

Health-promoting behaviour of university students, based on the Health Behaviour Inventory and on selected laboratory indicators of their health status

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ABSTRACT

Introduction: To limit the deterioration of health later in life, it is important for young adults to adopt principles of healthy lifestyle and of positive health behaviour as early as possible. Aim of the research was to assess health behaviour in correct eating habits (CEH), health preventive measures (HPM), positive mental attitude (PMA), positive health-maintaining practices (PHMP) and in selected laboratory tests.

Material and methods: The study concerned 115 young adults, first-year university students. The Health Behaviour Inventory (HBI) questionnaire was used to examine their health behaviour. Laboratory tests included measurements of total cholesterol, low-density lipoprotein, high-density lipoprotein and triglyceride concentrations, and glucose and insulin levels in blood samples.

Results: In the study group, the mean HBI General Index value was 4.6 ± 1.8 stens. The highest mean score (3.27 ± 0.81 points) was observed in the PMA subscale (compared with 3.52 ± 0.66 points in the normalized HBI test by Juczyński), while the lowest (3.11 ± 0.76 points) was found in the CEH subscale (compared with 3.22 ± 0.76 in the HBI test). Statistically significant correlations were noted between insulin level and HBI General Index value ($r_s = -0.21$, $p = 0.030$) and between insulin level and CEH ($r_s = -0.29$, $p = 0.002$). Moreover, a statistically significant correlation between level of triglycerides and HPM ($r_s = -0.20$, $p = 0.043$) was found.

Conclusions: Actions should be taken to improve knowledge of positive health behaviour among students. As they enter their new social environment, such as a university, young adults should be offered the opportunity of changing their lifestyle, the acquired health behaviour patterns serving them in the future.

KEY WORDS: young adults, health-promoting behaviour, Health Behaviour Inventory (HBI), laboratory indicators.

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INTRODUCTION

Obesity and concomitant diseases, such as type 2 diabetes, and cardiovascular and respiratory diseases, accompanied by psychological stress, are among the main global public health challenges [1]. In response to these challenges, to improve the education of health professionals and to promote positive health behaviour patterns among its students, the European Commission created the European University Alliance for Global

Health programme in 2019 within the European Universities programme [2].

According to the 2020 Polish National Health Test Report [3], only about 10% of respondents consciously and systematically follow healthy lifestyles and maintain disease prophylaxis, this ratio somewhat improving with age. Obesity and concomitant diseases also affect young people in Poland [4-6]. Therefore, it is important for young people and students in Poland to learn the prin-

ciples of a healthy lifestyle and positive health behaviour as early as possible – to reduce their health deterioration later in life by participating in various health-promoting activities, including participation in screening programmes [3, 7-9].

Correct health behaviour patterns – actions concerning medical aspects and practices to improve health and prophylaxis – have a positive impact on health. The Health Behaviour Inventory (HBI) developed by Juczyński [10], designed specifically for the Polish population, is a diagnostic tool developed to quantify health behaviour patterns by applying survey poll techniques and survey questionnaires [11, 12]. This study evaluated the health behaviour patterns among students of Andrzej Frycz-Modrzewski University (AFMU) in Kraków.

The general aim of the study was to assess health behaviour patterns – correct eating habits (CEH), health preventive measures (HPM), positive mental attitude (PMA), and positive health-maintaining practices (PHMP) – in a group of Polish university students, and also to evaluate their basic health parameters, as determined by a set of laboratory tests.

MATERIAL AND METHODS

The studied group consisted of first-year AFMU students (aged 18–24 years, mean age 20.7). Due to the COVID

pandemic, accrual was extended over the years 2021–2022. All 1400 first-year AFMU students were invited; of these, 127 volunteered, of whom 12 were over 24 years of age, so did not qualify, resulting in 115 participants: 87 (75.6%) female and 28 (24.4%) male students, mainly of medical disciplines (58.9%).

This female to male ratio reflects the AFMU student population, where female students constitute a majority in medical and liberal art departments. Due to the low response rate, every student who volunteered and fulfilled the inclusion criteria was accepted, introducing a sex bias in our study.

All volunteers were acquainted with the aims of this study and gave their informed consent to participate. Our study was approved by the AFMU Ethics Committee (No. KBKA/7/O/2021).

To correlate the health status and the health-promoting behaviour of our study participants, the HBI developed by Juczyński was applied, selected indicators of their health being evaluated against his standardized HBI values [10], related to a population of Polish adults.

