ПЕДАГОГИЧЕСКИ АЛМАНАХ

Педагогическо списание на Великотърновския университет „Св. св. Кирил и Методий“

Брой 2, 2020

DIFFERENCES IN BODY COMPOSITION BETWEEN THREE GROUPS OF STUDENTS

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Abstract: *The purpose of this paper was to confirm whether there is any difference in body composition between the three groups: Group1 – females (N=25) aged 19–21, Group2 – females aged 22–24, (N=27), and Group3 – males aged 19–24 years (N=22). Respectively to determine whether gender and calendar age has an impact on the body composition of women and men. The parameters of the body composition applied in this research were: height of the body (height), body weight (weight), body fat (body fat), muscle mass (muscle), daily calorie intake (kcal), metabolic age (metabolic age), total body water (water), visceral fat (visceral fat) and body mass index (BMI). Measurements were performed at the Faculty of Education in Pristina. The basic statistical and distribution parameters that have been applied in this paper are Minimum, Maximum, Mean, Std. Deviation, Skewness, Kurtosis, max-D, and Kolmogorov-Smirnov test (K-S). To confirm the differences between the arithmetic mean of the groups the LSD-post hoc test was applied. The results obtained showed that differences were obtained in the arithmetic averages in all parameters of body composition between Group1 and Group2. But a statistically significant difference between these two groups has been gained in the metabolic age variable which shows that from the age of 22 in women begins a decrease in daily physical movements. Also, after processing the results by ANOVA analysis, significant statistical differences were obtained between the groups of females and the group of males, in the arithmetic mean in all variables of body composition $p<0.01$ (except for the variable of body composition Daily Calorie Intake (Kcal) $p>0.38$).*

Keywords: *obesity; body composition; females; males; BMI.*

INTRODUCTION

Various diseases nowadays are associated with obesity. According to our data from the World Health Organization (WHO) 2.8 million adults die each year as a result of being overweight or obese (Ahmed et al. 2014). Obesity can be defined as the excessive accumulation of fat in adipose tissue, to the extent that health may be impaired (Caterson, Gill 2002). Obesity is a disorder that includes unhealthy and unwanted body fat. Based on Purnell (2018), overweight and obesity occur when excess fat accumulation (regionally, globally, or both) increases the risk to health. Obesity is a major health problem worldwide and is associated with a high incidence of cardiovascular complications such as hypertension,

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ischemic heart disease, and stroke (Scherrer et al. 1994). Statistics from public health institutes in many developed countries show a growing trend of consuming excess food, as well as an increase in various diseases related to overweight and increased mortality in this regard. Individuals should regulate this anthropological feature with healthy food and also sports activity. Because, it is never just about reducing obesity, but also about the normal functioning of the whole organism, which cannot be achieved by the only diet and not physical activities. Based on Shukova Stojmanovska and Gontarev (2018) little activity is necessary to eliminate the extra energy input and the percentage of fat. Overweight and obesity are the results of an imbalance of energy for a long period of time. Some of the factors that affect this imbalance are physical inactivity and poor nutrition. The combination of diet and regular exercise of five times per week, lead to decrease in body mass and the percentage of body fat, both in female and male. In our profession, body composition is usually seen as a two-component model, which consists of a) non-fatty mass of the body and b) body fat mass. This division allows us to calculate the optimal weight which gives us instructions for future treatments both through sports activities and diet. Correction of body composition is often equated with weight loss, which is totally wrong. It is predicted that a decrease in body mass does not mean a decrease in the percentage of adipose tissue at the same time, as a decrease can also occur due to a decrease in muscle tissue, which is not good. Body fat stores are the major energy stores of the body and are important determinants of survival in starvation or undernutrition (Norgan 1997). Based on Nuttall (2015), BMI is the metric currently in use for defining the anthropometric height and weight characteristics in adults and for classifying them. BMI correlates with total body fat which means that if the BMI score increases, so does the total body fat. Based on National Heart, Lung, Blood Institute, National Institute of Diabetes, Digestive & Kidney Diseases (1998), individuals with a BMI of 25 to 29.9 are considered overweight, while individuals with a BMI ≥30 are considered obese.

