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HEALTH COMPONENT LEVELS OF PHYSICAL FITNESS OF STUDENTS AT PARTIUM CHRISTIAN UNIVERSITY IN ORADEA

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ABSTRACT. Introduction. In 2013, the Cooper Institute from the U.S.A., along with the Hungarian School Sport Federation, implemented the *National Student Fitness Test* battery. In order to interpret the results, NETFIT uses a criterion-referenced standard depending on age and gender called the health standard, establishing the level of the subject in relation to certain objectives. This health standard corresponds to a minimal motor performance necessary to avoid certain risks of illnesses which may occur as a result of physical inactivity. The aim of this research is to determine the levels of health components of physical fitness among students in 1st year at Partium Christian University from Oradea, depending on their residential environment and gender. **Material and methods**. The research included a sample group of 112 students, aged 18 – 19 years. The health components of physical fitness were assessed by determining the adipose tissue level, two anthropometric measurements and 5 motor tests. **Results**. The registered data regarding the BMI values show that 13% of the students were overweight and 10% fell into the obese category. The female students with a low level of adipose tissue had significantly better results from statistical point of view at the standing broad jump test (r_{xy} = - 0.42, df = 71, p < 0.001, r_s = - 0.38, df = 71, p < 0.001). According to the data obtained at the motor tests, we found that at the standing broad jump test 49%, handgrip test 62.5%, paced curl-ups test 80%, flexibility test 64% and paced push-ups test 83% of the subjects fell within the healthy fitness zone. **Conclusions.** We consider that, in order to avoid risks due to insufficient physical activity, the level of biomotor potential of students must be related to their health. Not all students dream of performance and competitions, but they all want to be healthy!

Keywords: *health component, physical fitness, adipose tissue, student.*

REZUMAT. ***Nivelul componentelor de sănătate ale fitnessului fizic al studenților Universității Creștine Partium din Oradea.*** **Introducere.** În anul 2013, Institutul Cooper din SUA, împreună cu Federația Sportului Școlar din Ungaria, a introdus

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Bateria de teste *Nemzeti Egységes Tanulói Fittségi Teszt* (NETFIT). În vederea interpretării rezultatelor, NETFIT utilizează un standard de referinţă criterial, denumit standard de sănătate, după vârstă şi gen, stabilindu-se nivelul la care se situează subiectul faţă de unele obiective. Acest standard de sănătate corespunde cu o performanţă motrică minimă necesară pentru a evita unele riscuri de îmbolnăvire apărute ca urmare a inactivităţii fizice. **Scopul cercetării.** Scopul acestui studiu constă în determinarea nivelului privind componentele de sănătate ale fitnessului fizic a studenţilor din anul I a Universităţii Creştine Partium din Oradea, în funcţie de mediul de reşedinţă şi gen. **Subiecţi şi metode.** Cercetarea a inclus un eşantion de 112 studenţi cu vârsta de 18 şi 19 ani. S-a evaluat componentele de sănătate ale fitnessul fizic prin determinarea nivelului de ţesut adipos, două măsurători antropometrice şi 5 teste motrice. Pentru determinarea relaţiei dintre nivelul ţesutului adipos şi componentele motrice am utilizat coeficientul de corelaţie Pearson şi coeficientul Spearman rho iar pentru diferenţele dintre medii în funcţie de gen şi mediul de reşedinţă au fost testate cu ajutorul testului t pentru eşantioane independente şi testul U a lui Mann-Whitney. **Rezultate.** Datele înregistrate la valorile IMC arată că 13% dintre studenţi au fost supraponderali şi 10% au intrat în categoria celor obezi. Studentele cu un nivel scăzut al ţesutului adipos au avut rezultate semnificativ statistic mai bune la testul SL (r_{xy} = - 0.42, df = 71, p < 0.001, r_s = - 0.38, df = 71, p < 0.001). Potrivit datelor obţinute la testele motrice am constatat că la testul SL 49%, la testul DM 62.5%, la testul RRT 80%, la testul de supleţe 64% iar la testul FR 83% dintre subiecţi s-au încadrat în zona de sănătate. **Concluzii**. Considerăm că, în vederea evitării unor riscuri ca urmare a activităţii fizice insuficiente, nivelul potenţialului biomotric al studenţilor trebuie raportat inclusiv stării de sănătate. Nu toţi studenţii visează la performanţe şi competiţii, însă toţi vor să fie sănătoşi!

