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ASSOCIATION BETWEEN PHYSICAL ACTIVITY AND BODY COMPOSITION AMONG PHYSIOTHERAPY STUDENTS

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The purpose of this research was to assess the effects of moderate, non-professional physical activity on the body composition of future physiotherapists. The study involved 102 physiotherapy students (aged 17–18): untrained (M1, F1) and non-professionally trained (M2, F2). Non-professional training lasted up to 5 hours weekly at a moderate activity level. We observed the larger muscle component in group M2 (42.51 %), than in group M1 (40.18 %, $p \leq 0.05$), and in F2 (29.56 %) than in F1 (28.33 %, $p \leq 0.05$). The fat component was larger in group M1 (18.74%), compared to group M2 (16.30 %, $p \leq 0.05$), and in F1 (30.82 %) compared to F2 (27.58 %, $p \leq 0.05$). The highest percentage of individuals with normal body mass was found in groups M2 and F2 – 84.2 % and 75.0 %, respectively. The analysis of correlation coefficients demonstrates a general trend of increased fat tissue content ($r = 0.789–0.908$) and decreased muscle tissue content ($r = -0.108–0.730$) with higher BMI. We conclude that engagement in non-professional training induces alterations in both muscle and fat tissue content in the body of physiotherapy students.

Key words: non-professional training, body mass index, muscle component, fat component.

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ЗВ'ЯЗОК МІЖ ФІЗИЧНОЮ АКТИВНІСТЮ ТА КОМПОНЕНТНИМ СКЛАДОМ ТІЛА СТУДЕНТІВ-ФІЗИОТЕРАПЕВТІВ

Метою цього дослідження було оцінити вплив помірної, непрофесійної фізичної активності на компонентний склад тіла майбутніх фізіотерапевтів. У дослідженні взяли участь 102 студенти-фізіотерапевти (віком 17–18 років): нетреновані (M1, F1) та ті, що займалися непрофесійним спортом (M2, F2). Непрофесійні тренування тривали до 5 годин на тиждень із помірним рівнем фізичної активності. Виявлено більший м'язовий компонент у групі M2 (42,51%), ніж у M1 (40,18 %, $p \leq 0,05$), та у F2 (29,56 %), ніж у F1 (28,33 %, $p \leq 0,05$). Жировий компонент був більшим у групі M1 (18,74%) порівняно з M2 (16,30 %, $p \leq 0,05$) та у F1 (30,82 %) порівняно з F2 (27,58 %, $p \leq 0,05$). Найвищий відсоток осіб із нормальною масою тіла зафіксовано у групах M2 та F2 – 84,2 % та 75,0 % відповідно. Виявлена загальна закономірність до підвищення вмісту в організмі жирової тканини ($r = 0,789–0,908$) та зменшення вмісту м'язової тканини ($r = -0,108–0,730$) при зростанні індексу маси тіла. Ми дійшли висновку, що заняття непрофесійним спортом спричиняють зміни як у м'язовому, так і в жировому складі тіла студентів-фізіотерапевтів.

Ключові слова: непрофесійні тренування, індекс маси тіла, м'язовий компонент, жировий компонент.

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Recent literature analysis reveals a concerning trend toward changes in body composition, particularly alterations in fat percentage and lean body mass among students [11, 12]. Such changes may contribute to a decline in their overall physical fitness levels. This issue is particularly pertinent for physiotherapy students, as their future professional activities necessitate a proper level of physical fitness [3, 4, 11, 12].

One contributing factor to increased fat accumulation and decreased fitness levels among students could be the limited opportunities for physical activity and insufficient inclusion of exercise hours in academic curricula. Several studies highlight a low or inadequate level of physical activity among physiotherapy students [1, 11], which may result in below-average physical fitness levels, as well as higher body mass and fat levels compared to students in other disciplines [13]. Therefore, it is imperative to explore avenues for improving the health status, physical fitness, and body composition of students, particularly those in physiotherapy programs.

