

ASSESSMENT OF KNOWLEDGE AND NUTRITIONAL STATUS OF STUDENTS BEFORE AND AFTER NUTRITIONAL EDUCATION

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ABSTRACT

Introduction. There are many educational and health programs implemented on a smaller or larger scale in Poland. Many of them address the problem of overweight and obesity in different age groups. Each such activity is considered valuable and important, since the problem of excessive body fat is growing and, in addition, poses a health risk due to the development of other diseases, including diabetes and hypertension. The aim of the study was to test the effectiveness of nutrition education implemented over a 7-week period and to assess the nutritional status of 32 students aged 20-21 from Wrocław.

Objective. The study group of students participated in a Human Nutrition course that included 30 hours of lectures and 30 hours of exercises. In the study group, the level of knowledge was assessed twice (before and after education) using a questionnaire with 13 closed questions, and body composition analysis was performed twice (before and after education) using an InBody270 analyser.

Results. The study group showed a statistically significant increase in the number of correct answers on the nutrition knowledge questionnaire after the nutrition education (average 9.7 points vs. 11.4 points; $p < 0.05$). No statistically significant differences were noted in the studied anthropometric parameters performed before and after nutrition education.

Conclusions. The knowledge gained during nutrition education allowed the surveyed students to give more correct answers in the questionnaire after the Human Nutrition course. The nutritional status of the surveyed students did not change statistically significantly, but two students achieved a weight reduction of 1.5-2 kg during the study period.

Keywords: education, students, nutritional status

INTRODUCTION

According to the NCD Risk Factor Collaboration forecast, 28% (25.9% of women and; 30.3% of men) of adults in Poland will be obese in 2025 (<http://ncdrisc.org>). Compared to 2016, for an average estimate of obesity, the percentage of obese adults is projected to increase by 4%. Relating the data to the population projection compiled by the Central Statistical Office, 6.1-11.4 million adults with obesity are expected in 2025 [1, 2].

There are many methods to assess overweight, obesity or obesity type using anthropometric parameters and body composition [3, 4]. Excessive

adipose tissue, the specific location of which predisposes to metabolic disorders, should be diagnosed and treated as soon as possible [5, 6, 7]. Obesity is currently the most important public health problem generating a huge financial burden for the health care system. Due to the projected increase in the prevalence of obesity, an increase in the number of patients with obesity-related diseases is expected in 2025 (compared to 2017), in particular an increase in the number of adult patients with diabetes (estimated increase of 941,000 patients), hypertension (439,000) and knee osteoarthritis (146,000). In total, for these health problems, the estimated increase in the cost of

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services provided to adults in 2025 compared to 2017 will be 327-1,038 million zlotys [1].

There are various strategies related to the treatment of obesity (including diet therapy, physical activity). However, as the above medical statistics show, these interventions are not effective and require continuous evaluation and interdisciplinary cooperation. It seems that the best strategy to combat this condition is prevention and prophylaxis carried out from an early age. Stopping or preventing excessive body fat is individually beneficial in terms of health, but also relieves the burden and provides economic support for the country's health care systems. The need for education in healthy lifestyles, including nutrition education, is indicated by numerous studies [8, 9, 10, 11, 12].

Nowadays, with increasing public awareness, there are significant changes in the concept of health education. Among the most visible changes are a holistic approach to health, with emphasis on the role of psychosocial health, as well as the inclusion of representatives of the social sciences (e.g. psychodietitians) in health education, and a shift from the theoretical transmission of knowledge to the formation of habits, skills and competence to act. This means a shift from teaching to learning, which is particularly important for children and adolescents, since most health-promoting behaviors, including nutrition, begin in childhood.

Aim of the study

The aim of the study was to assess the knowledge of recommended nutrition in a group of 32 students before and after a 7-week education that included 30 hours of theoretical lectures and 30 hours of practical exercises (calculation and analysis). In addition, it was checked using the InBody 270 analyzer to see if the nutritional status of the students under study changed with the acquired knowledge.

