparents (%)	0.0	4.7	2.3
<i>Familial cancer</i>			
Total (%)	33.3	32.8	33.1
Parents (%) ²	3.2	1.5	2.3
Grandparents (%) ²	17.5	18.5	18.0
Great-grandparents (%) ²	12.7	12.3	12.5
Aunt and/or uncle (%) ²	3.2	1.5	2.3

¹mean±standard deviation

²The sum of the percentages exceed total percentage because some children had more than one member of the family who suffered from a given disease.

*Asterisks denote statistically significant results ($P=0.013$).

in the general population, especially mothers. Most probably, the high educational level of the parents enabled them to get a well-paid job and maybe that is why such high percentages of them assessed the economic status of the family as good or very good. The same tendency was observed in the group of 6-12-year-old children from various regions of Poland: as many as 53.2% of mothers and 39.8% of fathers had higher education and most of them assessed the economic status of the family either as good, 56.9%, or very good, 10.5% [4].

Unfortunately, there is no data on the number of children in Polish families in the demographic year-book [8]. In comparison to 5-6-year-old children from Pabianice [5], 3-7-year-old children from the Mazowsze region [21], 6-year-old children from Nowy Sącz and the vicinity [17] and 3-6-year-old children from Turek [22], the same tendency may be observed: that the percentages of families with two children were the highest followed by the percentages of families with one child. The only exception was the population of 3-6-year-old children from Darłowo [23] in which this tendency was opposite.

The high educational level of the parents along with the quite high percentages of those who assessed the economic status of their family as good or very good and the fact that most of the parents had no more than two children are all factors which favour a healthy lifestyle of the family.

Health status

The birth weight of the studied children was the same or similar to the birth weight of preschool children from other regions of Poland: Pabianice [5], the Mazowsze region [21], Darłowo [23], Nowy Sącz and the vicinity [20] and Turek [22].

It is unusual that a higher percentage of the studied girls, compared to boys, suffered from food allergies. This was observed only among preschoolers from Turek [22] while in other previous studies on children from various regions of Poland [5, 20, 21, 23] a higher percentage of boys, compared to their female peers, suffered from food allergies. The percentage of the studied girls who suffered from food allergies was similar to the percentage of preschool girls from Turek [22] and higher than among girls from other regions of Poland [5, 20, 21, 23], whereas the percentage of the studied boys who suffered from food allergies, in comparison to preschool boys from other regions of Poland [5, 20, 21, 23], was the lowest.

The higher percentage of the studied boys who suffered from other allergies, compared to the studied girls, was also observed among preschoolers from Pabianice [5], Nowy Sącz and the vicinity [20], and Turek [22]. Also in the general population of Polish children aged 0-4 years and 5-9 years [7], allergies are more prevalent

among boys than girls. The percentage of the studied boys who suffered from other allergies was the highest in comparison to their male peers from other regions of Poland [5, 20, 21, 22, 23] and this caused that also the percentage of the whole studied population of preschoolers who suffered from other allergies was the highest compared to preschoolers from other regions of Poland [5, 20, 21, 22, 23].

Statistically significantly higher percentage of boys who took medicines than their female peers was also observed among children from Pabianice [5]. In the other populations of preschool children studied previously [20, 21, 22, 23], the same tendency was observed, however, it was not statistically significant. It is disconcerting that the percentages of both girls and boys who took medicines were the highest in comparison to the percentages of girls and boys from other regions of Poland [5, 20, 21, 22, 23] and that the percentage of the studied boys was so high. This is partly because of the high percentage of the studied preschoolers who suffered from allergies since antiallergic drugs are the third most frequently used drugs by children aged 0-4 years and 5-9 years, right after antibiotics and drugs for cold, flu or sore throat [7].

The finding that most of the studied preschoolers took dietary supplements is in accordance with another study on preschool children from Kraków [13] of whom 62.2% took vitamin and/or mineral supplements. Among 6-year-old children from Nowy Sącz and the vicinity [20], the percentage of those who took vitamin and mineral supplements was even higher, 78.0%. However, in other studies on children of similar age from various countries, the percentages of those who used dietary supplements were lower: 54.2% of Korean 1-6-year-olds [12], 45% and 36% of the United States 2-5-year-olds and 6-11-year-olds, respectively [2], 41.5% of Polish 6-9-year-olds [4], 31.2% of Flemish 2.5-6.5-year-olds [10], 24% of British 4-10-year-old girls and 27% of British 4-10-year-old boys [3], 22.6% and 32.4% of Chinese children aged 5 years and less who lived in Australia and China, respectively [6], and 15% of Japanese children aged 6 years and younger [26]. These percentages show that using dietary supplements is quite popular among children. The differences in the prevalence of using dietary supplements may probably be explained mostly by the differences in age ranges of the studied preschoolers and the previously studied children [2, 3, 4, 6, 10, 12, 26]. In the National Health and Nutrition Examination Survey, 2007-2010, carried out in the United States, the highest prevalence of use of dietary supplements was observed among 2-5-year-old children and decreased with increasing age [2]. In Korean children aged 1 to 6 years, the highest intake rate of dietary supplements was observed in children aged 5 years, while in those aged 3 to 6 years – higher