In line with the HBI questionnaire, each participant evaluated 24 positive statements in four sub-scales of health-related behaviour: CEH, HPM, PMA, and PHMP, as listed within their respective subscales in Tables 1–4.

TABLE 1. Correct eating habits (CEH)

Question No. – Habit	Almost never	Rarely	From time to time	Often	Almost always	Average point value
	1 pt.	2 pts.	3 pts.	4 pts.	5 pts.	$\bar{x} \pm SD$
1. I eat a lot of vegetables and fruit.	2.61%	7.83%	26.09%	39.13%	24.34%	3.8 ± 1.0
5. I limit the consumption of such products as animal fat or sugar.	11.30%	28.83%	26.09%	26.09%	8.70%	2.9 ± 1.2
9. I care about proper nutrition.	10.43%	11.30%	40.00%	25.22%	13.05%	3.2 ± 1.1
13. I avoid consumption of preserved food.	17.39%	27.83%	26.96%	19.13%	8.69%	2.7 ± 1.2
17. I avoid salt and highly salted food.	17.39%	30.43%	21.74%	19.13%	11.31%	2.8 ± 1.3
21. I eat whole-grain bread.	2.75%	21.93%	34.21%	25.44%	16.67%	3.3 ± 1.0

TABLE 2. Health preventive measures (HPM)

Question No. – Habit	Almost never	Rarely	From time to time	Often	Almost always	Average point value
	1 pt.	2 pts.	3 pts.	4 pts.	5 pts.	$\bar{x} \pm SD$
2. I avoid colds.	0%	12.17%	19.13%	38.27%	30.43%	3.9 ± 1.0
6. I have the phone number of emergency services.	54.91%	9.57%	2.61%	7.83%	25.08%	2.4 ± 1.8
10. I follow medical recommendations resulting from my medical tests.	2.61%	9.57%	22.61%	32.17%	33.04%	3.8 ± 1.1
14. I regularly report for medical examinations.	23.48%	24.35%	26.09%	13.91%	12.17%	2.7 ± 1.3
18. I try to find out how others avoid diseases.	26.09%	25.22%	19.13%	25.22%	4.34%	2.6 ± 1.2
22. I try to obtain medical information and to understand the causes of health and diseases.	2.63%	13.16%	19.30%	36.84%	28.07%	3.7 ± 1.1

TABLE 3. Positive mental attitude (PMA)

Question No. – Habit	Almost never	Rarely	From time to time	Often	Almost always	Average point value
	1 pt.	2 pts.	3 pts.	4 pts.	5 pts.	$\bar{x} \pm SD$
3. I seriously consider advice of people expressing concern about my health.	4.35%	22.61%	31.30%	23.48%	18.26%	3.3 ± 1.1
7. I avoid situations that depress me.	9.57%	17.39%	29.57%	29.57%	13.90%	3.2 ± 1.2
11. I try to avoid excessive emotions, stress or tension.	20.78%	26.96%	20.87%	23.48%	7.83%	2.7 ± 1.3
15. I have friends and a stable family life.	5.22%	8.70%	17.39%	33.48%	45.21%	3.9 ± 1.2
19. I avoid feelings such as anger, anxiety or depression.	18.48%	27.19%	17.54%	23.68%	13.17%	2.9 ± 1.3
23. I think positively.	1.75%	9.65%	30.70%	34.21%	23.69%	3.7 ± 1.0

TABLE 4. Positive health-maintaining practices (PHMP)

Question No. – Habit	Almost never	Rarely	From time to time	Often	Almost always	Average point value
	1 pt.	2 pts.	3 pts.	4 pts.	5 pts.	$\bar{x} \pm SD$
4. I have enough rest.	6.96%	17.39%	27.83%	32.17%	15.65%	3.3 ± 1.1
8. I avoid overworking.	13.04%	25.22%	31.30%	35.22%	5.22%	2.8 ± 1.1
12. I control my body mass.	12.17%	16.65%	22.61%	36.52%	15.65%	3.4 ± 1.4
16. I have enough sleep.	9.57%	14.78%	23.48%	23.00%	37.00%	3.3 ± 1.2
20. I limit smoking.	15.74%	10.53%	10.53%	0%	63.20%	3.6 ± 1.6
24. I avoid excessive physical activity.	9.65%	24.56%	35.96%	22.81%	7.02%	2.9 ± 1.1

The study participant was requested to self-report his/her preferences concerning each of the above statements using five qualifiers (almost never – 1 point, rarely – 2 points, from time to time – 3 points, often – 4 points, almost always – 5 points). The sum of all points formed a subjective general intensity indicator concerning the health behaviour of the respondent.

