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EXPERIMENTAL PAPER

Pilot study of dietary supplement consumption by kindergarten and elementary school children (*ahead of print*)

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Summary

Introduction: The use of dietary supplements has been increasing globally, especially among children. A lot of parents are influenced by advertising. In addition, in Poland a trend to self-medication has been observed. Parents often do not distinguish dietary supplements, medicinal products and non-prescription drugs. These are the most common reasons for the increase in sales of dietary supplements in Poland. Until a few years ago, many products containing vitamins and minerals intended for children were sold as medicines. Today, a product with the same formulation is sold as a dietary supplement. However, a few studies have been conducted to assess the use of dietary supplements among Polish children.

Objective: The aim of the study was to analyse the use of dietary supplements provided by parents and the study of the awareness of the risks associated with supplements intake among preschool and elementary school students.

Methods: The study was conducted by questionnaire method among 316 parents/legal guardians of children attending elementary schools and preschools in three provinces.

Results: The questionnaire was completed by 88.3% mothers and 11.7% fathers. The age of the respondents was as follows: 64.5% aged 31–40, 18.3% aged 41–45, 9.5% aged 26–30, 7.2% above 46 years and only 0.3% younger than 25. About 80% of parents administered their children with dietary supplements in specific situations. Vitamin and mineral supplements were predominant. A statistical analysis showed the effect of the education level as well as having many children on the administration of dietary supplements.

Conclusion: The questionnaire shows that the vast majority of parents/legal guardians administer their children with dietary supplements. There is a need to educate parents/legal guardians about the use of supplements and the risks involved.

Key words: *dietary supplements, herbal substances, preschool, elementary school, children, Poland*

Słowa kluczowe: *suplementy diety, substancje ziołowe, przedszkole, szkoła podstawowa, dzieci, Polska*

INTRODUCTION

The definition of dietary supplement is understandable in the European Union. It is a condensed source of vitamins and minerals and, in several cases, also other active substances. A composition of dietary supplement is not regulated by pharmaceutical law. The simultaneous presence of products containing the same ingredients, e.g. herbs in pharmacies and herbal stores is confusing for the consumer, who finds it difficult to properly identify the particular product. In products dedicated to children, there is also a large group of food preparations enriched with vitamins, minerals and other substances supporting child development. Caring parents often administer them with a lot of vitamin and mineral preparations as well as other substances, such as fish oil or plant substances etc., which can lead to hypervitaminosis in children. Parents search for dietary supplements, not knowing that they can purchase a medicinal product containing the same active ingredient. The dietary supplement market is the one of the fastest growing areas in the pharmacy segment. It is estimated that the value of the dietary supplements market in 2017 was 4.4 billion PLN; 72% of Poles surveyed declared the consumption of dietary supplements, with 48% of them regularly.

MATERIALS AND METHODS

The survey included 14 questions concerning dietary supplements dedicated to children. The questions concerned respondents' knowledge about dietary supplements and the reasons for their use in children, observed benefits and safety. The survey consisted mostly of closed questions, with single or multiple-choice answers.

Data obtained from the question: "Did your child previously take or is currently taking any dietary supplements?" was classified as yes or no. Data concerning the use of dietary supplements involved two groups of people: a group that used/is using dietary supplements and a group that has never used dietary supplements.

Factors influencing key outcomes were demographic variables of parents/legal guardians of

children (i.e., age, gender, education level, number of children). Secondary outcomes were influenced by the degree of correctness in defining a dietary supplement, reasons for decision to administer children with dietary supplements, source of information about dietary supplements, periods of administration of dietary supplements, and types of dietary supplements administered. A survey was conducted among parents/legal guardians of preschool and elementary school children 2018/2019. The survey among parents of school and preschool children was conducted in Kujawsko-Pomorskie, Świętokrzyskie and Wielkopolskie provinces.

The chi-square test was used to assess the significant differences in use of dietary supplements depending on demographic data.

Ethical approval: The conducted research is not related to either human or animal use.