One potential approach to enhancing body composition and increasing physical fitness levels among students is through non-professional extracurricular sports activities. Multiple studies demonstrate the positive impact of additional physical activities on students' body composition [3, 5, 8, 15] and physical fitness [7, 9, 10, 12]. Some studies have also shown positive effects of physical activities on aerobic capacity, muscular endurance, and overall physical fitness levels specifically among physiotherapy students [1]. Despite the abundance of literature on this topic, we found only one study focused on physiotherapy students [7].

The purpose of the study was to assess the effects of moderate, non-professional physical activity on the body composition of future physiotherapists, recognizing physical activity and its absence as significant factors influencing body mass composition

Materials and methods. Participants. Our sample consisted of 102 male and female students without chronic illnesses from Ivan Bobersky Lviv State University of Physical Culture (LSUPhC). The male students were classified into Group M1 (44 persons), comprising individuals who do not regularly engage in any physical exercises, and Group M2 (19 persons), consisting of students who participate in non-professional sports. Female students were also classified into two groups – Group F1 (27 persons), comprising untrained individuals, and Group F2 (12 persons), consisting of individuals who participate in non-professional sports. Information regarding extracurricular physical activity was gathered through a questionnaire, wherein students detailed the type, duration, and intensity of their physical activities, if applicable. Students were assigned to either the M2 or F2 group if they engaged in regular non-professional sports activities for a minimum of six months, averaging up to five hours per week at a moderate intensity level.

Study organization. We have used the anthropometric methods for measuring height, employing a metallic stadiometer for accuracy. We also conducted bioimpedance analysis using the Omron BF-511, measuring various parameters including body weight, body mass index (BMI), percentage of body fat and skeletal muscle mass, basal metabolic rate, and visceral fat level. The BMI values were analyzed according to the World Health Organization's obesity classification scale [14]. The Omron BF-511 device measures the total electrical resistance of the body by applying an electric current of a specific frequency and intensity. The examination is painless and non-invasive, and the procedure does not take long. It can be applied to subjects of both sexes and of all ages. All the methods are standard practices, and have been extensively described in scientific literature and in our previous publications [8].

Statistical analysis. The obtained data were processed using the statistical functions of the Microsoft Excel 2010 and Origin 2018 software. The normality of the empirical data distribution was verified based on the Shapiro-Wilk criterion. Since the distribution did not differ from normal, the arithmetic mean and standard error of the mean ($M \pm SEM$) were analyzed, and the probability of the difference between groups was determined based on Student's t-test. Pearson's correlation coefficient was used to assess the relationships between variables.

All participants provided informed consent to participate in the research. The studies adhered to the established standards of the Helsinki Declaration regarding ethical principles for conducting research involving human subjects.

Results of the study and their discussion. Firstly, we compared the basic anthropometric and bioimpedance parameters between untrained male and female students (groups M1 and F1), and male and female students who engage in non-professional training (groups M2 and F2). Statistical analysis of the data (Table 1) indicates that there is no significant difference in body weight, height, and basal metabolic rate between the groups ($p > 0.05$).

Table 1

The results of anthropometric and bioimpedance analysis of LSUPhC physiotherapy students with different levels of physical activity ($M \pm SEM$)

Parameter	Male students		Female students	
	Group M1	Group M2	Group F1	Group F2
Age, years	17.30±0.09	17.32±0.11	17.42±0.15	17.56±0.41
Height, cm	178.6±1.30	178.79±1.31	166.19±0.83	166.83±1.86
Weight, kg	70.76±1.79	71.74±1.67	60.13±1.93	56.77±1.99
BMI, kg/m ²	22.64±0.56	22.34±0.44	21.67±0.63 [#]	20.35±0.53*
UW students, %	4.8	0.0	18.5	25.0
NW students, %	78.6	84.2	66.7	75.0
OW students, %	11.9	15.8	14.8	0.0
FC, %	18.74±1.20	16.30±0.99*	30.82±1.20	27.58±0.36*
MC, %	40.18±0.87	42.51±0.61*	28.33±1.16	29.56±0.57*
Basal metabolism, kcal/day	1702.28±0.40	1702.28±0.54	1343.19±25.46	1293.08±24.01 [#]

Notes: BMI in groups of underweight (UW), normal weight (NW), and overweight (OW) were < 18.5 kg/m², 18.5–24.9 kg/m² and > 25 kg/m² respectively; FC – fat component, MC – muscle component, * – $p \leq 0.05$, # – ≤ 0.10

The highest percentage of individuals with normal body weight was found in the groups of trained students M2 and F2 – 84.2 % and 75.0 %, respectively. At the same time, in group M2, there were no individuals with underweight, and in group F2, there were no individuals with overweight. It can be assumed that additional physical activities contribute to optimizing BMI values in students.