than in those under three years [12]. Among Hawaiian children, the prevalence of supplement use was higher in 6-9-year-olds, 48%, in comparison to 10-13-year-olds, 31% [16]. In Polish children, the percentage of children who took dietary supplements was the highest among 4-6-year-olds and decreased with increasing age [29]. It is noteworthy that among Chinese children aged 5 years and less, in whom the prevalence of using dietary supplements was higher in those who lived in China than in those who lived in Australia, the majority of children who lived in China were aged 3 to 5 years while the majority of children who lived in Australia were aged 2 years or less [6].

Our finding that the most frequently used dietary supplements were vitamin and mineral supplements is in accordance with the study on 7-12-year-old Polish children [14], the United States children and adolescents aged 19 years and less [2] and Hawaiian 8-11-year-old children [16]. It is noteworthy that most of the studied children's parents were convinced that the supplements they bought for their children contained only vitamins. In the other studies, usually multivitamin supplements were most frequently used by children of various ages [3, 10, 13, 27].

Taking dietary supplements by most of the studied children was not favourable. Parents should be educated that first of all they should balance their children's diets using foods and that supplements should be used exceptionally in the case when providing adequate amounts of all vitamins and minerals with food is not possible. Most probably, giving dietary supplements to children is so popular because of many commercials which emphasise the benefits of eating lots of vitamins and minerals in the daily diet and which present these supplements as the best way to achieve this goal. However, no information is included that excessive intake of these nutrients may have adverse health effects. Parents, who are not aware of this and of the fact that these nutrients should be provided with a balanced diet, buy dietary supplements for their children because they want to keep them healthy. Previous studies showed that the primary reason for using dietary supplements was improving or maintaining health [2], however, only very low percentages of children used these supplements to treat or prevent specific health conditions [2, 26].

It is also important to note that we concluded from our observations while carrying out various studies on preschoolers and talking to parents that they most often give their children dietary supplements in the autumn and winter in order to prevent their children from falling ill. This result shows the urgent need to educate parents that vitamin and mineral supplements should be used only in exceptional situations and only after having consulted it with a paediatrician. Among children aged 2 to 5 years and 6 to 11 years in the United States, only

17.2% and 11.0%, respectively, used dietary supplements on the advice or recommendation of a physician or other health care professional [2]. In Japanese children aged 6 years and younger, only 3.5%, 6.3% and 11.8% of their parents consulted dietary supplement use with a nutritionist, a physician or a pharmacist, respectively [26].

Above all, it is crucial to educate parents about rich dietary sources of vitamins and minerals. Previous studies showed that this knowledge among preschoolers' parents is low [19] while being indispensable to balance the children's daily diets. Using dietary supplements by people who do not have sufficient knowledge may not be able to compensate inadequate intake while increasing the risk of excessive intake. Previous studies showed that although parents used dietary supplements for their children, intakes of vitamin D and calcium were still too low [1, 9, 10, 27]. On the other hand, the studies showed that younger children had more adequate diets and that dietary supplements were most often useless. The findings from the National Health and Nutrition Examination Survey, 2003-2006, showed that among 2-8 year-olds the United States the prevalence of inadequate intakes of phosphorus, copper, selenium, folate, and vitamins B₆ and B₁₂ was minimal from foods alone and that using dietary supplements increased the likelihood of intakes above the Tolerable Upper Intake Level for iron, zinc, copper, selenium, folic acid, and vitamins A and C [1]. Therefore, this study [1] showed that children 2 to 8 years old had nutritionally adequate diets regardless of supplement use and that supplement use contributed to the potential for excessive intakes of some nutrients [1]. Similar conclusions were drawn from the study on Hawaiian children aged 6 to 8 years among whom the prevalence of dietary nutrient adequacy from foods alone ranged from 97% to 100% for all selected vitamin and minerals except for vitamins E, A and C in the case of which the prevalence was 63%, 86% and 90%, respectively [16]. Although supplement use increased the prevalence of adequate intakes in the case of these three vitamins, it had little effect on the adequacy of other nutrients [16]. In Flemish preschoolers, dietary intakes from food only, except for vitamin D intake, were higher than the dietary reference values for vitamins B₁, B₂ and C, as well as sodium, potassium, calcium, phosphorus, iron, magnesium and zinc, showing that many children were taking dietary supplements unnecessarily [10]. The DONALD cohort study on German children aged 2 to 18 years, which included 4-6-year-olds, showed that for most of the vitamins, intakes from food were at least adequate and that in a considerable number of children, intakes of vitamin A and folic acid exceeded the Tolerable Upper Intake Level [27].