RESULTS

The survey was conducted to obtain information on the consumption of dietary supplements by children. In the study 316 respondents were involved (279 females, 37 males). More than half of the respondents were 31–40 (64.5%), about 18.3% of respondents were 41–45, 9.5% of respondents were 26–30 years, and those at the age of 46 and above constituted 3% of respondents. The least numerous group were those aged 25 and younger, only 0.32%. The education of the respondents was as follows: 61.4% of them had an university education, 29.1% had a secondary education, 9.5% had a vocational education. 60% of those participating in the survey had two children, about 30% had one child, 3.2% had three children, and only 0.3% had five or more children. Among the offspring of the respondents, the gender distribution was comparable, with a slight predominance of girls.

As many as 73.4% of parents formulated the definition of a dietary supplement correctly; 17.4% of parents confused supplement with medicinal product. About 9% of respondents knew that a dietary supplement is food, but did not know exactly which categories of products they administered to their children.

At a time of the survey, the proportions of parents who administered or did not administer their children with dietary supplements were similar (56% of parents did not and 44% of parents did).

Table 1.

Dietary supplement use in preschool and elementary school children by demographic characteristics

n=316 Parents/legal guardians	
Parent's/legal guardian's age	
≤25	1
26-30	30
31-40	204
41-45	58
≥46	23
Parent's/legal guardian's education	
Vocational	30
Secondary	92
Higher	194
Number of children owned	
one	94
two	190
three	21
≥ four and more	11

Table 1 represents the use of dietary supplements based on sociodemographic data.

When asked if their child were ever administered with dietary supplements, as many as 80% of parents responded positively. Only 19% of parents declared that they have never given dietary supplements to their children. In this group, 62.34% of parents stated that they did not see such a need, 24.68% of parents did not trust such preparations, and 10.4% of parents considered them ineffective. Only 2.6% of parents cited economic considerations as a factor limiting the administration of dietary supplements.

What is interesting, as many as 33% of parents in this group administered their children with dietary supplements out of awareness. Most frequently they gave dietary supplements products such as: Cholinex junior (21.15%), Acidolac baby drops for infants (18.27%), Pneumolan gardlo lollipops (13.46%), Sinulan forte junior syrup (5.77%), Apetizer (4.8%), over 3% of respondents used Gardimax herbal syrup, Fjorda junior, Bioaron baby, more than 2% of respondents used Sanprobi super formula or Pneumolan plus. These preparations contained, in addition to vitamin C, B group vitamins and minerals, herbal ingredients such as chamomile (*Matricaria*

chamomilla L.), peppermint (*Mentha piperita* L.), sage (*Salvia officinalis* L.), thyme (*Thymus vulgaris* L.), Iceland moss (*Cetraria islandica* L.), linden (*Tilia cordata* Miller/*Tilia platyphyllos* Scopoli), marshmallow (*Althae officinalis* L.), elderberry (*Sambucus nigra* L.), African geranium (*Pelargonium sidoides* DC), common verbena (*Verbena officinalis* L.), mullein (*Verbascum thapsiforme* L.), anise (*Pimpinella anisum* L.), common chicory (*Cichorium intybus* L.), fennel (*Foeniculum vulgare* Mill.) and great yellow gentian (*Gentiana lutea* L.).

Respondents administered their children with dietary supplements searched for information about them both in the Internet (29.56%) and in pharmacies (27.67%). For 24.84%, the source of information was paediatrist; to a lesser extent the respondents drew their knowledge from advertisements (12.58%) and from friends (5.35%).

Most of respondents declared that their child receives only one dietary supplement (69.56%), simultaneous administration of two products was declared by 27.67% of respondents, and three or more by only 2.77% of respondents.

Most often respondents supplemented their children in autumn (35.57%) and winter (36.76%). During whole year, dietary supplements were administered by 23.32% of parents, and only a few parents decided to administer dietary supplements in spring (6.3%) and in summer (0.79%). 85% of parents reported reading the dietary supplement label and 91% reported not overdosing the recommended daily intake.

The main reason for administering dietary supplements to children was to improve the immune system and supplement deficiencies of vitamins and minerals (46.85%), prevent diseases (31.89%) and treat diseases such as sore throat, cold or stomach ache (27.16%). To a lower extent, dietary supplements were administered in children in order to improve concentration (7.09%), condition of skin, hair and nails, and to relieve stress (3.15%). Few parents decided to use dietary supplements to increase physical performance (2.36%) and control body weight (0.39%).