The general index of health-promoting behaviour based on the HBI [10] ranges between 24 and 120 points, with higher scores indicating better reported health behaviour. To interpret this general HBI result, scores were converted to standardized, normalized “sten” scores, according to the key of Juczyński [10]. Scores of 1–4 stens were considered low, 5–6 stens were considered average, and scores in the range 7–10 stens were considered high.

For each participant, analysis of the questionnaire was performed within each subscale: CEH, HPM, PMA, and PHMP (six statements per subscale). Within each subscale, applying the HBI interpretation key of Juczyński, preference averages were calculated. Again, the higher this average value was, the better was the participant’s reported health behaviour.

Preference average point values and their standard deviations for the four HBI subscales were then compared with the following respective values of Juczyński’s normalized group: CEH – questions no.: 1, 5, 9, 13, 17,

21 – 3.22 ± 0.76 points; HPM – questions no.: 2, 6, 10, 14, 18, 22 – 3.42 ± 0.78 points; PMA – questions no.: 3, 7, 11, 15, 19, 23 – 3.52 ± 0.66 points; PHMP – questions no.: 4, 8, 12, 16, 20, 24 – 3.32 ± 0.85 points.

The health status of each study participant was evaluated by the following laboratory tests, performed at the Diagnostyka Laboratory in Kraków: total cholesterol concentration, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and triglyceride concentration, glucose, and insulin concentration in blood. Fasting blood samples were drawn in the morning.

STATISTICAL ANALYSIS

The non-parametric Mann-Whitney *U*-test was used in statistical analysis. Non-normal distribution of variables was verified using the Kolmogorov-Smirnov test. Inter-variable correlations were examined using the Spearman correlation test.

RESULTS

In the Mann-Whitney *U*-test, no statistically significant differences were found between male and female student respondents for any tested health behaviour index scores. Therefore, in the following analyses, no distinction was made regarding the sex of individuals in the study group.

For all participants, their health status laboratory indicators remained within normal limits: glucose 4.8 ± 0.44 mmol/l; insulin 12.01 ± 9.87 μ U/ml; total cholesterol 4.25 ± 0.82 mmol/l; HDL 1.66 ± 0.36 mmol/l; LDL 2.23 ± 0.68 mmol/l; triglycerides 0.89 ± 0.42 mmol/l.

In the study group, the mean value of the HBI General Index was 4.6 ± 1.8 stens. Mean values of the four HBI subscales listed in Table 5 are slightly lower than those given for the normative group of Juczyński [10]. In our group, the highest mean value, 3.27 ± 0.81 , was found in the PMA subscale (compare to 3.52 ± 0.66) and the lowest, 3.11 ± 0.76 (compare to 3.22 ± 0.76), in the CEH subscale.

Within the CEH subscale, most respondents (63.47%) reported that they “often” or “almost always” consume a lot of vegetables and fruit (question 1). However, incorrect eating habits are observed by the majority, as most respondents reported that “almost never”, “rarely” or “from time to time”, they avoid consumption of preserved food and of salt and highly salted food; nor do they limit the consumption of such products as animal fat or sugar (questions 13, 17 and 5; 72.18%, 69.56% and 66.22%, respectively). Furthermore, 60% of respondents reported lack of care for “proper nutrition”; nor do they “eat wholegrain bread” (questions 9 and 21).

Within the HPM subscale, in terms of correct behaviour, most respondents (68.70%) reported that they “often” or “almost always” avoid colds (question 2), follow medical recommendations resulting from their medical tests (65.21%, question 10), and try to obtain medical information and try to understand the causes of health and diseases (64.91%, question 22). How-

ever, incorrect HPM are evident in their responses to the remaining questions – about 70% of respondents reported that they “almost never”, “rarely” or “from time to time” report for regular medical examinations (question 14), try to find out how others avoid diseases (question 18) or carry telephone numbers of emergency services (question 6).