Cuvinte-cheie: *componente de sănătate, fitnessul fizic, ţesut adipos, student*

Introduction

According to literature, the assessment of physical fitness can be performed by normative methods (normative test batteries) or criterion-referenced methods (criterion-referenced test batteries). Most test batteries use normative assessment methods, which allow the results obtained by one subject to be compared with the results of another subject from the same group.

The physical fitness level influences physical health as well as mental and cognitive health. According to studies, regular physical exercise increases physical fitness and has a beneficial effect on mental health (Sharma, Vishal, & Frederick, 2006) and cognitive development (Hogan, Mata, & Carstensen,

2013). People with an optimal physical fitness level have an increased ability to concentrate as well as an improved short-term and long-term memory (Hillman, Castelli & Buck, 2005).

In 2013, the Cooper Institute from the USA signed a partnership agreement with the Hungarian School Sport Federation regarding the implementation of a national test for the assessment of students' fitness levels. The *National Student Fitness Test (Nemzeti Egységes Tanulói Fittségi Teszt)* (NETFIT) test battery was created based on the FITNESSGRAM model and it was implemented following a previous representative study.

The NETFIT test battery consists of anthropometric measurements (height, weight), the determination of the BMI, analysis of body composition and seven motor tests: endurance shuttle run, paced curl-ups, trunk extension test, paced push-ups, handgrip test, standing broad jump and the flexibility test.

We wanted to ensure the conditions to perform exact measurements, with well-defined and unitary protocols, starting with the idea that the means of assessment and the measuring techniques of all the health components are well known. For this purpose, between September the 12th, 2014 and September the 20th, 2014, the researcher attended a professional training course called: *Physical Education in Schools within the Context of Health Development: applied methodological renewal and unitary physical fitness measuring (NETFIT) (Iskolai testnevelés az egészségfejlesztésben: módszertani megújulás és egységes fizikai fittségmérés (NETFIT) a gyakorlatban)* (N.281/8 from September the 22nd, 2014), a module consisting of 30 hours (theory and practice) which took place in Debrecen, Hungary.

Aim of the Research

1. Determining the levels of health components of physical fitness among students in 1st year at Partium Christian University from Oradea, depending on their residential environment and gender, in the 2018-2019 university year, and forwarding the results to the competent institutions.

2. Creating databases in order to compare the results with future measurements.

Subjects and Methods

The research was performed between December the 3rd-21st, 2018, on a sample group of 112, 18 and 19 year old students in the 1st year at Partium Christian University from Oradea, Faculty of Letters and Arts, Faculty of Economic and Social Sciences.

In order to interpret the results, NETFIT uses a criterion-referenced standard depending on age and gender called the health standard, establishing the level at which the subject is located in relation to certain objectives. This health standard corresponds to a minimal motor performance necessary to avoid certain risks of illnesses which may occur as a result of physical inactivity (cardiovascular diseases, type 2 diabetes, sedentariness, etc.). The values included in the health standard do not refer to the levels required in professional sports, but to those optimal to a healthy lifestyle.

In order to analyze the results regarding the body mass index values and adipose tissue percentage in relation to age and gender, we propose the subjects to be classified into three action zones, whose limits are represented by three color codes: Healthy fitness zone – green color, Needs improvement zone – yellow color and Needs continuous improvement zone – red color (high risk of developing diseases). According to their age and gender, the students that fall into the healthy fitness zone have an optimal level of physical fitness, avoiding certain risks of developing diseases which occur as a result of physical inactivity. The goal of the teacher and of the students is to maintain themselves in the healthy fitness zone or to exceed the needs improvement zone or the needs continuous improvement zone.

