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ORIGINAL PAPER

RELATIONSHIPS BETWEEN PHYSICAL FITNESS AND HEALTH-RELATED BEHAVIORS IN PHYSICAL EDUCATION AND PHYSIOTHERAPY STUDENTS

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Summary

Background. Physical fitness is a key determinant of health and good physical well-being. The aim of this study was to investigate the relationship between physical fitness and health-related behaviors among students.

Material and methods. A total of 176 individuals aged 20 to 28 participated in the study, 67 studied Physical Education (PE), 109 studied Physiotherapy (PT). The eight tasks of the International Physical Fitness Test (IPFT) battery were used to assess physical fitness. The research tools were Juczynski's Health Behavior Inventory (HBI) and a self-developed questionnaire.

Results. PE students, both male (450.4 vs. 381.6, $p<0.001$) and female (480.8 vs. 385.8, $p<0.001$), achieved higher scores in IPFT tests compared to PT students. PE students demonstrated higher levels of health behavior (overall score) than their peers studying PT (male 80.1 vs. 71.7, $p=0.009$, and female 85 vs. 76.3, $p=0.006$). Positive correlations were observed between physical fitness levels and all four health behavior categories and overall result measured by the HBI ($r=0.397$, $p<0.001$).

Conclusions. There are notable differences in health behaviors between PE and PT students. This may be linked to the higher proportion of active athletes among PE students. Participation in sports encourages healthy eating habits and caring for mental well-being.

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Keywords: International Physical Fitness Test, Health Behavior Inventory, physical fitness, lifestyle, students

Introduction

Physical fitness is a key determinant of overall health and good physical well-being. There are many aspects that highlight its significance. Most relevant are the cardiovascular system and heart health. Physical fitness results from regular physical activity. It has a positive effect on heart function, lowers blood pressure, reduces the risk of cardiovascular disease, and regulates cholesterol levels. Physical activity enhances lung function, improving oxygen uptake, which benefits both physical performance and overall well-being. Regular physical activity is associated with a reduced risk of chronic diseases, i.e. type 2 diabetes, hypertension, non-alcoholic steatohepatitis, and certain types of cancer. Exercise plays a vital role in achieving and maintaining a healthy body weight by burning calories and increasing metabolism, thereby preventing obesity and overweight. It enhances the body's ability to process and utilize energy, helping control sugar levels and prevent diabetes. Another crucial aspect of physical fitness is healthy bones and muscles, which help prevent osteoporosis and injuries and support overall endurance. It is possible to increase performance and energy through regular exercise, as the body becomes more efficient, increasing daily energy levels. Additionally, physical activity is linked to improved sleep quality and prevents insomnia. Beyond its physical benefits, exercise also has psychological advantages, since physical fitness and high physical activity reduce stress, improve mood, and alleviate symptoms of depression and anxiety [1-5].

Steptoe et al. identified five categories of health-promoting behaviors: dietary habits (limiting cholesterol-raising fats), preventive activities (self-monitoring health status),

avoidance of stimulants, positive health behaviors (regular physical activity, environmental hygiene, etc.), and communication safety [6].

The World Health Organization (WHO) classified health aspects into three dimensions of health behaviors: physical, mental, and social [7]. There are various methods and health behaviors to improve, maintain, or restore these aspects. The physical dimension includes proper nutrition, regular physical activity, strengthening the body's immunity, personal hygiene, and environmental hygiene. Mental health is maintained through self-confidence, high self-esteem, optimism, coping with stress, and building self-confidence. The social dimension includes establishing satisfying interpersonal relationships, effective communication, and conflict resolution [8].

Balanced nutrition contributes to overall well-being and resistance to illness. It prevents excessive strain on the musculoskeletal system and many diseases (e.g. overweight, hypertension, and some cancers) and reduces stress levels in the body [9,10].

Regular physical activity is also an important factor, as it not only determines a person's physical development but also compensates for passive leisure activities. It is divided into physical exercises that are planned and repeated (e.g. playing sports) and physical efforts that are related to activities of daily living (e.g. gardening, climbing stairs, cleaning, walking). Physical activity also has a psychosocial aspect, as organizing various forms of exercise helps maintain interpersonal relationships. Systematic physical activity prevents many somatic conditions and positively influences mental health. Physical exercise is regarded as the most effective and affordable method to combat stress and mental fatigue [11]. Physiotherapists, sports trainers, and physical education teachers should be the promoters of a healthy lifestyle. Therefore, it seems reasonable to examine students' predispositions to this role.

