DIFFERENCES IN MORFOLOGICAL CHARACTERISTICS BETWEEN DIFFERENT PHYSICAL ACTIVE FEMALE STUDENTS

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Abstract

The aim of the study was to determine differences in morphological characteristics (body height , body weight, body mass index) among female students who engaged in different specific kinesiology activity. The study included 2849 students of undergraduate studies at the University of Split, ages 19-25 years. Data collection of the morphological characteristics (height, weight, body mass index) was determined by student clinics in Split competence of physicians, while the psychological characteristics were collected by the Rosenberg self-esteem scale, which consisted of 10 items. Physical education engagement was conducted through three sub-variables: sports, recreation and walking. Differences in the quantitative values were determined by univariate and multivariate analysis of variation. The values of these methods were defined with error $p< 0.05$. The results showed a statistically significant difference in height ($p= 0.04$), weight ($p= 0.00$) and level of self-esteem ($p= 0.00$) between the various kinesiology student engagement, while no statistically significant differences were given in the variable index of body weight ($p = 0.88$). Students who were more kinesiology engaged had an average greater height of the body (AS 170.22 cm), greater weight (AS 63.4 kg), which can be attributed to a greater height and a greater amount of muscle mass due to kinesiology engagement. The research showed no statistically significant differences between body mass index and variable "sports" ($p= 0.26$), "dealing with recreation" ($p= 0.078$), and "practicing walking" ($p= 0.30$). In conclusion, physical activity has an irreplaceable instrumental value, because it represents the best means of achieving and maintaining optimal body weight regulation of body mass index, and self-actualization in one of the aspects of dealing with a particular kinesiology activity to promote health and longevity of life.

Key words: *physical activity, self-actualization, body height, body weight*

Introduction

The body is built for activity, not for the suspension, and it was a historical struggle: the struggle for survival looked for a good physical condition, and that means good functional ability. Many scientific, health and medical organizations around the world have formally recognized the importance of regular physical activity as a means of improving and maintaining health (Blair et al., 1996). Morphological characteristics that are also the subject of this study are most change under the influence of kinesiology activity, and manifest throught all the dimensions of morphological space, bone, fat and muscle tissue (Moore, 2000). Great changes are presented in the muscle tissue. The muscles under the influence of exercise increasing the volume (hypertrophy) and strength leads to better capillarization, increasing energy reserves in the muscle (glycogen, myoglobin, phospholipid, phosphate), the concentration of minerals (potassium, calcium, magnesium) (Cheng et al., 2003; Mraković, 2011). The biggest changes occur in the adipose tissue as regular exercise of kinesiology activity inevitably leads to its reduction[3,5]. Global problems associated with hypokinesia as a cause of various diseases, the data as 155 million obese and overweight children and youth in the world (Bronikovski et al., 2008; Catenacci & Wyatt, 2007) have public health problems and health professionals must be involved in promoting physical activity and to encourage the active life. In the morphology, anthropometry and physical activity are made large number of studies (Malousaris et al., 2008; Heimer et al., 2004; Hošek & Jeričević, 1982; Mišigoj-Duraković & Ivanek, 1995; Mišigoj-Duraković et al., 1998; Tsunawake et al., 2003), and demonstrate how physical activity has a positive effect on the growth of muscle mass and reduction in weight, or subcutaneous fat.

Methods

Participans

The study was conducted on a sample of 2849 regular student of the University of Split, aged 19-25 years.

We are talking about a representative sample that covers a large part of the students of Split University and in which participated girls from almost all of Split Faculties: Faculty of Medicine, Faculty of Philosophy, Faculty of Electrical engineering, mechanical engineering and shipbuilding, Natural-mathematical faculty, Faculty of Law, Faculty of Economics, Chemical engineering Department and faculty of Kinesiology.

Sample of variables

The pattern of variables is defined with with kinesiology engagement as criterion variable and variables for antrophological and health assessment status as predicted variables. Kinesiology contribution as criterion variable will be estimated in three variables: a) four levels of kinesiology engagement in the form of duration of walking (up to one hour per week, between 1 and 2 hours per week , between 2 and 4 hours per week and more than 4 hours per week); b) four levels of recreational kinesiology engagement in terms of dealing with free recreational activities (no recreational activity, recreational activity in duration of 1-2 hours per week, recreational activity in duration of 3-4 hours per week and recreational activity in duration of 5 or more hours per week); c) four levels of sports kinesiology involvement in the form of dealing with institutional sports (any sport activity, sports activity in duration of 1-2 hours per week, sports activity in duration of 3-4 hours a week and sports activity in duration of 5 or more hours per week); d) For evaluation of morphological characteristics of female students used the following variables; e) - body height, body weight, body mass index (BMI, Statistical methods. Collecting data on the anthropological and health status of students and their kinesiology permanent engagement was carried out in the Student clinic in Split by authorized doctors County Department of Public Health. The study was therefore carried out with the consent and active participation of competent doctors and service of the Institute. Due to the nature of research and the permanence of the data collection component of regular systematic medical examinations, all data were collected and statistically analyzed. Parallel Data collection was conducted, processed, analyzed, interpretated and the results are presented in the study. In the context of data processing, according to psychometric characteristics of individual variables were used parametric and nonparametric statistical procedures. For quantitative variables distributed on metric scale and used distribution parameters: mean (XA), minimum and maximum value of the results (MIN, MAX), standard deviation (SIG),