In case of the body mass index (BMI) and adipose tissue percentage, the healthy fitness zone was divided into two subzones. The subjects whose results were below the accepted limits, were considered to be part of the category of those that were *thin* from somatic point of view. According to Kaj, Csányi, Karsai & Marton (2014), the subjects whose BMI and adipose tissue percentage values fall within the *thin* subzone, may receive the *healthy* classification. In case of severe underweight we try to find out the causes and recommend the school doctor to be involved. The obese students fell within the needs continuous improvement zone. The BMI was also calculated based on the BMI reference chart in relation to age and gender, the percentile categories being those presented in table 1 (Barlow, 2007).

In case of motor tests regarding skeletal muscle fitness and flexibility, Kaj, Csányi, Karsai & Marton (2014) proposed two action zones: healthy fitness zone and needs improvement zone. We did not use the endurance shuttle run test and the trunk extension test.

When classifying the results into the needs improvement zone or the needs continuous improvement zone, we recommend a proper attention to be paid to the diet and the frequency with which different kind of physical activities are performed (Lukács & Hanţiu, 2017).

BMI Percentile	Nutritional Status
BMI<5 percentiles/gender/age	Underweight
BMI between 5-84 percentiles/ gender / age	Normal weight
BMI between 85-95 percentiles/ gender / age	Overweight
BMI ≥ 95 percentiles/ gender / age	Obesity

Table 1. Percentile categories regarding body mass index (Barlow, 2007)

For this study we used the anthropometric method to measure the two somatic indicators: height and weight using a Seca 213 (Marsden, UK) height measure and an Omron BF511 (Omron Corporation, Kyoto, Japan) digital scale. Adipose tissue was measured by the bioelectrical impedance (BIA) method.

The data of the individual measurements were statistically analyzed on a computer using the Statistical Package for Social Sciences software: version 20.0 SPSS Inc. (SPSS). Using the Kolmogorov-Smirnov test, we verified the normality of the distribution of the data resulted from the anthropometric and motor tests. In order to see the intensity and direction of the relation between the adipose tissue level and the motor components, we used the Pearson correlation coefficient (parametric) and the Spearman rho correlation coefficient (non-parametric). We performed the descriptive analysis (weighted mean (Xp), standard deviation (τ)), and the differences between the mean values in relation to gender and residential environment were tested using the independent sample *t-test* (parametric) and the Mann-Whitney U test (non-parametric).

Results

After processing the collected data, we found that 73 girls and 39 boys participated to the measurements. Using the Kolmogorov-Smirnov test, we verified the normality of the distribution of the data obtained from the anthropometric and motor tests of the NETFIT test battery which resulted in values below the threshold of 95% in case of the following variables: a) for girls (weight, BMI, adipose tissue, handgrip test, paced curl-ups, paced push-ups); b) for boys (standing broad jump and paced curl-ups) (table 2). For these variables, the data are not distributed normally, thus the non-parametric tests are going to be used. According to the standards of the World Health Organization (2007) regarding the growth in height of subjects in relation to their age and gender, we found that in case of 19 year old boys the mean values are close, while in case of girls this value is 2.04 cm lower (table 3).

Variable	Tests of Normality Kolmogorov-Smirnova					
	Girls			Boys		
	Statistically	df	Sig.	Statistically	df	Sig.
Height	0.064	73	0.200*	0.126	39	0.123
Weight	0.155	73	< 0.001	0.119	39	0.177
BMI	0.184	73	< 0.001	0.076	39	0.200*
Adipose tissue	0.105	73	< 0.05	0.089	39	0.200*
SBJ	0.101	73	0.062	0.143	39	0.044
HT	0.119	73	< 0.05	0.103	39	0.200*
PCU	0.270	73	< 0.001	0.226	39	< 0.001
FLT	0.088	73	0.200*	0.106	39	0.200*
PPU	0.155	73	< 0.001	0.101	39	0.200*

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 2. Testing of the normality of distribution of variables obtained at the anthropometric and motor tests (N=112)

Note: SBJ = Standing broad jump, HT = Handgrip test, PCU = Paced curl-ups, PPU = Paced push-ups, FLT = Flexibility test

