Morphological Examination of Young Adults Related to Obesity

Examen Morfológico de Adultos Jóvenes Relacionado con la Obesidad

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BORSOS, É.; HALASI, S.; IHÁSZ, F.; CZÉKUS, G.; HORÁK, R.; LEPES, J. & STAJER, A. Morphological examination of young adults related to obesity. *Int. J. Morphol., 36(1)*:121-129, 2018.

SUMMARY: This study presents a cross-board comparison of the morphological characteristic of students of the Hungarian Language teacher training faculty in Subotica, Serbia based on their nutritional status estimate of their nourishment state. The sample was composed by 146 young adults from all four study years of the faculty, ranging from age 19 to 23. The following anthropometric measurements were carried out: body weight, height, skin fold thickness (skin folds measured at the scapula, triceps, biceps, ilium, hip, thigh and abdomen) and circumferences (waist, hip). The authors calculated and analyzed the data, including: the BMI (body mass index) with the formula, skin fold thickness and with 4-Site Skin fold Equation and waist hip ratio. Descriptive statistic was used to describe the morphological characteristics. Independent T-test and ANOVA analysis was performed to compare the students according to sex and age. The main results of the present study are: (1) no significant difference is found between the age groups in the case of either height or body weight, not for the young men or the young women in the study; (2) the differences between height and weight in the case of the male and female as characteristic for this age group can be observed; (3) the female students are more often found to be overweight or obese than the male students; (4) the majority of participant students can be classified into the normal nutritional status' category, which holds true for both the young men and women of the study; (5) the fat percentages calculated based on skin fold values show that in terms of weight, the majority of the female students fall under the 'acceptable' category, while the majority of the young men are classed as 'thin'; (6) in the case of abdominal overweight 20.0 % of men and 19.48 % of women belong to the category 'obese'. This information about the students of the teacher training program is vital, as these young men and women will play an important role as future teachers and thereby, as role models helping to prevent childhood obesity and guiding children throughout their education towards a healthy life style.

KEY WORDS: Young adults; Obesity; BMI; Skin fold; Waist-hip ratio.

INTRODUCTION

Keeping the optimal body composition is essential in every walk of life. One of the most important tools of body weight stabilization is to achieve energy balance (to ensure the balance between energy intake and consumption). Obesity is as risk factor in the formation of numerous diseases: Type 2. diabetes, high blood pressure, occurrence of various types of heart disorders, stroke, etc. (Kissebah *et al.*, 1982; Colditz *et al.*, 1995; Wilson *et al.*, 2002). The WHO determined overweight itself as a non-infectious chronic disease. Being overweight does not only lead to public health problems, - but social and economic problems, as well. Approximately 2.8 million people die annually from being overweight, it is worth mentioning that this figure surpasses the number of those who die of malnourishment (WHO, 2017).

This paper uses the classification defined by the World Health Organization, 'normal weight', 'overweight' (or pre-obese) and 'obese' (WHO, 2018). One way to calculate obesity is with the help of the Broca index: the height of a person is taken in centimetres, minus 100, and then the value is reduced by another 10 %. The result is an optimal body weight, measured in kilograms (Berchtold *et al.*, 1977). However the Broca index can be used only for approximation, since it does not provide the necessary precision for extreme values (Robinson *et al.*, 1983). Nowadays the BMI (body mass index) is universally used to determine the actual nutritional status (Kuczmarski & Flegal, 2000). The BMI is an index that classifies the person into categories of nutritional status according to their height and body weight and height (Mantzoros, 2009).

One critical characteristic of obesity is the abdominal fat surface, that shows tight correlation with the waist-hip quotient (WHR) (Pouliot *et al.*, 1994). One is more likely to

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obtain better results for the body fat content with the instrument family working on the principle of bioimpedancy. The measurements are easy to perform and they provide reliable results, especially for a large sample (Ranasinghe *et al.*, 2013; Ihász *et al.*, 2015). The latest survey made by the Serbian National Health Institution shows that in the case of more than half of the adult population overnutrition can be observed in 56.3 %. Out of this percentage, 35.1 % is overweight, while 21.2 % is obese (Results of the National Health Survey of the Republic of Serbia 2013, 2014).

The Serbian National Health Institution listed the low fruit consumption and the lack of physical activity as the causes of the overweight (Results of the National Health Survey of the Republic of Serbia 2013). Observing the population between the ages of 7 and 18 shows that 17 % of them can be classified as overweight. The main reasons are the lack of the physical activity and the unhealthy eating habits. In the case of children, the ratio of those overweight increased from 8.5 % to 13.7 % in the period between 2006 and 2013. The survey did not specifically look at the data pertaining to young adults. The consequences of being overweight can be pre empted if the definition and the principles of a healthy life style are instilled into children early on. In this regard nursery-, elementary-, secondary schools and educators (nursery school teachers, teachers) play an important role in this process (Hoelscher *et al.*, 2004). Cooperation with the parents is also essential. With more than half of the people who are overweight in their childhood, it is likely that they remain overweight in their adulthood, too. Conversely, only one tenth of the children with normal weight are likely to become overweight as adults (Guo *et al.*, 2002).