Within the PMA subscale, most respondents reported that they “often” or “almost always” have friends and a stable family life, and that they think positively (78.69% and 57.87%, questions 15 and 23, respectively). Moreover, over 40%, “often” or “almost always” seriously consider concerns of other people with respect to their health (question 3; 41.74%) and avoid situations that depress them (question 7; 43.47%).

However, negative mental attitudes are evident in that over 60% of respondents reported that they “almost never”, “rarely” or “from time to time” avoid excessive emotions, stress or tension; nor do they avoid feelings such as anger, anxiety or depression (68.61% and 63.21%; questions 11 and 19, respectively).

Within the PHMP subscale, most respondents reported PHMP, as they “almost always” limit smoking (63.20%; question 20), and “often” or “almost always” have enough sleep (52.17%; question 16). About 50% of respondents rest enough and control their body mass (questions 4 and 12).

Negative health practices were reported by about 70% of respondents, who indicated that they “almost never”, “rarely” or “from time to time” avoid excessive physical activity or overwork (questions 8 and 24).

A statistically significant correlation between *insulin level* and HBI General Index value was found. The value of Spearman’s rank correlation coefficient, $r_s = -0.21$ ($p = 0.030$), indicates a weak negative relationship between the variables tested. The lower the level of insulin in the studied individuals was, the higher was their HBI score. A statistically significant correlation between *insulin level* and CEH score was observed. The value of Spearman rank correlation coefficient, $r_s = -0.29$ ($p = 0.002$), indicates a weak negative correlation between the variables tested. The higher the CEH score was, the lower was the insulin level in the studied individuals.

A statistically significant correlation between the *level of triglycerides* and HPM score was found. The value of Spearman rank correlation coefficient, $r_s = -0.20$ ($p = 0.043$), indicates a weak negative correlation between the variables tested. The higher the HPM score was, the lower was the level of triglycerides in the studied individuals.

Statistically significant correlations between the *level of insulin* and HBI general index and between the *level of insulin* and CEH score were stated. The values of Spearman rank correlation coefficient were $r_s = -0.21$ ($p = 0.030$) and $r_s = -0.029$ ($p = 0.002$), respectively. This indicates a negative correlation between the variables

TABLE 5. Health Behaviour Inventory (HBI) of study participants – HBI General Index points and sten scores and points for Correct Eating Habits (CEH), Health Preventive Measures (HPM), Positive Mental Attitude (PMA), and Positive Health-Maintaining Practices (PHMP) (mean values $\pm$ standard deviations [SD], medians and ranges)

HBI	Mean $\pm$ SD	Median	Range (min.–max.)
HBI General Index			
Points	76.8 ± 12.8	76.0	43-107
HBI General Index			
Sten scores	4.6 ± 1.8	4.00	1.00-9.00
CEH			
Points	3.11 ± 0.76	3.00	1.33-5.00
HPM			
Points	3.18 ± 0.73	3.70	1.50-4.83
PMA			
Points	3.27 ± 0.81	3.33	1.50-5.00
PHMP			
Points	3.23 ± 0.63	3.33	1.67-4.67

tested. The higher the CEH score was, the lower was the level of insulin in the studied individuals.

However, no statistically significant correlations were found between *lipid levels (total cholesterol, LDL, HDL, triglycerides), glucose and insulin levels* and the remaining health behaviour subscale scores, i.e. of PMA or of PHMP scores.

The average BMI value for the whole group was 22.23 ± 3.64 (median 21.3, minimum 17.1, maximum 32.3).

No statistically significant correlation was found between BMI of study participants and HBI General Index (points or sten scores) and scores of all four subscales (CEH, HPM, PMA, or PHMP).

DISCUSSION

Satisfactory health and well-being are important indicators of the general condition of society members. To achieve such conditions, CEH, HPM, PMA or PHMP should be maintained and promoted. Avoiding such practices may enhance the risk of chronic diseases and decrease both life expectancy and social activity [3, 7]. Therefore, PHMP, such as adequate physical activity, rational nutrition and sufficient time for rest and sleep, as well as participation in dedicated prophylactic screening programmes, should be promoted.