Most often parents gave their children fish oil, essential fatty acids (omega 3, omega 6) - 50.19% or probiotics - 48.62%. Vitamin-mineral preparations were given by 41.12% of parents, vitamins alone by about 36.36% of parents and minerals alone by 5.1% of parents. About 11.86% of parents administered bee products. Plant and vitamin dietary supplements were administered by approximately 15.41% of parents.

A similar number of parents decided to administer plant-vitamin-mineral (6.32%) and plant-only (6.3%) dietary supplements. Among plant materials, parents most often decided to give their children preparations containing garlic (*Allium L.*) (33.99%), elderberry (*Sambucus nigra L.*) (30.43%), linden (*Tilia cordata Mill.*) (25.69%), marsh-mallow (*Althaea officinalis L.*) (24.11%), dog rose (*Rosa canina L.*) (23.72%), echinacea (*Echinacea Moench*) (19.76%), chamomile (*Matricaria chamomilla L.*) (15.02%), thyme (*Thymus vulgaris L.*) (13.04%), sage (*Salvia officinalis L.*) (10.28%), fennel (*Foeniculum vulgare Mill.*) (9.88%). Parents also declared the administration of dietary supplements containing herbs such as mint (*Mentha L.*), onion (*Allium cepa L.*), African geranium (*Pelargonium sidoides DC.*), dandelion (*Taraxacum officinale F.H. Wiggers coll.*), Ashwagandha-Indian ginseng (*Withania somnifera L.*) – as well as raspberry (*Rubus L.*), black chokeberry (*Aronia melanocarpa Michx. Elliott.*), sea-buckthorn (*Hippophae rhamnoides L.*) and blackcurrant fruits (*Ribes nigrum L.*).

The statistical analysis did not show the influence of parents' education level on the knowledge about the correct definition of a dietary supplement. However, it was noticed that education level influenced the administration of dietary supplements. The better educated the parents were, the more willingly they administered supplements to their children. The trend was similar in the case of parents and legal guardians who were in the process of administering dietary supplements during the survey and in the group that declared that they had administered dietary supplements to children in the past. In the group of parents who administered dietary supplements at the time of the survey, 3.6% had a vocational education, 25.18% of them had a secondary education and 71.22% of them had a higher education ($p=0.00078$). Among parents and legal guardians who declared that they had given their children dietary supplements in the past, 8.27% of parents had a vocational education, 25.59% of parents had had a secondary education, and 66.14% had had a higher education ($p=0.00211$).

A correlation was also found between the family size and administration of dietary supplements. The administration of dietary supplements by parents of 1 or 2 children showed no significant differences. Statistically significant differences in the administration of dietary supplements to children were observed in the group of parents with 3 or more children. Only 4.32% of large families chose to administer dietary supplements during the study ($p=0.00241$); 8.27% of large families reported that

they had given dietary supplements to their children in the past ($p=0.02662$).

A statistically significant difference was observed depending on the age of the respondents who declared the administration of dietary supplements to their children at the time of the study. Approximately 71.94% of parents aged 31–40 declared that they were administering dietary supplement to their children during our survey ($p=0.01729$).

DISCUSSION

The results obtained in our study are similar to those derived from the research by Bylinowska *et al.* 2012 [1]. A statistically significant relationship was noted between the education level of the parent/legal guardian and the use of dietary supplements. More children consuming dietary supplements were among those whose parent/legal guardian had a secondary or higher education. However, no statistically significant correlations were found between the use of dietary supplements and gender, age, residential environment (urban, rural) and the financial situation of children in the Bylinowska *et al.* 2012 study [1]. In our study it was observed that the higher the parents' education, the more often their children received nutritional supplements. A similar relationship was noted by Kozyrska *et al.* 2010 [2] where parents higher and secondary educated administered more often dietary supplements to their children than those with a primary education. One determining factor may be greater understanding of dietary errors by parents with higher levels of education. These people are also more often interested in health problems, more often read press concerning healthy lifestyle and use information from the Internet and television, where materials on the topic of healthy diet and information on dietary supplements often appear [3]. A similar dependence was also found in countries such as Belgium and the UK [4, 5]. In these countries, parents' level of education and their interest in a healthy diet also influenced the administration of dietary supplements to children.