SUBJECTS AND METHODS

The study population consisted of an opportunistic sample of students, recruited into the study following initial contact with the University of Pristina "Hasan Pristina" Faculty of Education. A total of 74 students agreed to participate in the survey: Group1 – females aged 19–21 (N=25), Group2 – females aged 22–24 (N=27), and Group3 – males aged 19–24 years (N=22). No information about current medication use or whether the students were following any weight management diet was collected. Data on gender and on date of birth were collected together with anthropometry. Height was measured to the nearest 0.1 cm with a portable stadiometer with students standing in bare feet. Students were individually coded and the data anonymized. The parameters of the body composition applied in this research were: body height (height), body weight (weight), body fat, muscle mass (muscle), daily calorie intake (kcal), metabolic age, total body water (water), visceral fat, and body mass index (BMI). All the measurements included consider an individual's height, weight, age, and gender to estimate body composition. Measurements were performed in accordance with the International Biological Programme (IBP) standards. All body composition were measured with the TANITA BC-601 apparatus by the bioelectrical impedance method.

STATISTICAL ANALYSIS

For all body composition variables, were calculated the following values: arithmetic mean (Mean), standard deviation (Std. Deviation.), minimum value (Minimum) maximum value (Maximum), coefficient of asymmetry of the distribution of results (Skewness) and the coefficient of curvature of the distribution of results (Kurtosis), (Max-D) and the Kolmogorov-Smirnov test (K-S). To confirm the difference between the arithmetic averages of the three groups, ANOVA and MANOVA, the LSD-Post hoc test was applied. Data were analyzed using Statistical Package for the Social Sciences (SPSS) software for Windows, Version 22.0.

RESULTS

Table 1 presents the central and dispersion parameters of body compositions of Group1 (N = 25) – females 19–21 years. Based on the value of the skewness asymmetry test, a pronounced asymmetry was obtained in the variables of body composition: weight, muscle, kcal, metabolic age, and visceral fat. The normal asymmetry in the distribution of results is considered when the asymmetry test values (skewness) in the body composition variables are in the range between +/- 1.00 (Malacko, Popović 1997). The normal asymmetry of body composition variables is found in height, body fat, water, and BMI. Negative value of skewness indicates that the distribution of results is shifted to the right i.e., the largest number of results achieved is under the arithmetic mean value. Negative asymmetry is obtained in body composition on total body water. The positive value of the skewness indicates that the distribution of the results is shifted to the left i.e., the largest number of results achieved is above the arithmetic mean value. Positive asymmetry is obtained in these variables of body composition: age, weight, muscle mass, kcal, metabolic age, and visceral fat. Max-D values indicate that the result of Visceral fat have a deviation from the normal distribution.

Table 1. Central and dispersion parameters of body compositions – Group1 (N=25)

	Mean	Std. Deviation	Minimum	Maximum	Skewness	Kurtosis	max D	K-S
Height	1,68	0,06	1,55	1,85	0,68	2,12	0,17	p > .20
Weight	60,02	11,19	43,20	92,10	1,15	1,82	0,20	p > .20
Body fat	26,20	5,56	18,70	39,50	0,81	0,29	0,15	p > .20
Muscle %	42,19	7,62	32,10	65,70	1,74	4,07	0,22	p < ,15
Kcal	2186,92	358,63	1713,00	3263,00	1,60	3,16	0,24	p < ,15
Metabolic age	18,48	7,64	12,00	35,00	1,09	0,04	0,22	p < ,20
Water	54,52	3,44	47,00	60,60	-0,32	0,07	0,11	p > .20
Visceral fat	1,64	1,47	1,00	7,00	2,57	6,91	0,47	p < ,01
BMI	21,45	3,28	16,50	30,10	0,88	0,75	0,17	p > .20

Table 2 presents central and dispersion parameters of body compositions of Group2 (N = 27) – females 22–24 years. Based on the value of the skewness asymmetry test, a pronounced asymmetry was obtained in the variables of body composition: age, weight, muscle mass, visceral fat, and BMI. The normal asymmetry of body composition variables is found in: height, body fat, kcal, metabolic age and water. Negative asymmetry is obtained in body height and total body water. Max-D values indicate that the results of the age and visceral fat have a deviation from the normal distribution which is confirmed by the Kolmogorov-Smirnov test $p < 0.01$ and $p < 0.05$.