asymmetry (Sk) and the curvature distribution (KU). Testing for normality of distribution will be carried out by the method of Kolmogorov - Smirnov (Max D). Differences in quantitative predictive variables (morphological and physiological characteristics) between the different levels of kinesiology engagement determine the multivariate and univariate analysis of variance. For categorical variables (health characteristics and smoking status) were determined the representation in terms of frequency and percentage accounts. Relations between the criterion variable and categorical predictive variables were determined with nonparametric chi-square test. Data processing is the statistical software package Statistica for Windows Ver.7.0

Results

The results of the analysis in table 1 showed the relationship of frequency measured in kinesiology engagement in 4 stages: (up to one hour per week", between 1 and 2 hours per week", between 2 and 4 hours per week", more than 5 hours per week") in sports , recreation and walking, and body mass index (eng. Body Mass Index - BMI) among students.

Results were expressed numerically, or as %. To determine the statistical significance of differences in arithmetic means treated quantitative variables (weight, height, BMI, PSIZBIR) between groups of different kinesiology student engagement, in table 2 was used univariate analysis of variance. The analysis results showed the arithmetic mean (AS) in this group of female students who were less kinesiology and physical engaged, the values of F-test and statistical significance (p) F relations.

Discussion

Given the results in table 1, the obtained frequencies showed that the total number of students tested, 83.26 % or 2372 female students were in no way involved in sports, of which the ratio of students with lower BMI and greater BMI is 1374 (57.93 %) versus 998 (42.07 %).

Table 1. The ratio of kinesiology engagement and body mass index among college female students

VARIABLES	DOING SPORTS		DOING RECREATION		DOING WALKING	
	<BMI	>BMI	<BMI	>BMI	<BMI	>BMI
never/up to 1 hour	1374	998	753	542	36	28
	(83,02% - 57,93%)	(83,58% - 42,07%)	(45,50% - 58,15%)	(45,39% - 41,85%)	(2,18% - 56,25%)	(2,35% - 43,75%)
1-2 hours	187	117	692	464	649	496
	(11,30% - 61,51%)	(9,80% - 38,49%)	(41,81% - 59,86%)	(38,86% - 40,14%)	(39,21% - 56,68%)	(41,54% - 43,32%)
2-4 hours	55	39	170	146	562	411
	(3,32% - 58,51%)	(3,27% - 41,49%)	(10,27% - 53,80%)	(12,23% - 46,20%)	(33,96% - 57,76%)	(34,42% - 42,24%)
5 hours or more	39	40	40	42	408	259
	(2,36% - 49,37%)	(3,35% - 50,63%)	(2,42% - 48,78%)	(3,52% - 51,22%)	(24,65% - 61,17%)	(21,69% - 38,83%)
Pearson Chi- square	3,956		6,803		3,664	
p	0,26526		0,07848		0,30011	

Table 2. Relationship between kinesiology engagement and morphological characteristics among female students

Variable	Mean (less active) (n=2098)	Mean (more active) (n=751)	F	p
Weight	62,61	63,44	4,04	**0,04**
Height	169,21	170,22	14,93	**0,00**
BMI	21,84	21,86	0,02	0,88
Psychology values	32,93	33,62	17,55	**0,00**

Students who engaged in sports weekly for 1-2 hours was 304, or a percentage of 10.67 %, of which the lower BMI had 187 (61.51 %) students, and those with higher BMI had 117 student or a percentage of 38,49 %. Students who engaged in sports weekly 3-4 hours were 94 (3.30 %) of which 55 were those who had lower BMI (58.51 %), while 39 with a higher BMI or 41.49 %. 5 or more hours a week practiced only 79 (2.77 %) students and their relationship to a smaller or larger BMI was 30 versus 40 students (49.37 % vs. 50.63 %). Based on these results we could see that there were no statistically significant differences between the weekly sports and body mass index, or how students who did not practice the sport might have a lower body mass index than those students who practice sport. Frequency distributions that showed the relationship between the status of a weekly dealing with recreation and physical status index (BMI) are shown in table 1.