Using dietary supplements for the children by their parents who do not have sufficient knowledge is even more risky when taking into account the wide assortment of fortified foods and their commercials addressed to children. A study on Polish 6-12-year-olds showed that fortified foods were used by as many as 85% of children who also used dietary supplements [25]. Moreover, 76% of the parents were unaware that their children ate fortified foods [25].

The percentages of parents who reported diet-related diseases in their families cannot be compared directly to the prevalence of these diseases in the general population. This is because – as discussed in the previous article [20] – each child has several relatives which increase the probability of reporting at least one relative who suffers from a diet-related disease. However, the prevalence of familial diet-related diseases in the studied population reflects the prevalence of these diseases in Europe and in the Polish society. Familial hypertension was reported by the highest percentage of the studied preschoolers' parents, the same as in our previous studies [21, 22, 23], and high blood pressure, right after dietary risks, ranks the highest among the risk factors for death in Europe [11]. Myocardial infarction was the other cardiovascular disease, apart from hypertension, which was reported by a high percentage of the parents and these are cardiovascular diseases which have been the main cause of death in Poland for at least 24 years [28]. Diabetes was the second most frequently reported diet-related disease by the studied parents, the same as among parents of preschoolers from Turek [22]. Among parents of preschoolers from the Mazowsze region [21] and Darłowo [23], diabetes was the third most frequently reported diet-related disease. Osteoporosis was last but not one among the diet-related diseases reported both by parents of the studied children and by parents of children from other regions of Poland [21, 22, 23] while hyperlipidaemia was the last one. The cause of such a low percentage of parents who reported familial hyperlipidaemia is probably unawareness of suffering from this disease which was proved in the Polish national WOBASZ study [24].

CONCLUSIONS

1. The high percentage of the studied preschoolers who took dietary supplements shows the need to educate parents about the adverse effects of excessive intake of these nutrients and about the necessity to take such supplements only on recommendation of the paediatrician.
2. The analysed indices of health status of the studied children and their families show the need to pay much attention to balanced diet and daily physical

activity in order to prevent diet-related diseases in the studied preschoolers and their families.

Acknowledgement

This study was financed by the National Science Centre in Poland from the resources for financing research in the years 2010-2014 as a research project N N404 140437.

Conflict of interest

The authors declare no conflict of interest.

REFERENCES

1. Bailey R. L., Fulgoni V. L., Keast D. R., Lentino C. V., Dwyer J. T.: Do dietary supplements improve micronutrient sufficiency in children and adolescents? *J Pediatr* 2012;161:837-842.
2. Bailey R. L., Gahche J. J., Thomas P. R., Dwyer J. T.: Why US children use dietary supplements. *Pediatr Res* 2013;74(6):737-741.
3. Bates B., Lennox A., Prentice A., Bates C., Page P., Nicholson S., Swan G.: National Diet and Nutrition Survey. Results from Years 1, 2, 3 and 4 (combined) of the Rolling Programme (2008/2009 – 2011/2012). Available from: <https://www.gov.uk/government/publications/national-diet-and-nutrition-survey-results-from-years-1-to-4-combined-of-the-rolling-programme-for-2008-and-2009-to-2011-and-2012> (27.01.2015).
4. Bylinowska J., Januszko O., Rolf K., Sicińska E., Kaluża J., Pietruszka B.: Factors influencing vitamin or mineral supplements use in a chosen group of children aged 6-12. *Rocz Panstw Zakl Hig* 2012;63(1):59-66 (in Polish).
5. Chalcarz W., Merkiel S., Hodyr Z.: Nutritional status of preschool children from Pabianice. *New Med (Wars)* 2008;12(2):29-35.
6. Chen S., Binns C. W., Maycock B., Liu Y., Zhang Y.: Prevalence of dietary supplement use in healthy preschool Chinese children in Australia and China. *Nutrients* 2014;6:815-828.
7. Główny Urząd Statystyczny (Polish Central Statistical Office): Health status of the Polish population in 2009. Zakład Wydawnictw Statystycznych, Warsaw, 2011 (in Polish).
8. Główny Urząd Statystyczny (Polish Central Statistical Office): Demographic Yearbook of Poland. Zakład Wydawnictw Statystycznych, Warsaw, 2012.
9. Hamulka J., Wawrzyniak A., Starzak-Jankowska E.: Contribution of supplements to the intake of minerals by school children. *Bromat Chem Toksykol* 2010;43(1):51-59 (in Polish).
10. Huybrechts I., Maes L., Vereecken C., De Keyser W., De Bacquer D., De Backer G., De Henauw S.: High dietary supplement intakes among Flemish preschoolers. *Appetite* 2010;54:340-345.
11. Institute for Health Metrics and Evaluation: Global Burden of Disease (GBD) Arrow Diagram. Available