Table 2. Central and dispersion parameters of body compositions Group2 (N=27)

	Mean	Std. Deviation	Minimum	Maximum	Skewness	Kurtosis	max D	K-S
Height	1,66	0,06	1,52	1,80	-0,24	0,18	0,11	p > .20
Weight	62,33	13,04	44,80	102,70	1,49	2,68	0,17	p > .20
Body fat	27,76	6,98	15,40	45,00	0,31	0,36	0,10	p > .20
Muscle %	41,59	7,09	26,60	60,50	1,00	2,05	0,23	p < ,10
Kcal	2171,85	351,85	1596,00	2952,00	0,92	0,10	0,22	p < ,15
Metabolic age	24,07	9,85	12,00	43,00	0,32	-1,31	0,14	p > .20
Water	52,37	5,54	37,00	62,00	-0,86	1,47	0,11	p > .20
Visceral fat	2,22	1,83	1,00	9,00	2,22	6,36	0,27	p < ,05
BMI	22,59	4,06	17,07	34,80	1,20	1,93	0,16	p > .20

Table 3 shows the central and dispersion parameters of body compositions for Group3 (N=22) – Males 19–24 years. Based on the value of the skewness asymmetry test, there was not obtained any pronounced asymmetry in the variables of body composition. The normal asymmetry of body composition variables were found in all variables. Negative asymmetry is obtained in: weight, body fat, muscle, visceral fat, and BMI. Max-D values indicate that all the results doesn't have any deviation from the normal distribution which is confirmed by the Kolmogorov-Smirnov test.

Table 3. Descriptive statistical parameters for Group3 (N=22)

	Mean	Std. Deviation	Minimum	Maximum	Skewness	Kurtosis	max D	K-S
Height	1,79	0,05	1,71	1,92	0,79	0,20	0,18	p > .20
Weight	83,69	10,47	59,00	103,00	-0,22	-0,23	0,10	p > .20
Body fat	18,15	3,71	9,20	25,00	-0,42	0,28	0,13	p > .20
Muscle %	60,58	12,10	38,30	79,00	-0,65	-0,71	0,17	p > .20
Kcal	1989,93	228,95	1515,00	2495,00	0,17	-0,06	0,10	p > .20
Metabolic age	27,45	10,85	13,00	54,00	0,77	0,14	0,17	p > .20
Water	58,86	2,86	53,40	65,22	0,25	0,35	0,08	p > .20
Visceral fat	5,12	1,79	1,50	8,50	-0,06	-0,17	0,09	p > .20
BMI	25,61	3,40	15,10	31,80	-0,94	1,98	0,10	p > .20

Table 4 shows the difference between 3 arithmetic averages, Group1, Group2, and Group3. After processing the results by analysis of variance (ANOVA), significant statistical differences were obtained between the groups in the arithmetic mean in all variables of body composition $p<0.01$ – except for the variable of body composition Daily Calorie Intake – Kcal ($p>0.38$).

Table 4. ANOVA and MANOVA – three groups

	Sum of Squares	Df	Mean Square	F	Sig.
Hight	,263	2	0,13	38,04	0,00
Weight	9673,943	2	4836,97	37,05	0,00
Body fat	1192,931	2	596,47	18,31	0,00
Muscle %	9459,375	2	4729,69	97,28	0,00
Kcal	194065,813	2	97032,91	0,97	0,38
Metabolic age	975,805	2	487,90	5,42	0,01
Water	520,441	2	260,22	14,74	0,00
Visceral fat	155,896	2	77,95	26,77	0,00
BMI	256,025	2	128,01	9,65	0,00

Wilks' Lambda	F	Hypothesis df	Error df	Sig.
.01	49.25	20	124	.000*

Since ANOVA variance analysis is used to test the hypothesis whether there is a difference between two or more averages but does not indicate that significant statistical difference between which variables exist, therefore we used the LSD – Post hoc test between groups.