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Aim of the work

A health-oriented lifestyle and well-structured health education should lead to improved physical fitness. Therefore, the aim of this study was to investigate the relationship between physical fitness and health-related behaviors among students. The application goal was to formulate postulates regarding the health values of the Physical Education (PE) and Physiotherapy (PT) curriculum through their comprehensive impact on the lifestyle and physical fitness of students.

Material and methods

Participants

The survey was conducted among students at the Józef Piłsudski University of Physical Education in Warsaw (AWF) and the Medical University of Warsaw (WUM), Poland. A total of 176 individuals aged 20 to 28 participated in the study. Among them, 67 studied PE, while 109 studied PT (Table 1). The inclusion criterion was the absence of medical contraindications for the physical fitness testing. Individuals who did not complete at least one test attempt were excluded. Second and third year students were recruited for the research. The study was voluntary and anonymous.

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Table 1. Characteristics of the examined students

Gender	Group	Number of people	Age [years]	Body mass [kg]	Body height [cm]	BMI [kg/m^2]
Women	**Physical Education**	31	22.27±2.53	59.03±6.29	166.63±5.13	21.35±2.44
	Physiotherapy	56	21.65±1.82	61.29±9.75	167.86±5.87	21.74±3.34
Men	**Physical Education**	36	21.31±1.93	79.97±11.26	183.00±6.10	24.17±3.20
	Physiotherapy	53	20.92±1.43	78.72±14.47	181.36±7.59	23.81±3.40

Procedure

The eight tests of the International Physical Fitness Test (IPFT) battery, which was developed by the International Council for the Teaching of Physical Education and Sport, were used to assess physical fitness. The IPFT enables monitoring trends in changes in the level of physical activity and overall health on an international scale. It can be used by schools, research institutions, and public health organizations to evaluate the effectiveness of educational programs and interventions aimed at improving physical fitness and health. The test consists of eight trials assessing motor skills, including speed (50 m run), jumping ability (standing long jump), endurance (1000 m, 800 m, and 600 m run), hand strength (dynamometer measurement), arm and shoulder strength (overhead hang), agility (4 x 10 m shuttle run), abdominal strength (sit-ups from a supine position), and flexibility (sit-and-reach). All trials were converted into scores ranging from 0 to 100 [12].

The Computer-Assisted Web Interview (CAWI) method was also used in the research. The research tools were Zygfryd Juczynski's Health Behavior Inventory (HBI) and a self-developed questionnaire [13].

The HBI consists of a description of health behaviors assessed by a five-point scale, where 1 indicates "almost never" and 5 means "almost always". A general health behavior intensity index was established, covering four categories of daily activities that impact health:

(1) nutrition habits, (2) preventive behavior, (3) positive attitude, and (4) health practices. The survey index was the HBI scale, ranging from 24 to 120 points with higher scores indicating greater health-oriented behavior [13].

The self-developed questionnaire included questions regarding basic demographic data, such as gender, age, body height, body weight, field of study, and self-rated health status and physical fitness (on a scale of 1 to 5 points).

Statistical analysis

Differences between groups were determined by the Mann-Whitney U test. Associations between individual variables (e.g. IPFT test scores and age, training length, or training frequency) were established using Spearman's rho correlation analysis. The minimal level of statistical significance was set at $p \leq 0.05$. –

Results

PE students, both male (450.4 vs. 381.6) and female (480.8 vs. 385.8), achieved higher scores in physical fitness tests compared to PT students ($p<0.001$). Among women, significantly higher scores (in favor of PE students) were recorded in the following tests: 800 m run, 50 m run, long jump from a standing position, sit-ups from a supine position, 4 x 10 m shuttle run, and active overhead hang on a bar. Male PE students scored significantly higher in five out of eight trials: 800 m run, 50 m run, long jump from a standing position, 4 x 10 m shuttle run, and pull-ups on the bar. For the flexibility test (sit-and-reach), slightly higher results were obtained by PT students (Tables 2 and 3).

Table 2. Results of physical fitness test (women)

Group	800 m run	50 m run	Long jump	Sitting up from lying down	4x10 m run	Hand grip	Hang on the bar	Trunk bend	Sum
Physical Education	60.85± 10.45	68.32± 17.24	65.27± 14.85	58.59± 7.95	55.62± 6.37	67.54± 11.66	51.62± 16.23	54.88± 13.19	480.08± 58.13
Physiotherapy	41.42± 11.14	46.05± 7.42	45.71± 10.50	50.96± 7.87	48.41± 6.56	64.32± 12.02	35.02± 25.33	56.98± 11.38	385.79± 52.93
Differences	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	0.255	**0.001**	0.488	**0.000**

Notes: bold *p*-values – statistically significant.