Health behaviour patterns develop over life, following individual experience and knowledge. Such patterns are inspired by local culture, are acquired from family, schools, mass media or peers, and are also stimulated by the local health system. As young people enter university-level education, their lifestyle and health behaviour patterns may radically change. It is in this period when positive or negative health behaviour patterns may be acquired and may remain over their future lives. Participation in prophylactic screening programmes, such as colonoscopy, represents a correct health behaviour pattern, as rectal colon cancer is presently being observed at increasingly younger ages [13]. The study of Rucińska *et al.* [13] demonstrates that in the young adult population there is insufficient information about rectal colon cancer and the availability of relevant screening tests. Only $\frac{1}{3}$ of respondents in the study of Rucińska *et al.* [13] reported their knowledge on this subject as being good or very good – acquiring their knowledge mainly from the internet. Since we designed our study following the approach of Juczyński [10], we did not question our respondents as to their sources of information on health behaviour patterns.

According to the 2020 Report on the National Health Test of Poland [3], the HBI scores of almost one-fifth of those tested fell below 50%. Only about 10% of those tested intentionally chose positive health behaviour patterns and health-maintaining practices. The report also stated that with increasing age of respondents, their HBI scores also increased, together with their compliance with recommended prophylaxis schedules.

Therefore, it is essential, especially for young people, to develop and maintain a positive attitude to health – to limit the likelihood of health deficits or of life-threatening conditions at later stages of their lives. Decisions taken by students just entering adulthood may considerably affect their later lifestyles [1, 7–9].

The HBI [10] offered us the possibility of evaluating the health-promoting behaviour of first-year students of our university. We found that the overall value of the HBI General Index in the student group we investigated fell within the lower range of average scores, indicating an unsatisfactory level of their health behaviour patterns. We note that while Juczyński's HBI [10] applies to the adult Polish population (mean age 41.2), no other Polish standardised inventories more appropriate to our studied group are available. Therefore, our results, concerning a rather small group of AFMU students, predominantly female, cannot be considered as being representative of Polish students in general.

Walentukiewicz *et al.* [14] also reported unsatisfactory health behaviour levels in Polish students of nursing, as did by Michalski *et al.* [15] in secondary school pupils. However, in a study of students at various universities in Bydgoszcz, Weber-Rajek *et al.* [16] found a mid-range average value of the HBI General Index. In all the above-mentioned studies [14–16], the HBI approach of Juczyński [10] was applied.

In other surveys, the highest compliance was found with PMA and the lowest with PHMP and CEH subscales [14, 17]. This tends to support our results, as in our case PMA, PHMP and HPM obtained the highest mean scores, while the CEH score was the lowest. However, in our study, average values of all four subscales were lower than those in Juczyński's normalized Polish adult group.

Within their PMA subscale questions (Table 3), our students scored the highest average value compared to average scores in other subscales, yet somewhat lower than Juczyński's normalized value for adults [10]. Thus, most of our students demonstrated correct mental attitudes. They evaluated *positive thinking* and *stable family life* habits as being most important, while attaching less importance to *avoiding emotions such as anger, anxiety or depression*, or to *acknowledging concerns about their health expressed by other people*.

Within their *health-maintaining practices* (Table 4), our students correctly indicated *limiting smoking* and *having enough sleep* as being most important, while attaching less importance to *controlling body weight*. In their opinion, *avoiding excessive physical activity* and *avoiding overworking* was the least important. Hence, in our view, our investigated group does not maintain positive health practices in general.

Within the HPM category (Table 2), our group correctly selected *avoiding colds*, and *following medical recommendations*. They *try to obtain medical information and understand the cause of health and disease*. They do not

consider reporting for medical examinations or find out how others avoid diseases, as being equally important in maintaining good health.

In our study, the average score in the CEH subscale (Table 1) was the lowest of all subscales investigated and was also lower than the average value for Juczyński's normalized group of Polish adults [10]. However, over 60% of our respondents *eat a lot of vegetables and fruit*, a correct eating habit. Yet, most of our respondents (over 70%) *did not avoid salt, nor salted and preserved food*. Nor did they *limit consumption of animal fat or sugar*. Their incorrect eating habits are further evidenced by *neglecting proper nutrition* or *avoiding whole-grain bread*.

Incorrect eating habits were also found by Palacz *et al.* [17] in their group of tourism and recreation students. A correlation between CEH and low body mass was found by Suwalska *et al.* [18] in their group of medical students. Generally, most students do not eat sufficient amounts of fruit and vegetables [9, 18, 19].

In a study by Gallo *et al.* [19] of 361 Australian students, less than a third were concerned about fibre, calcium, and potassium consumption, and most male and almost 50% of female students exceeded their daily sodium intake.