We found significant differences in the values of body fat and skeletal muscle content between groups of students with different levels of physical activity. Specifically, in group M2, the percentage of body fat was by 13 % lower than in group M1 ($p < 0.05$). The percentage of skeletal muscle tissue in the bodies of students

in group M2 was 6 % higher ($p < 0.05$) than in group M1. There was no significant difference in the visceral fat content between groups of trained and untrained students. It was found that the percentage of body fat in group F2 was 11 % lower ($p < 0.05$) than in untrained individuals in group F1. At the same time, the content of skeletal muscle tissue in female students of group F2 was 4 % higher ($p < 0.05$) than in group F1. The visceral fat content in the bodies of female students in groups F1 and F2 did not significantly differ. Thus, physical activities at the level of non-professional training induce significant changes in the content of muscle and fat tissue and do not affect the visceral fat content in the bodies of students.

Analysis of the morphological characteristics of students with normal weight, overweight, and underweight (according to BMI) revealed certain differences between these groups (Table 2).

Table 2

**Features of anthropometric and bioimpedance parameters
of male physiotherapy students with different BMI levels (M \pm SEM)**

Parameter	Group	Nutritional status (BMI level)		
		UW	NW	OW
Height, cm	M1	187.00 \pm 5.29	177.32 \pm 1.07	181.00 \pm 5.87
	M2	-	177.94 \pm 1.58	179.33 \pm 2.96
	F1	163.80 \pm 1.66	167.06 \pm 1.01	165.25 \pm 2.39
	F2	163.67 \pm 6.39	167.89 \pm 1.54	-
Weight, kg	M1	62.13 \pm 5.26	67.46 \pm 1.07	90.49 \pm 5.50
	M2	-	69.09 \pm 1.62	81.87 \pm 2.34
	F1	46.86 \pm 1.61	60.44 \pm 1.43	75.33 \pm 3.16
	F2	48.37 \pm 3.21	59.57 \pm 1.57	-
BMI, kg/m ²	M1	17.69 \pm 0.53	21.52 \pm 0.29	28.71 \pm 1.34
	M2	-	21.81 \pm 0.33	25.47 \pm 0.33*
	F1	17.24 \pm 0.27	21.59 \pm 0.37	27.55 \pm 0.50
	F2	18.03 \pm 0.22	21.12 \pm 0.46	-
FC, %	M1	10.00 \pm 0.20	16.53 \pm 0.98	30.73 \pm 1.90
	M2	-	15.55 \pm 1.06	20.53 \pm 0.07*
	F1	21.66 \pm 1.55	31.49 \pm 0.82	39.25 \pm 2.09
	F2	23.30 \pm 1.65*	29.00 \pm 1.11*	-
MC, %	M1	44.85 \pm 0.25	41.62 \pm 0.80	33.31 \pm 1.45
	M2	-	42.92 \pm 0.68*	40.33 \pm 0.23*
	F1	29.44 \pm 0.67	28.41 \pm 0.37	26.63 \pm 1.40
	F2	28.77 \pm 1.99	29.82 \pm 0.49*	-

A similar pattern of correlation between body composition indicators (muscle and fat mass) and students' BMI was observed across all groups. Analysis of the correlation coefficients revealed an increase in body fat content with rising BMI. In groups M1 and M2, the corresponding coefficients were $r = 0.792-0.789$, while in groups F1 and F2, they ranged from $r = 0.896$ to 0.908 . Based on this data, it can be assumed that weight gain and BMI increase in different groups of studied students occur through the mechanism of accumulating body fat, regardless of additional physical activities. However, male students with overweight who also engage in training (group M2) have lower body fat content and higher skeletal muscle content compared to untrained students (group M1, $p < 0.05$). The differences in skeletal muscle content between groups with the BMI gradations are somewhat less pronounced. In groups M1 and M2, the correlation coefficient between muscle mass content and BMI ranged from $r = -0.667$ to -0.730 , while in groups F1 and F2 it was only $r = -0.465$ to -0.108 . Surprisingly, in the group of female students with underweight, a higher percentage of body fat is found in the group physically active female students (group F2) compared to untrained individuals (group F1).