MATERIALS AND METHODS

Study design and settings

The study involved second-year students of food technology and nutrition, studying at the Wrocław University of Life Sciences. The respondents participated in an educational course on Human Nutrition (30 hours of lectures and 30 hours of practical exercises). The CAWI (Computer Assisted Web Interview) method [13] was used to assess nutritional knowledge, and the research tool was a proprietary questionnaire with 13 closed-ended questions. The questions in the survey covered the general knowledge taught in the Human Nutrition course. The student received 1 point for each correct answer, and 0 points for an incorrect one. All participants agreed

to participate in the study. Access to the survey was strictly limited by the date and time of the round 1 of the study (13.03.2023) and the round 2 of the study (27.04.2023).

In addition, the nutritional status of the students studied was assessed by electrical bioimpedance using an InBody270 instrument (inbodypoland.pl). Four parameters measured twice before and after education were selected for analysis: body weight (kg), BMI, fat mass (kg) and muscle mass (kg). The range of normal BMI was adopted in accordance with the WHO, i.e. 18.5-24.9, while the other anthropometric parameters were taken in accordance with the manufacturer's instructions for the measuring apparatus. Approval was obtained from the Bioethics Committee to conduct the study no. 14/2023.

Participants

The group of 32 was made up of students aged 20-21, among them were 25 women and 7 men. The inclusion criteria were: student status, attendance at lectures and classes, a written declaration to participate in the study. In addition, each student declared to be in good health, lack of metabolic diseases and not taking any permanent drugs, that could interfere with the assessment of nutritional status.

Statistical analysis

The statistical distributions of the data were examined using the Shapiro-Wilk test. The data distributions deviated from the normal distribution. Wilcoxon non-parametric test was used for further analyses. The level of significance was assumed at $p < 0.05$. All analyses were performed using Statistica version 13.3 (TIBCO Software Inc.).

RESULTS

Participants

The questions in the survey covered general knowledge of the principles of human nutrition. The second-year students had not previously taken a course on a similar topic in their curriculum and, prior to the course, relied on their knowledge from elementary school, high school, and the family home, as well as other sources of information. They gave answers individually in a home environment.

Questionnaire

Table 1 shows the number of points obtained for the answers about nutritional knowledge in round 1 (before education) and round 2 (after education) for the whole group without breaking down the respondents by gender. The average score obtained in round 1 was 9.7 out of 13 possible scores. The minimum number of correct answers obtained in round 1 was 5 points. The

Table 1. Scores of nutrition knowledge in round 1 and round 2 of the whole group

Nutrition knowledge	N	Average points	SD	Me	Min	Max	Lower quartile	Upper quartile	Wilcoxon test p<0.05
round 1 (before education)	32	9.7	1.7	10.0	5.0	13.0	8.5	11.0	0.00
round 2 (after education)	32	11.4	1.0	11.5	9.0	13.0	11.0	12.0	0.00

N – number of observations; SD – standard deviation; Me/Min/Max – median, minimum, maximum; p – level of statistical significance

lowest number of correct answers (only 11 students) was shown for the question about the definitions of the RI level of the standard (reference intakes ranges for macronutrients expressed in % energy). In round 2, better results were obtained for all questions. The average score obtained was 11.4 out of 13 possible scores, which was 88% of the possible score (Table 1). There was a statistically significant difference ($p<0.05$) between the average number of points obtained in the study group before and after the education survey (Table 1).

Anthropometric parameters

Nutritional status was analyzed separately for men, and women, due to gender-dependent physiological differences in body composition. Among women, the average body weight was 60.7 kg before education and 59.5 kg after education (Table 2). Among men, 77.9 kg and 77.8 kg, respectively (Table 3). All subjects had

normal BMIs ranging from 18.5-24.9. The average for this parameter BMI in women was 21.6, and in men it was 23.4 in round 1 of study. Body fat mass in the women's group (average 17.1 kg in round 1 and 17.4 kg in round 2) increased slightly, but the correlation was not statistically significant. Muscle tissue content in the women's group decreased slightly (23.9 kg vs. 23.6 kg, respectively), but the difference also did not show statistical significance (Table 2). During the study (7 weeks) in the male group, fat mass and muscle mass did not change in a statistically significant manner, and were 10.5 kg vs. 10.4 kg fat mass and 38.5 kg vs. 38.4 kg muscle mass, respectively (Table 3).