A low level of physical activity, particularly in students of nursing and obstetrics, was noted by Walentukiewicz *et al.* [14], and by Radosz *et al.* [20], while Palacz *et al.* [17] observed that health behaviour practices and the level of physical activity are related – students with a low level of physical activity also scored lowest in all their health behaviour patterns.

Weber-Rajek [16] generally concluded that students of health sciences observed better health behaviour patterns than students of engineering, national security, logistics or nursing. According to Palacz *et al.* [17], students of physiotherapy demonstrated the highest, and students of tourism and recreation the lowest average HBI General Index values. Radosz *et al.* [20] confirmed that physiotherapy students maintained healthier lifestyles than students of nursing. In our study, it was mainly students of the Department of Medicine and Health Sciences who reported interest in their voluntary participation. A rather disturbing observation may therefore follow – as demonstrated by their low HBI scores – that future teachers, health specialists or nurses will likely not observe sufficiently high health behaviour standards themselves.

Any relation between gender and health behaviour patterns appears to be inconclusive. This is supported by our results, and also by Szkup-Jabłońska *et al.* [21] who, however, noted that PMA and positive maintaining health practices prevail in younger students. On the other hand, according to Palacz *et al.* [17] and Rogowska *et al.* [22], women achieved higher HBI scores than men, while Pochwała *et al.* [9] found that stress is usually handled better by men than by women.

Gacek *et al.* [23] observed that levels of HBI scores differed between Polish and Spanish students of physical education, aged between 18 and 35 years. Polish students demonstrated lower PMA scores, which may indicate that patterns of health behaviour may also be affected by the environment, culture, and personal attitudes of inhabitants of different countries. Openness and extravert behaviour of younger respondents may positively affect their eating habits [24]. In our study we noted that the lower the level of insulin in the studied individuals was, the higher was their HBI General Index score; and that the higher their CEH score was, the lower was their insulin level. Our observations are supported by a longitudinal study of 667 young adults over several years, by Goode *et al.* [25], who found that a healthy, plant-based diet led to higher insulin sensitivity and, potentially, to a lower risk of type 2 diabetes later in life. However, Sood *et al.* [26] provide no clear indication whether adherence to the Mediterranean diet may be associated with improved insulin sensitivity and lower levels of inflammatory markers in overweight and obese individuals without diabetes. Further longitudinal and interventional studies involving larger populations are required to resolve such issues.

An interesting relationship between health behaviour practices and knowledge of cancer prophylaxis was discussed by Gujska *et al.* [27], who observed differences between knowledge and health practices in students of nursing. As indicated by differences in their Juczyński HBI scores, while their knowledge of risk factors and symptoms of malignant diseases was high, their overall HBI scores were average, and were lowest in the health-maintaining practices subscale.

A similar trend was observed by Serń *et al.* [28] for working nurses, whose HBI scores in the health-maintaining practices and CEH were the lowest. In the same study, their levels of health-maintaining practices were compared with individual judgements of their personal efficacy. The higher their knowledge and opinion of personal efficacy were, the higher were their general HBI index and subscale scores. While we did not investigate these issues in our study, we agree that they should be included in future work.

Kaczor-Szkodny *et al.* [29] noted that knowledge about health is not the only, or main, determinant of health-maintaining practices in young adults. Other factors, such as social, psychological or environmental aspects also play a role. Generally, women appear to possess better knowledge of correct health-maintaining practices than men [13, 29]. Pope *et al.* [30] in their randomized study analysed the positive effect of implementing modern technologies of social media in educating the public on matters of health and health competence, a view which we share and fully support.

CONCLUSIONS

The mean HBI General Index value obtained in our study places our first-year Polish university students

within the lower ranges of average sten values of Juczyński's questionnaire [10]. Values of their scores within the four HBI subscales were also average, as compared with Juczyński's normalized Polish adult group scale. As our investigative study concerned only a relatively small number of students of different departments of our university, our results may not be representative of our students nor of Polish students in general. Their health behaviour patterns perhaps also reflect their social inequalities.

The predominance of women respondents may represent a potential confounding factor in our study, likely resulting from the greater responsiveness of female students to the invitation to participate. While not being clearly supported by literature studies, we strongly believe that health education at younger ages, especially with regard to primary and secondary prophylactic procedures, will lead to better health outcomes at later ages.