The resulting frequencies showed that the total number of students tested, them 45.45 % or 1295 female students was in no way involved in recreation of which the ratio of students with lower BMI and greater BMI was 753 (58.15 %) versus 542 (41.85 %). The number of students who engaged in recreation weekly for 1-2 hours was 1156 or in the percentage of 40.58 %, of which the lower BMI have 692 (59.86 %) students, and those with higher BMI 464 students or 40 %.   316 students (11.09 %) students practiced weekly some sort of recreation of 3-4 hours, which were more numbering those with lower BMI of 170 (53.80 %) versus those with higher BMI of 146 or 46.20 %. Of the five or more hours per week in recreation dealed only 82 students (2.88 %) and their relationship to a smaller or larger BMI was 40 versus 42 students (48.78 % vs. 51.22 %). Based on the results we could see that the difference was on the border of statistical significance (p = 0.07848), but not significant, meaning that there were no statistically significant differences between the groups. We concluded that students with lower and higher body mass index were equally involved in dealing with the weekly recreation. The resulting frequencies showed the relationship between the status of weekly practicing walking and physical status index (BMI). The total number of students tested, them 2.25 % or the number of 64 students weekly dealt by walking up to one hour, of which the ratio of students with lower BMI and higher BMI was 36 (56.25 %) versus 28 (43.75 %). The number of students who engaged in weekly walking

1-2 hours was 1145 or percentage of 40.19 %, of which the lower BMI had 649 (56.68 %) students, and those with higher BMI 496 students or 43 %. Students who engaged weekly of walking 2-4 hours were 973 students (34.15 %) of which were more numerous those with lower BMI or 562 (57.76 %), while those with a higher BMI 411 or 42,24 %. 4 or more hours a week walking engaged 667 students (23.41 %) and their relationship to larger or smaller BMI was 408 versus 259 students (61.17 % vs. 38.83 %). Based on the results we concluded that students from lower and higher body mass index alike engaged or did not engage in walking, and there were no statistically significant differences among the analyzed samples, p= 0.30011 . By analyzing the resulting data in table 2, it could be concluded that students who were less engaged and more engaged significantly differ in the level of significance of 0.05 in weight, as well as variables for evaluating the psychological status of Rosenberg self-esteem scale (Rosenberg Self-Esteem Scale), which was a self-assessment of general self-esteem at a significance level of 0.01.

There was no statistical significance in the differences between means in variable physical index (BMI), whose statistical significance was p= 0.88, which meant that students who were less engaged physicaly had a higher body mass index due to the inactivity of students who were more kinesiology engaged. It was evidented that students who were more engaged in physical education had on average greater height of the body (AS 170.22 cm), more weight that could be attributed to the higher altitude and greater amount of muscle mass due to kinesiology engagement. Also students who were more kinesiology engaged statistically significantly different from students who were less committed to their overall psychological variables representing self-assessment of general self-esteem in the form of a general assessment of the respondents about their own value as a human being. The variable was formed as the cumulative variable self-esteem like the sum of all positive assertions. Based on the results of psychological questionnaires we could see that students who were more concerned with physical activity had greater degree of self-esteem, self-actualization and satisfaction as opposed to students who were less engaged in kinesiology activity on level of p= 0.00.

Conclusion

Regular physical activity in sport and recreation is a fundamental way to improve physical and mental health. It reduces the risk of many chronic non-communicable diseases, alleviates their progress and significantly benefits society by increasing social interaction and community engagement. In addition to prevention, physical activity involves improving physical fitness, muscle strength and quality of life. This is especially important for the elderly, because regular physical activity can increase the potential for independent living.

References

Blair, S.N., Booth, M., Gyarfas, I., Iwane, H., Marti, B., Matsudo, V., Morrow, M.S., Noakes, T., & Shephard, R. (1996). Development of public policy and physical activity initiatives internationally. *Sports Medicine*, *21*(3), 157-163.

Bronikowski, M., Gonzales-Gross, M., Kleiner, K., Knisel, E., Martinkova, I., Stache, A., Kantanista, A., Lopez, D.C., & Konlechner, A. (2008). Physical activity, obesity and health programs in selected European countries. *Studies in Physical Culture and Tourism*, *15*(1), 9-17.

Catenacci, V.A., & Wyatt, H.R. (2007). The role of physical activity in producing and maintaining weight loss. *Nature Clinical Practice: Endocrine Metabolism, 3*, 518–529.

Cheng, Y.J., Macera, C.A, Addy, C.L., Sy, F.S., Wieland, D., & Blair, S.N. (2003). Effects of physical activity on exercise tests and respiratory function. *Br J Sports Med, 37*, 521-528.