Age	N	M Height (SD)	M Weight (SD)	WHO Height (SD)
Girls				
18	5	162.70±10.03	55.42±6.57	163.05±6.60
19	68	161.11±5.28	62.78±12.84	163.15±6.54
Boys				
18	3	174.16±9.11	63.86±3.52	176.14±7.47
19	36	176.79±6.40	73.69±12.10	176.54±7.29

Table 3. Mean values and standard deviations of weight and height

The registered data show that 81 out of the total of 112 subjects had a normal weight for their age. A number of 15 subjects were overweight and 11 students fell into the obese category. According to the BMI results, the number of students with weight problems was higher among girls (17 cases) than among boys (9 cases), reaching a rate of 23% of the sample group (table 4).

BMI percentile / Nutritional status	Girls		Boys		Girls + Boys	
	N	%	N	%	N	%
Underweight BMI percentile < 5	1	2	4	10	5	4
Normal weight BMI percentile 5-85	55	75	26	67	81	73
Overweight and obesity BMI >85	17	23	9	23	26	23
Obesity BMI percentile ≥ 95	8	11	3	8	11	10
Total	73	100	39	100	112	100

Table 4. BMI distribution in relation to the gender of the subjects

The BMI mean scores in case of girls (M = 23.97, SD = 4.89) are not significantly higher (t = 0.71, df = 110, bidirectional p = 0.48) than in case of boys (M = 23.30, SD = 4.31). The Mann-Whitney *U* test has concluded that the BMI mean scores of girls are not significantly higher than those in case of boys (*U* = 1413.5, N_1 = 73, N_2 = 39, bidirectional p = 0.95).

The mean scores of AT in case of girls (M = 35.54, SD = 7.89) are significantly higher (t = 10.77, df = 110, bidirectional p < 0.001) than in case of boys (M = 19.36, SD = 6.91).

Based on the Mann-Whitney *U* test it resulted that the mean scores of AT of girls are significantly higher than those in case of boys (*U* = 146.5, N_1 = 73, N_2 = 39, bidirectional p < 0.001).

The Mann-Whitney *U* test has shown that the BMI mean scores of girls from the urban area are not significantly higher than the scores of the girls from the rural area (*U* = 659, N_1 = 37, N_2 = 36, bidirectional p = 0.93). The Mann-Whitney *U* test has shown that the mean scores of AT of the girls from the urban area are not significantly higher than the scores of the girls from the rural area (*U* = 662, N_1 = 37, N_2 = 36, bidirectional p = 0.96).

The BMI mean scores in case of boys from the rural area (M = 23.32, SD = 3.63) are not significantly higher (t = - 0.01, df = 37, bidirectional p = 0.98) than in case of boys from the urban area (M = 23.29, SD = 4.76).

The mean scores of AT in case of boys from the rural area (M = 19.61, SD = 7.38) are not significantly higher (t = - 0.18, df = 37, bidirectional p = 0.86) than in case of boys from the urban area (M = 19.20, SD = 6.76).

In order to see the intensity and direction of the relation between the adipose tissue level and the motor components, we used the Pearson correlation coefficient (parametric) and the Spearman rho coefficient (non-parametric) (table 5).

Variable	Boys N = 39		Girls N = 73	
	rxy = -0.13	rs = -0.09	rxy = - 0.42	rs = - 0.38
SBJ	p = 0.41	p = 0.58	p < 0.001	p < 0.001
	n = 39	n = 39	n = 73	n = 73
	-	rs = 0.25	-	rs = 0.14
HT	-	p = 0.13	-	p = 0.21
	-	n = 39	-	n = 73
	-	rs = 0.01	-	rs = - 0.08
PCU	-	p = 0.94	-	p = 0.47
	-	n = 39	-	n = 73
	rxy = 0.06	rs = 0.05	rxy = - 0.11	rs = - 0.13
FLT	p = 0.76	p = 0.81	p = 0.45	p = 0.38
	n = 39	n = 39	n = 73	n = 73
	-	rs = - 0.08	-	rs = - 0.16
PPU	-	p = 0.62	-	p = 0.16
	-	n = 39	-	n = 73