The initial impetus for our research was the problem identified by many authors concerning negative changes in body composition and physical fitness among students [1, 8], including those studying physiotherapy [7, 10, 13]. This issue is significant not only because of the potential adverse effects on the health and quality of life of the students but also due to the necessity for physiotherapists to maintain an adequate level of physical fitness to perform their professional duties effectively. Additionally, some authors have observed negative trends, such as increased body fat content, BMI, and waist circumference, during university studies [7].

Numerous studies examining male and female students [6] with varying levels of physical activity (high, moderate, satisfactory, and low) have demonstrated a relationship between physical activity levels and the fat and muscle components of body composition. While an increase in daily physical activity intensity can lead to a reduction in body fat content [4], several studies [9, 11, 15] indicate that aerobic exercises are the most effective for reducing fat content. Additionally, various studies support the impact of physical exercise on lean body mass and fat content [5] as well as the muscle content in students' bodies [9].

The positive impact of increased physical activity on body mass index (BMI) has been observed in younger individuals from 15 years old [3], as well as in students [1, 10]. However, some studies [10] found no correlation between BMI and the Physical Fitness Index (PFI) among physiotherapy students. At the same time, other authors discovered that among students with higher physical activity levels, aerobic capacity, endurance of trunk muscles, and overall physical fitness, there was no significant difference in BMI values [6]. This suggests that the BMI parameter does not always reflect the physical fitness level of students, making the analysis of body composition a more preferable method.

Thus, a significant body of literature indicates the need to maintain a high level of physical activity among students to optimize body composition, enhance physical fitness, and prepare for professional duties. Meanwhile, the curriculum for students enrolled in “227 Physiotherapy, Occupational Therapy” includes only 2 hours of physical activity per week. Since WHO recommendations call for up to 300 minutes of moderate-intensity aerobic physical activity or 75–150 minutes of vigorous-intensity aerobic physical activity per week, it is evident that additional forms of physical activity are necessary. From this perspective, analyzing the possibilities for students to engage in extracurricular activities according to their preferences is appropriate.

Our analysis showed that only 30% of male students and 31% of female students enrolled in “227 Physiotherapy, Occupational Therapy” are additionally engaged in non-professional sports at a moderate level for up to 5 hours per week. These physical activities led to a 7 % decrease in BMI among female students, a reduction in the fat component by 11–13 %, and an increase in the muscle component by 4–6 % among both male and female students. Other studies have found that students engaging in physical activity for at least 250 minutes per week leads to a decrease in body weight by 1–8 %, body fat by 12–16 %, an increase in muscle tissue by 8–11 %, and a reduction in BMI by 9–10 % [2]. Similarly, participating in physical exercises three times a week for 8 weeks resulted in a 6 % reduction in fat mass, a 2 % increase in skeletal muscle mass, and a 4 % decrease in body fat percentage [9]. Therefore, the outcomes achieved through specifically selected physical exercises are comparable to the results we obtained.

Several publications also compare body composition and physical fitness indicators of students with different levels of physical activity. For instance, when physical activity is higher by 13 %, the BMI is found to be lower by 8 %, body fat decreases by 11 %, and VO_{2max} increases by 31 % [11]. Similarly, changes in BMI (-1 %) and body fat (-21 %) were observed when comparing physically active students (engaging in 5 to 7 hours per week of swimming, running, games, martial arts) with students not engaged in any structured activity [5]. Furthermore, an increase in muscle tissue content by 2 % and a decrease in fat content by 8 % were observed in students with a higher (by 55 %) level of physical activity [13].

Therefore, the results we obtained, along with data from other studies, indicate the potential benefits of using extracurricular physical activities to correct body composition and enhance physical fitness and aerobic capacity in physiotherapy students. Promising directions for further research include studying the impact of specific types of extracurricular activities, which can only be achieved by increasing the number of participants in the study.