Table 3. Results of physical fitness test (men)

Group	800 m run	50 m run	Long jump	Sitting up from lying down	4x10 m run	Hand grip	Pull-ups on the bar	Trunk bend	Sum
Physical Education	51.03± 14.20	55.60± 10.41	58.49± 10.38	53.26± 8.21	58.91± 8.96	60.69± 11.72	58.74± 14.00	53.71± 9.84	450.43± 38.42
Physiotherapy	36.87± 14.90	47.25± 6.94	44.34± 12.12	52.06± 8.85	45.72± 6.39	56.26± 11.49	45.85± 17.13	53.94± 13.27	381.58± 55.01
Differences	**0.000**	**0.000**	**0.000**	0.517	**0.000**	0.085	**0.000**	0.926	**0.000**

Notes: bold *p*-values – statistically significant.

PE (male and female) demonstrated higher levels of health behavior (overall score) than their peers studying PT. Female PE students scored higher in all four health behavior categories (Table 4). Among male students, significant differences were noted in the categories of dietary habits and positive mental attitude (Table 5).

Table 4. Level of health-related behaviors (women)

Group	Nutrition habits	Preventive behavior	Positive attitude	Healthy practices	Health-related behaviors – sum
Physical Education	3.79±0.62	3.66±0.74	3.84±0.64	3.55±0.47	85.00±10.68
Physiotherapy	3.31±0.64	3.04±0.67	3.36±0.56	2.91±0.56	76.27±9.05
Differences	**0.001**	**0.000**	**0.001**	**0.000**	**0.006**

Notes: bold *p*-values – statistically significant.

Table 5. Level of health-related behaviors (men)

Group	Nutrition habits	Prophylactic behavior	Positive attitude	Healthy practices	Health-related behaviors – sum
Physical Education	3.44±0.70	3.24±0.75	3.50±0.66	3.22±0.67	80.08±12.78
Physiotherapy	2.87±0.88	2.96±0.79	3.10±0.72	2.96±0.73	71.75±13.58
Differences	**0.001**	0.095	**0.008**	0.092	**0.009**

Notes: bold *p*-values – statistically significant.

PE students rated their health and fitness levels significantly higher. The above relationships apply to both male and female participants. Self-assessment of physical fitness among PT students showed just above three points on a five-point scale (Table 6).

Table 6. Self-assessment of health and physical fitness

Group	Women		Men	
	Self-assessment of health	Self-assessment of physical fitness	Self-assessment of health	Self-assessment of physical fitness
Physical Education	4.16±0.76	4.26±0.73	4.19 ±0.57	4.46±0.51
Physiotherapy	3.56±0.89	3.04±0.84	3.45±1.13	3.10±1.11
Differences	**0.005**	**0.000**	**0.000**	**0.000**

Notes: bold *p*-values – statistically significant.

Significant positive correlations were found between physical fitness level (measured by the IPFT) and health behaviors (measured by the HBI). Significant correlations were recorded for each of the health behavior categories for the entire study group (Table 7).

Table 7. Correlation between level of physical fitness and health-related behaviors

Group	Nutrition habits	Prophylactic behavior	Positive attitude	Healthy practices	Health-related behaviors – sum
All	0.216*	0.226*	0.333***	0.300**	0.397***
Physical Education	0.118	-0.049	0.212	0.197	0.203
Physiotherapy	0.094	0.145	0.149	0.083	0.169*

Notes: *$p<0.05$; **$p<0.01$; ***$p<0.001$.

Significant positive correlations were also found between fitness level and self-rated health and between fitness level and self-rated fitness. These relationships applied to both the overall study group and the PE students (Table 8).

Table 8. Correlation between level of physical fitness and self-assessment of health and physical fitness

Group	Self-assessment of health	Self-assessment of physical fitness
All	0.259**	0.345***
Physical Education	0.354**	0.436***
Physiotherapy	-0.048	-0.112

Notes: **p<0.01; ***p<0.001.

Discussion

The aim of the study was to understand how different educational programs and academic environments influence students' health and fitness behaviors. Comparing the two groups is important for several reasons. Firstly, students at the AWF and WUM represent different perspectives on health and fitness, which may be reflected in their daily habits and self-rated health. Secondly, the study results provide valuable insights into the needs and challenges associated with promoting healthy lifestyles in different student populations. Finally, understanding these differences can help in designing effective health promotion strategies tailored to the specific needs of students at different universities.