In our study, a relationship was found between having a large family and the administration of dietary supplements. Parents with three or more children administered dietary supplements less frequently. The fact that there is a statistically significant difference in the administration of dietary supplements in large families may be due to the high cost of dietary supplements, smaller financial resources of large families,

higher costs of living for large families, but also a greater child-rearing expertise, and the administration of medicinal products as more effective. In the U.S., not only parental education but also material status influenced the administration of supplements to children. It was also found that children born first were statistically more likely to be given supplements than their younger siblings. [6]. In our study, parents did not cite high prices of dietary supplements as the main reason for not giving them. However, it seems that the economic factor associated with supporting a large family may influence the frequency of giving dietary supplements to children. In Kozioł-Kozakowska's study among preschool children, it was observed that parents with higher incomes were statistically more likely to administer their children with dietary supplements [7]. Also, education level and socioeconomic status influenced the frequency of giving dietary supplements to the children of US residents. In the Multiethnic and Cohort VITAL study, educational level was positively associated with supplement use [9, 10].

In the study of Kozyraska *et al.* 2010 [2], most children were given vitamin-mineral supplements (53% of the subjects) and the smallest group was administered with preparations containing only one vitamin (8%). In our study, parents were also willing to give their children vitamin-mineral supplements, as well as fish oil, essential fatty acids (omega 3, omega 6) and probiotics. To a lower extent, children were given plant-vitamin-mineral supplements and plant-only supplements.

The frequency of administering dietary supplements to children is similar in our experiments and the studies performed by Kozyraska *et al.* [2]. Only one dietary supplement was used in 76% children, two preparations were administered to about 21% of children, and three preparations were administered to about 3%. Similar results were obtained in the work of Kobayashi *et al.* 2018 [11], where the majority of children (72.8%) took one preparation, and more than a quarter of children used two or more preparations simultaneously; only 0.8% mothers gave their children more than five preparations.

Similar to our study, parents in Japan also sought information about dietary supplements on the Internet or in pharmacies. Interestingly, in Japan, mothers of boys were more likely to use the Internet (42.3%) and mothers of girls were more likely to use a pharmacy or drugstore (46%) [11]. In few cases, the administration of dietary supplements was prescribed by the physician, the exception may be the recommendation to supplement infants' diet with vitamin D. In

the majority of studies, the authors indicated that parents themselves made the decision to administer dietary supplements [1, 2, 11]. In a 2012 study by Bylinowska *et al.*, dietary supplements containing vitamins and/or minerals were most often given to children as a result of parents' own decision (66.9%), followed by doctor's recommendations (31.3%), and less often by a pharmacist's advice (1.9%) [1]. The most common reasons for giving the child additional vitamins or minerals were: the beneficial effect of these preparations on health (43%) and the belief that the child's diet is poor in nutrients (41%). Dietary supplements were rarely used on a doctor's recommendation (2.2%) [2].

Dietary supplements were used by a half of the children in Poland at the time of the survey.

Interestingly, dietary supplements are used all over the world, even in countries where conventional medicine is used equally with alternative medicine. In the study conducted in four primary schools in Hunan Province, China (n=706 parents/guardians of children aged 6–12), approximately 20.4% of students were using dietary supplements. The main taken supplements were: calcium (16.7%), vitamin C (9.2%) and vitamin D (8.5%) [12]. In our study, parents also frequently administered their children with vitamins and minerals. Similar research results as in China or Poland were shown by researchers in South Korea, where 16.9–24.2% of children aged 7–12 used dietary supplements [13]. A study performed in Taiwan also found that around 22% of elementary school students were using dietary supplements [14]. As in the research in Poland, parents also decided to administer supplements to improve immunity (43.6%) [14].