DISCUSSION

A study by Kowalska et al. [14] in a group of 520 high school students showed no effect of a lecture on the principles of healthy eating conducted at school

Table 2. Selected anthropometric parameters in women (n=25) before and after education (round 1 and round 2 of the study)

Anthropometric parameters	Round		Wilcoxon test p<0.05
	1 (before education)	2 (after education)	
	average \pm SD (min-max)	average \pm SD (min-max)	
Body mass [kg]	60.7 \pm 6.7 (50.1-77.3)	59.5 \pm 9.0 (50.5-77.5)	0.4352
BMI [kg/m ²]	21.6 \pm 2.3 (17.9-25.2)	21.7 \pm 2.3 (17.8-25.3)	0.1747
Body fat mass [kg]	17.1 \pm 4.7 (10.9-28.2)	17.3 \pm 4.7 (10.7-26.9)	0.4929
Body muscle mass [kg]	23.9 \pm 2.8 (20.3-34.1)	23.6 \pm 3.0 (19.5-34.7)	0.0615

SD – standard deviation; p – level of statistical significance

Table 3. Selected anthropometric parameters in men (n=7) before and after education (round 1 and round 2 of the study)

Anthropometric parameters	Round		Wilcoxon test p<0.05
	1 (before education)	2 (after education)	
	average \pm SD (min-max)	average \pm SD (min-max)	
Body mass [kg]	77.9 \pm 18.7 (53.6-81.4)	77.8 \pm 18.9 (54.3-82.9)	0.9165
BMI [kg/m ²]	23.4 \pm 5.9 (18.5-23.7)	23.6 \pm 5.7 (18.8-23.8)	0.2249
Body fat mass [kg]	10.5 \pm 5.4 (8.6-20.1)	10.4 \pm 5.2 (8.7-20.4)	0.3454
Body muscle mass [kg]	38.5 \pm 9.2 (25.8-43.5)	38.4 \pm 9.7 (25.5-44.6)	0.8927

SD – standard deviation; p – level of statistical significance

on increasing the subjects' nutritional knowledge. Zaborowicz et al. [15] conducted an assessment of nutrition behavior and knowledge among 456 students. It was shown that the nutritional knowledge of 1/3 of the subjects was inadequate and could be the cause of the dietary errors found. It was assessed that those with insufficient nutritional knowledge consumed fruit less often and salty snacks more often. Significant conclusions about students' dietary behavior were demonstrated in her study by Orkusz [16]. Students from the University of Economics (n=181), despite knowing the rules of proper nutrition, do not put them into practice. This suggests the need to shape a healthy lifestyle among them.

Similar findings were demonstrated by Likus et al. [17] in a study of Medical University students (n=239). The study found that adolescents aged 19-20 studying medicine, while aware of the importance of proper nutrition and physical activity for health, did not apply this in the practice of daily life. Poplawska et al. [18] studied the nutritional knowledge of students from Warsaw in the first (n=27) and third years (n=29) of a personal trainer course. Most of the students surveyed had a sufficient level of knowledge regardless of their year of study. The authors emphasized the need for further educational efforts to improve the nutritional knowledge and behavior of university students. Similarly, Badrasawi et al. [19] found in assessing the nutritional knowledge of 249 students from Palestine that the evaluation of nutrition knowledge among sports students at An-Najah National University revealed that the overall nutrition knowledge was insufficient. The result of this study recommends including a sports nutrition education course in the program to improve their health, nutritional awareness, and knowledge levels. Priya and Sinha [20] conducted among 60 students (30 boys and 30 girls) from all colleges of RPCAU in India who were residing in University hostel and studying in seventh semester. For testing the nutritional knowledge, 138 questions related to nutrition impacting health were asked through a developed interview schedule. To assess the nutritional status anthropometric and clinical examinations were evaluated by personal meeting. Significant difference in the knowledge level between boys and girls was observed. Knowledge level of girls was better in comparison to boys. Majority of both boys (86.66%) and girls (63.33%) were within the normal BMI range. Among girls there was the case of underweight (23.33%) and overweight (13.34%). Boys were having less nutrition knowledge that clearly showed a negative impact on their health. Hence, it recommended that the knowledge of nutrition is utmost important for all. In the study of Grygiel-Górniak et al. [21] 151 students participated from the medical university (90 female and 61 male subjects).