Conclusion

Our findings indicate that moderate non-professional physical activity – up to 5 hours per week – engaged in by 30 % of male and 31 % of female students in the “227 Physiotherapy, Occupational Therapy” program, has a favorable effect on their anthropometric indicators. Such activity contributes to optimizing BMI, with a notable 7 % reduction observed among female students. Additionally, these physical exercises lead to significant reductions in fat mass (11–13 %) and increases in muscle mass (4–6 %) for both male and female students, without affecting visceral fat levels. The rising BMI levels are associated with increased body fat and a decline in the proportion of skeletal muscle tissue in both active and inactive students. These results underscore the value of regular, moderate extracurricular sports in improving students’ body composition and support incorporating structured physical activity into their daily routines.

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ASSOCIATION BETWEEN CLINICAL MANIFESTATIONS AND MUTATIONAL VARIANTS OF THE MEFV GENE IN CHILDREN

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The purpose of the study was to assess the clinical characteristics of Familial Mediterranean fever, depending on the variants of genotypic mutations. In total 11 patients with Familial Mediterranean fever aged from 1 to 18 years (mean age 7.4±3.5 years) were involved in the study. The examination included physical, laboratory and instrumental methods. Of the 11 patients with a mutation in the MEFV gene, 55 % had the homozygous M694V variant, 20 % had the homozygous R202Q variant, 15 % had the heterozygous pV726A variant, and 10 % had a compound homozygous R202Q and M694V variant. Patients with the M694V mutation had more severe clinical symptoms (periodic fever, polyserositis), earlier disease onset, and a higher risk of amyloidosis. In the combined variant, 2 boys had phenotypic clinical features of type M694V, as well as elevated paraclinical inflammatory markers and colchicine resistance. Children with heterozygous V726A mutation had abdominal pain, limited in duration fever, and decreased attacks frequency.

Key words: familial Mediterranean fever, MEFV gene, amyloidosis, mutation, children.

Н.С. Гасанова, Ф.М. Мамедова, С.М. Мамедов, Л.А. Гідаятова АСОЦІАЦІЯ КЛІНІЧНИХ ПРОЯВІВ ІЗ РІЗНИМИ ВАРІАНТАМИ МУТАЦІЙ ГЕНА MEFV У ДІТЕЙ

Метою дослідження була оцінка клінічних характеристик сімейної середземноморської лихоманки залежно від варіантів генотипових мутацій. Загалом у дослідженні взяли участь 11 пацієнтів із сімейною середземноморською лихоманкою віком від 1 до 18 років (середній вік 7,4±3,5 років). Обстеження включало фізикальні, лабораторні та інструментальні методи. З 11 пацієнтів із мутацією в гені MEFV у 55 % був гомозиготний варіант M694V, у 20 % – гомозиготний варіант R202Q, у 15 % – гетерозиготний варіант pV726A і в 10 % – компаунтний гомозиготний варіант R202Q і M694V. У пацієнтів з мутацією M694V спостерігалися більш виражені клінічні симптоми (періодична лихоманка, полісерозит), ранній початок захворювання і вищий ризик розвитку амлоїдозу. При комбінованому варіанті у 2 хлопчиків спостерігалися фенотипічні клінічні ознаки, характерні для M694V, а також підвищені запальні маркери і резистентність до колхіцину. У дітей із гетерозиготною мутацією V726A відзначалися болі в животі, обмежена за тривалістю лихоманка і зниження частоти нападів.

Ключові слова: сімейна середземноморська лихоманка, ген MEFV, амлоїдоз, мутація, діти.

Familial Mediterranean fever (FMF) is an autosomal recessive disease that was previously rare and was observed in representatives of certain ethnic groups (Jews, Greeks, Armenians, Turks, Arabs), but the disease became widespread due to intercontinental travel in the twentieth century. FMF is characterized by recurrent self-limiting fever, peritonitis, arthritis, and erysipelas-like-erythema [1, 3, 9].

The MEFV gene consists of 10 exons and is located on chromosome 16p13.3. In different populations, MEFV gene mutations occur with different frequencies: among Turks, as well as Ashkenazi