LSD – post hoc test

LSD – post hoc test is used to test the hypothesis, whether exist any difference between two or more averages. The T-test is also used to test whether there is a significant difference between the two averages, but in cases of comparing more than two averages, the T-test can cause errors. Although it is possible to compare the test with more than two averages in the form of two by two, this will lead to a large increase in the error of the first type. The more it is tested, the more the first type of error increases. LSD – post hoc test is used to compare more than two averages without increasing the level of error of the first type.

Table 5. Shows that there is a statistically significant differences between the arithmetic averages of the three groups: Group1– Females 19–21 years and Group2 – Females 22–24 years p<0.00; Group1– Females 19–21 years and Group3 – Males 19–24 years, p<0.00; Group2 – Females 22–24 years and Group3 – Males 19–24 years p<0.00.

Table 5. LSD – Post hoc test between groups

	Group	Group	Mean Difference	Std. Error	Sig.
Height	1	2	0,02	0,02	0,28
	1	3	-,120)*	0,02	0,00
	2	3	-,138)*	0,02	0,00
Weight	1	2	-2,31	3,17	0,47
	1	3	-26,125)*	3,34	0,00
	2	3	-23,815)*	3,28	0,00
Body fat	1	2	-1,56	1,58	0,33
	1	3	7,855*	1,67	0,00
	2	3	9,418*	1,64	0,00
Muscle %	1	2	0,60	1,94	0,76
	1	3	-24,421)*	2,04	0,00
	2	3	-25,016)*	2,00	0,00
Metabolic age	1	2	-5,594)*	2,63	0,04
	1	3	-8,975)*	2,77	0,00
	2	3	-3,38	2,73	0,22
Water	1	2	2,15	1,17	0,07
	1	3	-4,345)*	1,23	0,00
	2	3	-6,490)*	1,21	0,00
Visceral fat	1	2	-0,58	0,47	0,22
	1	3	-3,433)*	0,50	0,00
	2	3	-2,851)*	0,49	0,00
BMI	1	2	-1,14	1,01	0,26
	1	3	-4,525)*	1,06	0,00
	2	3	-3,386)*	1,05	0,00

In the body composition variable of body height, there is a significant difference between Group1 and Group3 – p<0.00; Group2 and Group3 – p<0.00; there is no significant statistical difference between Group1 and Group2 – p>0.28.

In the body composition variable of body weight, there is a significant difference between Group1 and Group3 – p<0.00; Group2 and Group3 – p<0.00; there is no significant statistical difference between Group1 and Group2 – p>0.47.

In the body composition variable of body fat, there is a significant difference between Group1 and Group3 – p<0.00; Group2 and Group3 – p<0.00; there is no significant statistical difference between Group1 and Group2 – p>0.33.

In the body composition variable of muscle mass, there is a significant difference between Group1 and Group3 – $p<0.00$; Group2 and Group3 – $p<0.00$; there is no significant statistical difference between Group1 and Group2 – $p>0.76$.

In the body composition variable metabolic age, there is a significant difference between Group1 and Group2 – $p<0.00$; Group1 and Group3 – $p<0.00$; between Group2 and Group3 – $p> 0.22$ there is no significant statistical difference.

In the body composition variable of total body water, there is a significant difference between: Group1 and Group3 – $p<0.00$; Group2 and Group3 – $p<0.00$; between Group1 and Group2 – $p<0.07$ there is no significant statistical difference.

In the body composition variable of visceral fat, there is a significant difference between Group1 and Group3 – $p<0.00$; Group2 and Group3 – $p<0.00$; between Group1 and Group2 – $p>0.22$ there is no significant statistical difference

In the body composition variable of body mass index (BMI), there is a significant difference between Group1 and Group3 – $p<0.00$; Group2 and Group3 – $p<0.00$; between Group1 and Group2 – $p>0.26$ there is no significant statistical difference.