The average BMI in the group of women was obtained at 21.2, body mass 59.5 kg, in men appropriately 24.2 and 80.1 kg and were comparable to our study. The authors stressed that despite improper balanced diets observed in this study, any forms of physical activity should be implemented in the schedule of students. They should be encouraged to participate in a high level of physical activity so as to promote good health.

Limitations

The limitations of the study were the small number of subjects. In future studies, especially the number of men should be increased. Only 7 men took part in the study, so the whole group was subjected to a nutritional assessment without gender breakdown. It should be examined whether gender can be a differentiating factor in nutrition knowledge. It would also be necessary to see if the level of knowledge influences the practical eating behavior of the students surveyed. Also, expanding the group to include students from other fields of study (e.g., humanities) will enable an in-depth analysis of data on students' nutrition knowledge. All students surveyed had good nutritional status (BMI in the range of 18.5-24.9). Two achieved weight reductions of 1.5-2 kg. It should be checked in the long term whether a high level of nutritional knowledge influences the achievement of better anthropometric parameters in the studied students. Due to limited study time and organizational considerations, the pool of questions in the survey was not expanded to include possible changes in eating habits during the study. These topics will be addressed in future studies.

CONCLUSIONS

Nutrition education should be considered a long-term "investment" in the health of society and should be multi-level, starting with the family through kindergarten and, school with the participation of children and teachers, and involve health care personnel, i.e., doctor, nurse, nutritionist, psychologist, as well as mass media. In the present study, an improvement in students' nutritional knowledge was obtained after 7 weeks of education as expressed by an increase in the number of right answers. The study group showed a statistically significant increase in the number of correct answers on the nutrition knowledge questionnaire after the nutrition education (appropriately average 9.7 points vs. 11.4 points; $p < 0.05$).

No statistically significant differences were noted in the studied anthropometric parameters performed before and after nutrition education. It should be emphasized that, during the study, all the

anthropometric parameters of the students surveyed were within normal and healthy ranges.

Conflict of interest

The authors declare no conflict of interest.