In the study of the American child and adolescent population, approximately 37% of respondents used dietary supplements, 31% of respondents used only multivitamin products (MVM), 4% of respondents used single vitamins or minerals alone or in combination with a multivitamin supplement, and 2% of respondents used non-vitamin and mineral products alone or in combination with other supplements [15].

Interesting research has been conducted in children from Chinese families living in China and Australia. The survey was conducted in Perth, Western Australia (n=237) and in Chengdu and Wuhan, China (n=2,079). In China, 22.6% of the surveyed children took dietary supplements, and in Australia, 32.4%. In China, the most commonly used dietary supplements were calcium (58.5%) and zinc (40.4%), while in Australia the most frequently used

were multivitamins/minerals (46.2%) and fish oil (42.3%) [14]. In our study, fish oil, along with vitamins, was also the most common ingredient in dietary supplements administered to children. In the study by Kabayashi *et al.* [11] it was also noted that children received mostly vitamins and minerals: 31.1–53.7%. Vitamin C and B, as well as calcium and iron were used more frequently than multivitamin and multimineral mixtures. In addition, providing cod liver oil in children was particularly popular. Respondents also reported glucosamine, chondroitin, garlic, propolis, and some herbal preparations. However, these were used by only a few children, so the authors classified these products as “other” in compiling the results.

In our survey, only 19% of parents did not administer dietary supplements to their children. The reasons were: no need, lack of confidence in such products, and lack of efficacy. Only a few parents cited economic reasons as primary factor limiting the administration of dietary supplements. Interestingly, in a study from Kozyrska *et al.* [2] about 70% of parents did not declare administering dietary supplements to their children. In another study from 2012, 60% of parents did not administer dietary supplements to their children [1]. On the other hand, in another study conducted among children aged 11–12 in Mazowsze province, only 40% of children did not take dietary supplements [16]. A similar percentage of children (38%) did not use dietary supplements in a study conducted in 2007–2008 in Cracow among 223 preschool children [7]. The divergence in the results may be an effect of changes resulting from greater knowledge about products considered to be dietary supplements, as well as from the rising living standard of Polish families, resulting in the ability to spend more money on food, including dietary supplements.

CONCLUSION

In summary, dietary supplements are administered to children in Poland. Parents usually administer children with dietary supplements containing vitamins, minerals as well as fish oil or probiotics. Multicomponent dietary supplements often include herbs, which are often given to children in these products by unaware parents. An example is a group of surveyed parents declaring no administration of dietary supplements, at the same time reporting that their children consumed preparations containing chamomile (*Matricaria chamomilla* L.), peppermint (*Mentha piperita*

L.), sage (*Salvia officinalis* L.), thyme (*Thymus vulgaris* L.), Iceland moss (*Cetraria islandica* L.), linden (*Tilia cordata* Miller/*Tilia platyphyllos* Scopoli), marsh-mallow (*Althaea officinalis* L.), elderberry (*Sambucus nigra* L.), African geranium (*Pelargonium sidoides* DC), common verbena (*Verbena officinalis* L.), mullein (*Verbascum thapsiforme* L.), anise (*Pimpinella anisum* L.), common chicory (*Cichorium intybus* L.), fennel (*Foeniculum vulgare* Mill.), and great yellow gentian (*Gentiana lutea* L.). Most likely, some of these preparations had a status of dietary supplement. It turns out that despite parents/legal guardians' well-understood definition of a dietary supplement, there are still misleading products, not classified and labelled properly, in particular products located on the borderline between herbal medicine and dietary supplement.

Conflict of interest: Authors declare no conflict of interest.