- from: <http://www.healthmetricsandevaluation.org/gbd/visualizations/gbd-arrow-diagram> (08.10.2014).
12. Kang D. S., Lee K. S.: The status of dietary supplements intake in Korean preschool children: data from the Korea National Health and Nutrition Examination Survey 2010-2012. *Pediatr Gastroenterol Hepatol Nutr* 2014;17(3):178-185.
 13. Kozioł-Kozakowska A., Piórecka B., Jagielski P., Schlegel-Zawadzka M.: Diet supplementation with vitamin-mineral preparations among preschool children in Krakow. *Żyw Człow* 2009;36(1):12-18 (in Polish).
 14. Kozyrska J., Januszko O., Urbańska A., Pietruszka B.: Profile of dietary intake of vitamin and mineral supplements and fortified food products among children aged 7-12 years. *Probl Hig Epidemiol* 2010;91(4):549-555 (in Polish).
 15. Magnussen C., Niinikoski H., Juonala M., Kivimäki M., Rönnemaa T., Viikari J., Simell O., Raitakari O.: When and how to start prevention of atherosclerosis? Lessons from the cardiovascular risk in the young Finns study and the special Turku coronary risk factor intervention project. *Pediatric Nephrology* 2012;27(9):1441-1452.
 16. Martin C. L., Murphy S. P., Novotny R.: Contribution of dietary supplements to nutrient adequacy among children in Hawaii. *J Am Diet Assoc* 2008;108:1874-1880.
 17. Merkiel S.: Dietary intake in 6-year-old children from southern Poland: part 1 - energy and macronutrient intakes. *BMC Pediatrics* 2014;14:197. doi:10.1186/1471-2431-14-197.
 18. Merkiel S., Chalcarz W.: Nutrition in preschool age: Part 1. Importance, reference values, methods of research and their application. Review. *New Med. (Wars.)* 2007;11(3):68-73.
 19. Merkiel S., Chalcarz W.: Nutritional knowledge of parents of preschool children from Nowy Sącz and the vicinity. 3. Rich sources of minerals and vitamins. *Nowa Pediatr* 2010;14(1):15-20 (in Polish).
 20. Merkiel S., Chalcarz W.: Selected indices of health status in 6-year-old children and their families from southern Poland. *New Med (Wars)* 2014;18(3):79-82.
 21. Merkiel S., Chalcarz W., Deptuła M.: Comparison of physical activity and favourite ways of spending free time in preschool girls and boys from the Mazowsze region. *Rocz Panstw Zakl Hig* 2011;62:93-99 (in Polish).
 22. Merkiel S., Chalcarz W., Mielczarek D.: Ordinary and additional physical activity and favourite ways of spending leisure time in preschool children from Turek. *Medycyna Rodzinna* 2014;17(3):112-120 (in Polish).
 23. Merkiel S., Chalcarz W., Roszak M.: Analysis of physical activity in preschool children from Darłowo. Part 1. Ordinary and additional physical activity and favourite ways of spending leisure time. *Medycyna Rodzinna* 2014;17(1):3-11 (in Polish).
 24. Pająk A., Wiercińska E., Polakowska M., Kozakiewicz K., Kaczmarczyk-Chalas K., Tykarski A., Gaździk D., Zdrojewski T.: Prevalence of dyslipidemia in men and women between the ages of 20-74 in Poland. Results of the WOBASZ program. *Kardiol Pol* 2005;63, 6 (Suppl 4):S620-S625 (in Polish).
 25. Rolf K., Januszko O., Bylinowska J., Sicińska E., Pietruszka B., Kaluża J.: Influence of selected factors on fortified food intake by children. *Rocz Panstw Zakl Hig* 2012;63(3):339-346 (in Polish).
 26. Sato Y., Yamagishi A., Hashimoto Y., Virgona N., Hoshiyama Y., Umegaki K.: Use of dietary supplements among preschool children in Japan. *J Nutr Sci Vitaminol* 2009;55:317-325.
 27. Sichert-Hellert W., Wenz G., Kersting M.: Vitamin intakes from supplements and fortified food in German children and adolescents: results from the DONALD Study. *J Nutr* 2006;136:1329-1333.
 28. Stańczak J.: Basic information about demographic situation in Poland in 2011. Główny Urząd Statystyczny, Departament Badań Demograficznych (*Polish Central Statistical Office, Department of Demographic Studies*). Material for press conference on the 27th of January 2012 (in Polish).
 29. Szponar L., Stoś K., Oltarzewski M.: Dietary supplements in nutrition of children and adolescents. *Pediatr Współcz Gastroenterol Hepatol Żywienie Dziecka* 2007;9(1):41-44 (in Polish).

Received: 20.11.2014

Accepted: 10.02.2015