Note: r_{xy} = Pearson correlation coefficient, r_s = Spearman rho correlation coefficient,
SBJ = Standing broad jump, HT = Handgrip test, PCU = Paced curl-ups,
FLT = Flexibility test, PPU = Paced push-ups

Table 5. The association between adipose tissue levels and motor components in case of boys and girls

In the case of girls, there is a significant negative relation between the adipose tissue level and the results obtained at the standing broad jump test (r_{xy} = - 0.42, df = 71, p < 0.001, r_s = - 0.38, df = 71, p < 0.001). Students with a low level of adipose tissue had significantly better results from statistical point of view at the jumping test. In case of boys there was no significant difference regarding the relation between the adipose tissue level and the motor component.

According to table 6, the mean scores of the results obtained by boys at the broad jump test, handgrip test, paced curl-ups and paced push-ups test are significantly higher than those obtained by girls at the same tests. According to table 7, there are no significant differences between the results of the motor tests obtained by girls from the urban area and those obtained by girls living in the rural area.

Motor component	Gender	Descriptive analysis		Independent Samples t test			Mann-Whitney U test	
		M	SD	t	df	p	U	p
SBJ	G	143.0	20.3	-12.1	110	p < 0.001	142.5	p < 0.001
	B	198.4	27.5					
HT	G	26.8	4.3	- 12.6	47.8	p < 0.001	54.0	p < 0.001
	B	45.9	8.8					
PCU	G	24.8	16.7	-	-	-	715.5	p < 0.001
	B	34.0	14.2					
FLT	G	29.2	7.9	0.3	110	0.73	-	-
	B	28.6	7.2					
PPU	G	9.1	4.2	-11.7	52.7	p < 0.001	-	-
	B	23.2	6.7					

Note: G = girls, B = boys, SBJ = Standing broad jump, HT = Handgrip test, PCU = Paced curl-ups, FLT = Flexibility test, PPU = Paced push-ups

Table 6. Presentation of differences between mean values of motor components in relation to gender

Motor component	Residential environment	Descriptive analysis		Independent Samples t test			Mann-Whitney U Test	
		M	SD	t	df	p	U	p
SBJ	Urban	140.4	24.2	-1.10	71	0.27	-	-
	Rural	145.7	15.3					
HT	Urban	27.2	4.6	-	-	-	559.0	0.24
	Rural	26.5	4.0					
PCU	Urban	22.1	11.7	-	-	-	540.0	0.16
	Rural	27.6	20.4					
FLT	Urban	29.2	9.1	-0.02	71	0.98	-	-
	Rural	29.2	6.7					
PPU	Urban	8.6	3.9	-	-	-	612.0	0.68
	Rural	9.6	4.5					

SBJ = Standing broad jump, HT = Handgrip test, PCU = Paced curl-ups, FLT = Flexibility test, PPU = Paced push-ups

Table 7. Presentation of the differences between the mean values of motor components in case of girls (urban N = 37, rural N = 36) in relation to their residential environment

Also, there are no significant differences between the results of the motor tests obtained by boys from the urban area and those obtained by boys from the rural area (table 8). Regarding the BMI values, 69% of the total of

112 students (52 girls and 26 boys) were within the healthy fitness zone, 18% (10 girls and 10 boys fell within the needs improvement zone and 13% (11 girls and 3 boys) of the subjects were in the needs continuous improvement zone (table 9).

Motor component	Residential environment	Descriptive analysis		Independent Samples t test			Mann-Whitney U Test	
		M	SD	t	df	p	U	p
SBJ	Urban	196.8	29.3	-	-	-	171.5	0.80
	Rural	201.1	25.2					
HT	Urban	46.4	10.1	0.42	37	0.67	-	-
	Rural	45.1	6.7					
PCU	Urban	30.7	10.9	-	-	-	142.0	0.26
	Rural	39.3	17.6					
FLT	Urban	28.4	7.7	- 0.18	37	0.86	-	-
	Rural	28.9	6.8					
PPU	Urban	22.9	7.7	- 0.46	37	0.65	-	-
	Rural	23.9	4.9					