REFERENCES

1. Bylinowska J, Januszko O, Rolf K, Sicińska E, Kałuża J, Pietruszka B. Czynniki warunkujące stosowanie suplementów diety zawierających witaminy i/lub składniki mineralne w wybranej grupie dzieci w wieku 6-12 lat. *Rocz Państw Zakł Hig* 2012; 63:59-66.
2. Kozyrska J, Januszko O, Urbańska A, Pietruszka B. Charakterystyka stosowania suplementów i produktów wzbogaconych w witaminy i składniki mineralne u dzieci w wieku 7-12 lat. *Probl Hig Epidemiol* 2010, 91(4):549-555.
3. Filas R. Kto w Polsce czyta prasę, jaką i czego szuka w niej. *Zeszyty Prasoznawcze* 1997; 3-4:26-46.
4. Bristow A, Qureshi S, Rona RJ, Chinn S. The use of nutritional supplements by 4-12 year olds in England and Scotland. *Eur J Clin Nutr* 1997; 51:366-369. doi: <https://dx.doi.org/10.1038/sj.ejcn.1600411>
5. Huybrechts I, Meas L, Vereecken C, Keyzer DW, Bacquer DD, Backer GD, Henauw SD. High dietary supplement intakes among Flemish preschoolers. *Appetite* 2010; 54:340-345. doi: <https://dx.doi.org/10.1016/j.appet.2009.12.012>
6. Yu SM, Kogan MD, Gergen P. Vitamin-mineral supplement use among preschool children in the

- United States. *Pediatrics* 1997; 100(5):E4. doi: <https://dx.doi.org/10.1542/peds.100.5.e4>
7. Koziół-Kozakowska A, Piórecka B, Jagielski P, Schlegel-Zawadzka M. Suplementacja diety preparatami witaminowo-mineralnymi wśród dzieci w wieku przedszkolnym w Krakowie. *Żyw Człow Metab* 2009; 36:12-18.
 8. Shaikh U, Byrd RS, Auinger P. Vitamin and mineral supplement use by children and adolescents in the 1999–2004 National Health and Nutrition Examination Survey. *Arch Pediatr Adolesc Med*. 2009 February; 163(2): 150–157. doi: <https://dx.doi.org/10.1001/archpediatrics.2008.523>
 9. Foote JA, Murphy SP, Wilkens LR, Hankin JH, Henderson BE, Kolonel LN. Factors associated with dietary supplement use among healthy adults of five ethnicities: the multiethnic cohort study. *Am J Epidemiol*. 2003; 15:157(10):888-97. doi: <https://dx.doi.org/10.1093/aje/kwg072>
 10. Satia-Abouta J, Kristal AR, Patterson RE, Littman AJ, Stratton KL, White E. Dietary supplement use and medical conditions: the VITAL study. *Am J Prev Med* 2003; 24 (1):43-51. doi: [https://dx.doi.org/10.1016/s0749-3797\(02\)00571-8](https://dx.doi.org/10.1016/s0749-3797(02)00571-8)
 11. Kobayashi E, Nishijima C, Sato Y, Umegaki K, Chiba T. The Prevalence of dietary supplement use among elementary, junior high, and high school students: A nationwide survey in Japan. *Nutrients* 2018; 10:1176. doi: <https://dx.doi.org/10.3390/nu10091176>
 12. Liu H, Zhang S, Zou H, Pan Y, Yang Q, Ouyang Y, Luo J, Lin Q. Dietary supplement use among chinese primary school students: A cross-sectional study in Hunan Province. *Int J Environ Res Public Health* 2019;16:374. doi: <https://dx.doi.org/10.3390/ijerph16030374>
 13. Kang M, Kim DW, Jung HJ, Shim JE, Song Y, Kim K, Paik HY. Dietary supplement use and nutrient intake among children in South Korea. *J Acad Nutr Diet* 2016; 116:1316-1322. doi: <https://dx.doi.org/10.1016/j.jand.2016.02.020>
 14. Chen SY, Lin JR, Kao MD, Hang CM, Cheng L, Pan WH. Dietary supplement usage among elementary school children in Taiwan: Their school performance and emotional status. *Asia Pac J Clin Nutr* 2007; 16 (Suppl. 2):554-563.
 15. Dwyer J, Nahin RL, Rogers GT, Barnes PM, Jacques PM, Sempos CT, Bailey R. Prevalence and predictors of children's dietary supplement use: the 2007 National Health Interview Survey. *Am J Clin Nutr* 2013; 97(6):1331-1337. doi: <https://dx.doi.org/10.3945/ajcn.112.052373>
 16. Wawrzyniak A, Hamułka J, Michalczyk A. Udział suplementów w spożyciu witamin przez dzieci w wieku szkolnym. *Żyw Człow Metab* 2009;36:19-24. [in Polish]