REREFENCES

1. NCD Risk Factor Collaboration. Country profile [Internet]. 2024. Available from: <http://ncdrisc.org/country-profile.html>.
2. Departament Analiz i Strategii, Narodowy Fundusz Zdrowia. Cukier, otyłość – konsekwencje. Przegląd literatury, szacunki dla Polski [Internet]. 2019. Available from: <https://www.nfz.gov.pl/aktualnosci/aktualnosci-centrali/prezentacja-raportu-cukier-otylosc-konsekwencje,7296.html>.
3. Leszczyńska T, Franczyk-Żarów M, editors. Żywnie człowieka. Akademicki podręcznik praktyczny. Kraków: Wydawnictwo UR; 2023. ISBN 978-83-66602-63-2.
4. Gawęcki J, editor. Żywnie człowieka. Podstawy nauki o żywieniu. Tom 1. Warszawa: PWN; 2022. EAN:9788301221164.
5. Brończyk-Puzoń A, Koszowska A, Bieniek J. Podstawowe pomiary antropometryczne i pochodne wskaźniki w poradnictwie dietetycznym – część pierwsza [Basic anthropometric measurements and derived ratios in dietary counseling: Part one]. *Piel Zdr Public*. 2018;8(3):217-222. doi: 10.17219/pzp/92366.
6. Stupnicki R. Weight-height relations and the use of BMI in children and youths [Internet]. 2015. Available from: <https://www.wskfit.pl/PDF/artykuly/15/15024Stupnicki.pdf>.
7. Lizak D, Budzowski A, Seń M, Czarny W. Przegląd antropometrycznych mierników otluszczeniowości stosowanych w diagnozowaniu otyłości [Anthropometric measures of body composition used in obesity diagnosis – an overview]. *Hygeia Public Health*. 2016;51(2):124-133.
8. Bray GA. Medical consequences of obesity. *J Clin Endocrinol Metab*. 2004;89(6):2583-9. doi: 10.1210/jc.2004-0535.
9. Zalewska M, Maciorkowska E. Rola edukacji żywieniowej w populacji dzieci i młodzieży [The role of nutrition education in the population of children and adolescents]. *Med Og Nauk Zdr*. 2013;19(3):375-378.
10. Grajek M, Wanat G. Skuteczność przekazu zdrowotnego na przykładzie edukacji żywieniowej uczniów z użyciem piramidy żywieniowej [The effectiveness of health education analyzed on the basis of teaching students proper nutrition using the food pyramid concept]. *JEcolHealth*. 2013;17(3):153-157.
11. Cieślak E, Siembida A, Kuś A, Folcik A, Kopeć A. Wpływ edukacji na świadomość żywieniową młodzieży szkół ponadgimnazjalnych w aspekcie profilaktyki chorób dietozależnych [Influence of nutritional education of high school students on prevention of nutrition-related diseases]. *Probl Hig Epidemiol*. 2014;95(4):927-933.
12. Bugajska J. Edukacja zdrowotna i promocja zdrowia w Szkole Promującej Zdrowie – działalność na rzecz współpracy ze środowiskiem lokalnym. *Humanum*. 2017;25(2):155-162.
13. Marciniak S, Lange E, Laskowski W. Assessment of the knowledge of nutritional recommendations and way of nutrition in vegetarians and vegans. *Rocz Panstw Zakl Hig*. 2021;72(4):381-391. doi: 10.32394/rpzh.2021.0182.
14. Kowalska J, Słowiński J, Zieleń-Zynek I. Ocena wiedzy żywieniowej uczniów szkół ponadgimnazjalnych [Assessment of nutritional knowledge among upper secondary school students]. *Probl Hig Epidemiol*. 2019;100(2):124-129.
15. Zaborowicz K, Czarnocińska J, Galiński G, Kaźmierczak P, Górka K, Durczewski P. Evaluation of selected dietary behaviours of students according to gender and nutritional knowledge. *Rocz Panstw Zakl Hig*. 2016;67(1):45-50.
16. Orkus A. Ocena wybranych zwyczajów żywieniowych studentów Uniwersytetu Ekonomicznego we Wrocławiu. Część I [Assessment of selected dietary habits of students of the Wrocław University of Economics. Part I]. *Nauki Inżynierskie i Technologie*. 2014;3(14):74-85. doi: 10.15611/nit.2014.3.05.
17. Likus W, Milka D, Bajor G, Jachacz-Łopata M, Dorzak B. Dietary habits and physical activity in students from the Medical University of Silesia in Poland. *Rocz Panstw Zakl Hig*. 2013;64(4):317-24.
18. Popławska H, Aleksandra Dębowska A, Dmitruk A, Hołub W. Nutritional behaviour and knowledge about food and nutrition among personal trainer students of Józef Piłsudski University of Physical Education in Warsaw, branch in Biała Podlaska. *Rozprawy Społeczne/Social Dissertations*. 2022;16(1):104-115. doi: 10.29316/rs/146001.
19. Badrasawi MM, Shraim NY, Al-Atrash MH. Knowledge of Physical Education Students about Nutrition: A Cross- Sectional Study from Palestine. *Int J Nutr Pharmacol Neurol Dis*. 2018;8:101-7. doi:10.4103/ijnpnd.ijnpnd_32_18.
20. Priya R, Sinha M. Nutritional knowledge and nutritional status amongst university students. *J Nutr Metab Health Scien*. 2020;3(1):22-25. doi:10.18231/j.ijnmhs.2020.005.
21. Grygiel-Górniak B, Tomczak A, Krulikowska N, Przysławski J, Seraszek-Jaros A, Kaczmarek E. Physical activity, nutritional status, and dietary habits of students of a medical university. *Sport Sci Health*. 2016;12:261–267. doi: 10.1007/s11332-016-0285-x.

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