Clearly, measures should be taken to improve the knowledge and practice of correct health behaviour of our students and of young adults in general. Implementation of modern communication technologies in educating the public on matters of health and health competence should be appealing to students – and to the younger generation in general. The AFMU in Kraków should consider active participation in the development of such technologies to improve the health and health competence of our students.

DISCLOSURE

The authors report no conflict of interest.

References

1. GBD 2019 Risk Factor Collaborators. Global Burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; 396(10258): 1223–1249.
2. European University Alliance for Global Health. European Universities, 2019. Available from: <https://education.ec.europa.eu/sites/default/files/document-library-docs/european-universities-factsheet-eugloh.pdf> (accessed: 27 February 2025).
3. Grodzicki T, Jankowski P, Krzakowski M, et al. Narodowy Test Zdrowia Polaków 2020 Raport [National Health of Polish 2020 Report]. Medonet, Kraków 2020. Available from: <https://www.nn.pl/dam/zasoby/raporty/Narodowy-Test-Zdrowia-Polakow-2020-raport.pdf> (accessed: 27 February 2025).
4. Niklas A, Flotyńska A, Puch-Walczak A, et al. Prevalence, awareness, treatment and control of hypertension in the adult Polish population – Multicenter National Population Health Examination Surveys – WOBASZ studies. *Arch Med Sci* 2018; 14(5): 951–961. DOI: 10.5114/aoms.2017.72423.
5. Stepaniak U, Micek A, Waśkiewicz A, et al. Prevalence of general and abdominal obesity and overweight among adults in Poland. Results of the WOBASZ II study (2013–2014) and comparison with the WOBASZ study (2003–2005). *Pol Arch Med Wewn* 2016; 126(9): 662–671. DOI: 10.20452/pamw.3499.
6. Zdrojowy-Wełna A, Zatońska K, Bednarek-Tupikowska G, et al. Determinants of obesity in population of PURE study from Lower Silesia. *Endokrynol Pol* 2018; 69(6): 644–652. DOI: 10.5603/EP.a2018.0061.
7. Woynarowska B. Edukacja zdrowotna. Podstawy teoretyczne, metodyka, praktyka [Health education. Theoretical, methodology, practice]. PZWL, Warsaw 2017; 57–60.
8. Sadowska A. Aktywność fizyczna i zdrowie polskiej młodzieży jako wartość [Physical Activity and Health of Polish Youth as a value]. *Zeszyty Naukowe Katolickiego Uniwersytetu Lubelskiego Jana Pawła II* 2021; 64(4): 33–46.
9. Pochwała M. Prozdrowotny styl życia polskich studentów [Pro-health lifestyle of Polish students]. *Studenckie Prace Prawnicze, Administratywistyczne i Ekonomiczne* 2019; 27: 49–59.
10. Juczyński Z. Narzędzia pomiaru w psychologii zdrowia [Measurement tools in health psychology]. *Przegl Psychol* 1999; 42(4): 43–56.
11. Levant RE, Wimer DJ, Williams CM. An evaluation of the health behaviour inventory-20 (HBI-20) and its relationships to masculinity and attitudes towards seeking psychological help among college men. *Psychology of Men & Masculinity* 2011; 12(1): 26–41. DOI:10.1037/a0021014.
12. Bodys-Cupak I, Róg K, Majda A, Kózka M. The self-assessment of the health condition versus personal resources and health behaviors of homeless people. *Pielęgniarstwo w Opiece Długoterminowej/Long-Term Care Nursing* 2020; 5(1): 17–29.
13. Rucińska M, Lewandowska M, Andrzejczak A, Osowiecka K. Wiedza na temat profilaktyki pierwotnej i wtórnej raka jelita grubego wśród młodych Polaków [Knowledge of primary and secondary colorectal cancer prevention among young people in Poland]. *Zdr Pub Zarz* 2023; 3(20): 81–88.
14. Walentukiewicz A, Łysak A, Wilk B. Zachowania zdrowotne studentek pielęgniarstwa [Health behavior of nursing students]. *Nursing Topics* 2013; 21(4): 484–488.
15. Machalski P, Wagner S, Andruszkiewicz A, et al. Zróżnicowanie zachowań zdrowotnych, wartości osobistych i kryteriów zdrowia w zależności od płci wśród uczniów szkół ponadgimnazjalnych [Differences of health behaviours, personal values and health criteria related to high-school students gender]. *Forum Med Rodz* 2016; 10(4): 219–228.
16. Weber-Rajek M, Lulinska-Kuklik E, Moska W. Health behaviors in early adulthood. *Balt J Health Phys Act* 2017; 9(4): 147–153.
17. Palacz J. Zachowania zdrowotne studentów w świetle wybranych uwarunkowań [Health behaviors of students in the light of selected conditions]. *Med Og Nauk Zdr* 2014; 20(3): 301–306.
18. Suwalska J, Kolańska K, Łojko D, Bogdański P. Eating behaviors, depressive symptoms and lifestyle in University students in Poland. *Nutrients* 2022; 14(5): 1106. DOI: 10.3390/nu14051106.
19. Gallo LA, Gallo TF, Young SL, et al. Adherence to dietary and physical activity guidelines in Australian undergraduate biomedical students and associations with body composition and metabolic health: a cross-sectional study. *Nutrients* 2021; 13(10): 3500. DOI: 10.3390/nu13103500.
20. Radosz Z, Paplaczek M, Gruszczyńska M, Tomaszewska-Kumela P. Zachowania zdrowotne studentów kierunków me-