SBJ = Standing broad jump, HT = Handgrip test, PCU = Paced curl-ups, FLT = Flexibility test, PPU = Paced push-ups

Table 8. Presentation of the differences between the mean values of motor components in case of boys (urban N = 24, rural N =15) in relation to their residential environment

Variable	HFZ			NIZ			NCIZ		
	Girls	Boys	Total	Girls	Boys	Total	Girls	Boys	Total
BMI	48 + 4*	22+4*	78	10	10	20	11	3	14
AT	25	24+3*	52	25	11	36	23	1	24
SBJ	35	20	55	38	19	57	-	-	-
HT	39	31	70	34	8	42	-	-	-
PCU	58	32	90	15	7	22	-	-	-
FLT	37	35	72	36	4	40	-	-	-
PPU	59	34	93	14	5	19	-	-	-
Total	305	205	510	172	64	236	34	4	38

Note: * = *thin* from somatic point of view, HFZ = healthy fitness zone, NIZ = needs improvement zone, NCIZ = needs continuous improvement zone, SBJ = standing broad jump, HT = handgrip test, PCU = paced curl-ups, PPU= paced push-ups, FLT = flexibility test

Table 9. Classification of subjects into action zones in relation to their gender

Regarding the adipose tissue percentage, 34.2% of the girls and 28.2% of the boys fell within the needs improvement zone and 31.5% respectively 2.5% into the needs continuous improvement zone. As far as the adipose tissue percentage is concerned, 65.7% of the girls and 30.7% of the boys fell within the needs improvement + needs continuous improvement zone. According to the data obtained at the motor tests, we found that at the SBJ test 49%, at the HT 62.5%, at the PCU test 80%, at the FLT 64%, and at the PPU test 83% fell within the healthy fitness zone.

Discussions

According to a study by Kalka, Pastuszak and Buśko (2019), the average height value of male students (N = 589) of the Warsaw University of Technology was 180.09 ± 7.2. As stated in a study by Podstawski, Markowski & Clark (2020) the average height value of male students (N = 2691), female students (N = 3955) of University of Warmia and Mazury in Olsztyn, Poland, between 2000-2018 was 181.12±6.08 respectively 165.06±6.47 compared to the students of the Partium Christian University with the result of 176.79 ± 6.40 for men and 161.11 ± 5.28 for women.

According to a NETFIT report drawn up for the 2018 – 2019 school year in Debrecen city regarding 18 – 19 year old subjects (N = 2298 boys, N = 2472 girls), the percentage of those who fell within the healthy fitness zone was the following: a) Girls: BMI = 81%, AT = 61%, SBJ = 76%, HT = 53%, PCU = 97%, FLT = 58%, PPU = 80%; b) Boys: BMI = 72%, AT = 69%, SBJ = 59%, HT = 68%, PCU = 95%, FLT = 77%, PPU = 71% (NETFIT Reports and Statistics, 2019)

The classification of the students of the Partium Christian University (N = 39 boys, N = 73 girls) within the healthy fitness zone, is the following: a) Girls: BMI = 71%, AT = 34%, SBJ = 48%, HT = 53%, PCU = 79%, FLT = 50%, PPU = 81%; b) Boys: BMI = 67%, AT = 69%, SBJ = 51%, HT = 79%, PCU = 82%, FLT = 89%, PPU = 87%.

Conclusions

The performed research allows us to formulate the following conclusions:

a) In Romania, the percentage of overweight and obese people has increased significantly. The number of students participating in various competitions of the Federation of School and University Sports is small.

b) We consider that, in order to avoid risks due to insufficient physical activity, the level of biomotor potential of students must be related to their health. Not all students dream of performance and competitions, but they all want to be healthy!

c) We reflect that a new vision is needed in approaching the physical education lessons in Romania and it is important that the people involved know the concept of fitness from an early age and receive feedback whenever necessary. The priority of physical education specialists should be for all students to enjoy any organized sports activity and to develop their knowledge about the advantages offered by the high level of physical fitness.

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