Malousaris, G.G., Bergeles, N.K., Barzouka, K.G., Bayios, I.A., Nassis, G.P., & Koskolou, M.D. (2008). Somatotype, size and body composition of competitive female volleyball players. *Journal of Science and Medicine in Sport*, *11*(3), 337-344.

Moore, M.S. (2000). Interactions between physical activity and diet in the regulation of body weight. *Proceedings of the Nutrition Society, 59*, 193–198.

Mraković, S. (2011). *Antropološka obilježja studentica različitih studijskih programa* [Antropological characteristics of female students that study different faculty programmes. In Croatian.]. /Master thesis/. Zagreb: Kineziološki fakultet.

Tsunawake, N., Tahara, Y., Moji, K., Muraki, S., Minowa, K., Zukawa, K. (2003). Body composition and physical fitness of female volleyball and basketball players of the Japan inter-high school championship teams. *Journal of physiological Antropology and Applied Human Science*, *22*(4), 195-201.

Heimer, S., Mišigoj-Duraković, M., Matković, B.R., Ružić, L., Prskalo, I., Tonković-Lojović, M., & Beri, S. (2004). EUROFIT CROATIA – Postupci mjerenja i norme morfoloških obilježja i funkcionalno-motoričkih sposobnosti odrasle radne populacije Republike Hrvatske [EUROFIT CROATIA – Measurement procedures and norms of morphological characteristics and functional-motor abilities in adult work population of republic Croatia. In Croatian.]. *Sport za sve, 37*, 3-14.

Hošek, A., & Jeričević, B. (1982). Latentna struktura morfološkog statusa studenata Fakulteta za fizičku kulturu [Latent structure of morphological status of Physical Education students. In Croatian.]. *Kineziologija*, 14(5), 9-20.

Mišigoj-Duraković, M., & Ivanek, M. (1995). Udio masti u strukturi tijela studentica Fakulteta za fizičku kulturu [Fat proportion in body structure of female Physical education students. In Croatian.]. *Kineziologija*, 27(1), 73-76.

Mišigoj-Duraković, M., Heimer, S., & Matković, B.R. (1998). Morfološke i funkcionalne karakteristike studentske populacije Sveučilišta u Zagrebu [Morphological and functional characteristics of students population on University of Zagreb. In Croatian.]. *Kineziologija*, 30(2), 31-37.

RAZLIKE U MORFOLOŠKIM ZNAČAJKAMA RAZLIČITO TJELESNO AKTIVNIH STUDENTICA

Sažetak

Cilj istraživanja bio je utvrditi razlike u morfološkim karakteristikama (visina tijela, tjelesna masa, indeks tjelesne mase) među studentica koje se bave različitim specifičnim kineziološkim aktivnostima. U istraživanju je sudjelovalo 2.849 studenata dodiplomskog studija na Sveučilištu u Splitu, u dobi od 19 do 25 godine. Prikupljanje podataka o morfološkim karakteristikama (visina, težina, indeks tjelesne mase) je određeno u studentskim klinikama u Splitu u nadležnosti liječnika, dok su psihološke karakteristike prikupljenje pomoću Rosenbergove skale samopoštovanja, koja se sastojala od 10 predmeta. Određenje tjelesnog angažmana je provedeno kroz tri pod-varijable: sport, rekreaciju i šetnju. Razlike u količinskim vrijednostima određene su po univarijatnoj i multivarijatnoj analizi varijacija. Vrijednosti ovih postupaka su definirane s pogreške p <0,05. Rezultati su pokazali statistički značajnu razliku u visini (p = 0,04), težini (p = 0.00) i razini samopoštovanja (p = 0.00) između različitih kinezioloških angažmana, dok su statistički neznačajne razlike s obzirom na varijablu indeksa tjelesne težine (p = 0,88). Studenti koji su više sudjelovali u kineziološkim aktivnostima imali su prosječno veću visinu tijela (kao što je 170,22 cm), veću težinu (kao što je 63,4 kg), što se može pripisati većoj visini i količini mišićne mase zbog angažmana. Istraživanje je pokazalo da nema statistički značajne razlike između indeksa tjelesne mase i varijable "sportova" (p = 0,26), "bavljenja rekreacijom" (p = 0,078) i "šetnje" (p = 0,30). U zaključku, tjelesna aktivnost ima nezamjenjivu instrumentalnu vrijednost, jer predstavlja najbolje sredstvo za postizanje i održavanje optimalne regulacije tjelesne težine od indeksa tjelesne mase i samoaktualizacije. U jednom od najvažnijih aspekata oni koji se bave određenom aktivnošću bliži su promicanju zdravlja ali i dugovječnosti života.

***Ključne riječi**: tjelesna aktivnost, samo-aktualizacija, tjelesna visina, tjelesna težina*