- dycznych [Medical students' health behaviors]. *Social Dissertations* 2020; 14(2): 151-164.
21. Rogowska AM, Nowak PF, Kwaśnicka A. Healthy behavior as a mediator in the relationship between optimism and life satisfaction in health sciences students: a cross-sectional study. *Psychol Res Behav Manag* 2021; 14: 1877-1888. DOI: 10.2147/PRBM.S335187.
 22. Szkup-Jabłońska M, Romanowska D, Reczyńska A, et al. Ocena zachowań zdrowotnych studentów uczelni szczecińskich [Assessment of health behaviors of students of Szczecin Universities]. *Family Med Care Rev* 2013; 15(2): 175-177.
 23. Gacek M, Kosiba G, Wojtowicz A. Personality determinants of pro-health behaviours among Polish and Spanish physical education students. *Stud Sport Human* 2020; 27: 35-48.
 24. Conner TS, Thompson LM, Knight RL, et al. The role of personality traits in young adult fruit and vegetable consumption. *Front Psychol* 2017; 8: 119. DOI: 10.3389/fpsyg.2017.00119. eCollection 2017.
 25. Goode JB, Smith KJ, Breslin M, et al. A healthful plant-based eating pattern is longitudinally associated with higher insulin sensitivity in Australian adults. *J Nutr* 2023; 153(5): 1544-1554. DOI: 10.1016/j.tjnut.2023.03.017
 26. Sood S, Feehan J, Itsiopoulos C, et al. Higher adherence to a mediterranean diet is associated with improved insulin sensitivity and selected markers of inflammation in individuals who are overweight and obese without diabetes. *Nutrients* 2022; 14(20): 4437. DOI: 10.3390/nu14204437.
 27. Gujska D, Gutek A, Gajewska N, et al. Zachowania zdrowotne studentów pielęgniarstwa w zakresie profilaktyki chorób nowotworowych [The health behaviours of nursing students related to the prevention of neoplastic diseases]. *J Educ Health Sport* 2016; 6(6): 107-120.
 28. Seń M, Trybała K, Stołkowska A, Klisowska I. The relationship between self-efficacy and health behaviors and the level of knowledge about breast cancer prevention in the professional group of nurses. In: *Family Health Disease*. Gołkowski F, Dębska G (eds). Oficyna Wydawnicza AFM, Kraków 2024; 155-168.
 29. Kaczor-Szkodny PM, Szkodny W. Wybrane elementy wpływające na powstawanie i kształtowanie postaw i zachowań zdrowotnych [Selected elements affecting the formation and shaping of attitudes and health behaviours]. *Med Og Nauk Zdr* 2021; 27(1): 45-49.
 30. Pope ZC, Barr-Anderson DJ, Lewis BA, et al. Use of wearable technology and social media to improve physical activity and dietary behaviors among college students: a 12-week randomized pilot study. *Int J Environ Res Public Health* 2019; 16(19): 3579. DOI: 10.3390/ijerph16193579.

AUTHORS' CONTRIBUTIONS

GD, FG, ABW prepared a research concept and design of the manuscript. GD, EK, ZF collected and/or assembled data. GD, FG, ABW analysed and interpreted data. GD, ABW wrote the article. GD, EK, ZF, FG, ABW revised the article. All authors approved the article finally. GD, ABW announced it.