DISCUSSION

For each individual, regardless of age or gender, within the morphological characteristics (body composition), there are exactly certain percentages of muscle tissue, adipose tissue and bone tissue that are the basis for good functional status of the organism, i.e., for good health. In this paper, the two-component model was used, which divides the whole body into total body fat (fat mass) and fat-free mass. Considering the importance of quality of life in the context of the growth of overweight in the population of any age and gender, this study was conducted in order to investigate and confirm the difference between women aged 19–21 and 22–24 years and men aged 19–24 years. We took the two first groups with these ages in research thinking that from the age of 19–21 years as the age of late adolescence with greater physical activity is passed to the age of 22–24 years with a different lifestyle. And also we took the age 19–24 of males to compare with two groups of females and to see the differences in body composition between each group, considering differences in body composition between males and females remain detectable during childhood; moreover, females enter puberty earlier and undergo a more rapid pubertal transition, whereas boys enter puberty later than girls and have a substantially longer growth period. The results obtained from the first group and second group after statistical processing indicate two important statistical differences in the variables of body composition, calendar age which has been consistent because even for the purposes of this paper we have divided the sample according to the age that was expected to be obtained one significant statistical difference in the variable of metabolic age. This confirms earlier studies that have found that there are differences between women and men since fetal life, where differences in body composition begin to occur rapidly in adolescence to continue with even greater changes after adolescence.

CONCLUSION

We conclude that obesity is a complex social problem, so we suggest that free time should be used for physical activities and should be one of the priorities for the fastest possible solution against obesity. Since overweight and physical inactivity are the main risk factors for chronic non-communicable diseases, reducing their incidence in the most vulnerable categories of the population (especially over the age of 22) would indirectly reduce existing health inequalities, which is one from the priorities in the field of public health. The results show that the risk of gaining overweight starts at the age of 22, which in later periods can be followed by the appearance of various diseases due to physical inactivity and excessive consumption of energy substances. From the results obtained we can conclude that gender and age can be factors that indicate in differences of the: body height (height), body weight (weight), body fat (body fat), muscle mass (muscle), daily calorie intake (kcal), metabolic age (metabolic age), total body water (water), visceral fat (visceral fat) and body mass index (BMI), It is very important to develop a habit of exercising at a young age so that later it can be transformed into a way of life and affects the quality of life in both females and males.

BIBLIOGRAPHY

Ahmed, H. G. et al. (2014). Prevalence of obesity in Hail region, KSA: in a comprehensive survey. *Journal of obesity*, 2014.

Caterson, I. D., P. T. Gill, (2002). Obesity: epidemiology and possible prevention. *Best Practice & Research Clinical Endocrinology & Metabolism*, 16(4), 595 – 610.

Malacko, J., D. Popović (1997). *Metodologija kineziološko-antropoloških istraživanja.* Priština: Fakultet fizičke kulture.

National Heart, Lung, Blood Institute, National Institute of Diabetes, Digestive, & Kidney Diseases (US). (1998). *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report* (No. 98). National Heart, Lung, and Blood Institute.

Norgan, N. G. (1997). The beneficial effects of body fat and adipose tissue in humans. *International journal of obesity*, 21(9), 738 – 746.

Nuttall, F. Q. (2015). Body mass index: obesity, BMI, and health: a critical review. *Nutrition today*, 50(3), 117 – 128.

Purnell, J. Q. (2018). Definitions, classification, and epidemiology of obesity. In *Endotext [Internet]*. MDText. com, Inc.

Scherrer, U. et al. (1994). Body fat and sympathetic nerve activity in healthy subjects. *Circulation*, 89(6), 2634 – 2640.

Shukova Stojmanovska, D., & S. Gontarev (2018). Gender Differences in Decreasing of Body Mass and the Percentage of Body Fat with Body Building. *International Journal of Science and Research (IJSR), 7*(1), 1815 – 1822. doi: 10.21275/ART20179824.