The study results clearly indicate significant differences in physical fitness levels between students at AWF and WUM. AWF students, both male and female, scored significantly higher on fitness tests, likely due to greater involvement in sports and higher levels of physical activity in their academic curricula.

Fitness level is evaluated in two ways: objectively and subjectively. As Jopkiewicz et al. [14] note, self-assessment is a valuable measure of physical fitness, as it provides knowledge about the perceived health status of contemporary youth. Positive health measures include proper somatic characteristics such as body height, body weight, weight-to-height ratio, and physical fitness and physical capacity indices. Regular physical activity is critical as it significantly impacts both health and fitness [2,15-18].

The results also show clear differences in health behaviors between students at AWF and WUM. This is likely due to more frequent participation in sports by PE students. Research by other authors confirms that athletes engage in healthier behaviors compared to non-athletes [19-21]. The above relationship also applies to former athletes, as many continue a health-conscious lifestyle even after retiring from competitive sports [22].

Self-esteem is an important element of a person's personality, affecting social functioning. Individuals with high self-esteem perceive themselves as valuable and satisfied with life. Studies on students' self-rated health indicate that most assess their health as good [23].

Students take various steps to improve their health. There is a wealth of research that addresses health and anti-health behavior in Poland. Studies indicate that engagement in physical activity or sports is at a low level. Common problems in students include irregular eating habits and stress-induced dietary mistakes. Many students smoke cigarettes, consume alcohol or drugs, fail diagnostic tests, or neglect body hygiene [23]. Ochal conducted research highlighting the beneficial effects of physical activity on students' health and its role in shaping overall health [24]. Other studies confirm a strong relationship between physical activity and cardiovascular fitness. Students who exercise regularly display higher cardiovascular fitness [25].

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The findings on self-rated health and fitness among students from AWF and WUM show that AWF students (both female and male) rated their health and fitness higher than WUM students.

Comparing the physical fitness and health behaviors of these two groups provides important insights into the impact of the educational environment on young adults' health. These findings highlight the importance of physical activity, fitness, and healthy habits as key lifestyle elements that should be promoted at all universities [25].

The results clearly show that AWF students outperform WUM students in most fitness tests. These differences can be attributed to the specifics of the curricula at the two universities. AWF focuses on PE, which implies daily physical activity, regular training, and participation in sports. This environment is conducive to developing and maintaining a high level of physical fitness. The results also highlight the importance of regular physical activity not only for physical fitness but also for overall health and well-being [25,26].

The findings suggest that educational programs integrating physical activity as an essential part of the curriculum could contribute to better health and fitness among students. Medical universities could consider implementing more physical activity programs to promote physical activity and improve the physical fitness of their students. This could be regular sports activities, healthy lifestyle workshops, or educational campaigns on the benefits of regular physical activity. It was observed that physical activity decreases with age. In the group of people aged 15-24, 74% is physically active, while in the group of 25-39 years, it is only 65%. There were different motivations for physical activity, depending on age, gender, health status, and place of residence. Most often, respondents pay attention to improving health and general physical fitness. For many people, physical training is a form of relaxation and fun. It was observed that significant differences in the number of exercises occur among students from different fields of study. Due to their profession, the people who spend the most

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time on physical activity are students of PE, but also PT. For them, aesthetic considerations and appearance are also important, as well as feeling pleasure from exercise [26,27]. Education at universities should meet the needs of students, as well as the need for physical activity.

Despite clear differences observed in the results, some limitations of the study should be acknowledged. Self-assessment of health and fitness is subjective and may be influenced by personal beliefs, current health status, and stress levels. Additionally, the study was limited to two universities. It would be interesting to check the level of health behavior of PT students from multiple universities. Further research should consider expanding the study groups. The implementation of objective tools would also undoubtedly increase the application value of the study.

In conclusion, the results of this study indicate significant differences in physical fitness and self-rated health between PE and PT students. These findings provide a basis for developing programs to promote healthy lifestyles at various universities, ultimately contributing to the improved health and well-being of young adults. The observed differences in fitness levels between PE and PT students may stem from greater involvement in sports (among AWF students) and the nature of their academic curricula.

Conclusions

1. There are notable differences in health behaviors between students at AWF and WUM. This may be linked to the higher proportion of active athletes among AWF students. Participation in sports encourages healthy eating habits and caring for mental well-being.

2. Further research on student lifestyles should be conducted to implement health education as effectively as possible in university curricula, particularly in courses related to health prevention.

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The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki. The study was approved by the Research Ethics Committee of the Józef Pilsudski University of Physical Education in Warsaw (No. SKE 01-38/2023).

Artificial intelligence (AI) was not used in the creation of the manuscript.

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