For the young adult population over the age of 18 in various European countries, the rate of overweightness and obesity is 10-25 % for men, while for women, the rate is 10-30 %. Great-Britain shows the worst percentages, where 23.9 % of the adult women and 22.1 % of adult men are in the overweight category (WHO, 2017).

The authors found no encompassing study in the relevant literature focusing on the physical constitution characterization of future teachers. It is precisely the study of these young adults that comprises the originality of the authors' work. Namely, the observation made here show the social importance of these students' setting an example for the children they will teach.

The aim of this research is to present the nutritional status and body composition of the students of the University of Novi Sad, Hungarian Language Teacher Training Faculty, Subotica.

MATERIAL AND METHOD

The study of the students of the Hungarian Language Teacher Training Faculty was conducted in the spring of 2017. All of the participant students volunteered for the survey, in total, 24 men and 122 women (their average age was 21.64± 1.76).

Height was measured using an anthropometer (GPM Anthropometer 100; DKSH Switzerland Ltd., Zurich, Switzerland) with 0.1 cm precision, without footwear. Body weight was measured using a digital scale. Calculation of the BMI indexes was performed using the following formula: body weight (kg) per height^2 (m). As for the measuring of skin folds, the skin fold of the thigh was pinched with a caliper on the lower point of the scapula, under the triceps, under the biceps, above the ilium, the hip, on the upper thigh, as well as at the lower part of the abdomen, and the values were recorded (ISAK, 2011). Measuring the waist and hip circumference was performed using a measuring tape.

The percentage of fat was calculated using the 4-Site Skin fold Equation (triceps skin fold, abdomen skin fold, hip skin fold and thigh skin fold) values according to these formulas (Jackson & Pollock, 1985):

Boys: (0.29 x sum of skin folds)-(0.0005 x [sum of skin folds]2)+(0.15 x age)-5.76

Girls: (0.29 x sum of skin folds)-(0.0004 x [sum of skin folds]2)+(0.02 x age)+1.40

All analyses were performed using SPSS, PC program, version 20.0 (SPSS Inc., Chicago, IL, USA).

The averages and percentiles were calculated using descriptive statistics.

ANOVA examinations were made to compare the age groups, while sexes comparisons were performed using an independent t-test.

RESULTS

The participating students were classified into five groups according to their age: 19.00-19.99; 20.00-20.99; 21.00-21.99; 22.00-22.99; 23.00-23.99 years old.

After calculating the BMI values it can be establish that 67.1 % of the students have normal (healthy) body

weight, 5.5 % of them are undernourished, 20.5 % of them are slightly overweight, 6.1 % of them are overweight and one student (0.68 %) is categorized as 'obese'. The BMI value of the obese student is 49.54 kg/m^2, which is the highest calculated value. The lowest calculated value is 16.56 kg/m^2, which falls under the 'undernourished' category.

The BMI average of the participating students is 23.21 kg/m^2 (with a standard deviation of 5.13), this value indicates a normal (healthy) nutritional status.

A total of 75 % of the male students have normal body weight, whereas 25 % of them are overweight. The average of the BMI values is: 23.35±3.48. The studied group of male students did not include any undernourished, or obese young men.

First, the results and measurements obtained for the participating young men will be described. Based on the results classified according to the male students' ages, it can be established that 66.66 % of 19-year-old male students have normal body weight, while 33.33 % of them are overweight (Table I). 88.88 % of the 20-year-old young men have normal body weight, with 11% of them overweight. In the case of 21 and 23-year-old men, the ratio is 60 % to 40 % for those with normal body weight and those overweight. In the case of 22-year-olds this ratio is 80-20 %.

No significant differences can be observed in the case of height, weight, or the BMI data based on the analysis of the four age groups. In the case of height, themaximum value can be observed in the group of 22-year-old male students (180.10±5.22). Among the male students aged 20 and 22 there are significant differences (t(12,11)=2.67; p=0.02). In the case of body weight, the 23-year-old students have the highest value (82.00±12.72). However there is a significant

difference between the students aged 20 and 23 (t(12,11)=2.48; p=0.03). In the case of the BMI, the highest value was measured in the male group of those aged 23 (26.01±5.09). Among the age groups, no significant difference can be observed in the case of BMI data.

Here follows an overview of data for the female participants of the study. A small percentage, 6.55 % of the young women are undernourished, 65.57 % of them have normal (healthy) body weight, 19.67 % of them are slightly overweight, 7.34 % of them are overweight, while 0.81 % of the participants belong to the 'obese' category. The average of their BMI values is 23.49 (given a standard deviation of 4.58).

The results of the analysis according to age groups show that 4.34 % of the 19-year-old young women are undernourished, 56.52 % of them have normal body weight, 37.81 % of them are overweight, whereas 4.34 % of them are obese. Within the group of 20-year-old female students, none of them are obese (Table II), a total of- 10.00 % are undernourished, the majority, i.e., 75.00 % of the female students have normal body weight, 10% of them are overweight, while 5.00 % are classified as 'obese'. The weight distribution of the female students aged 21 is the following 3.57 % of the young women are undernourished, 67.86 % of the female students have normal body weight, 14.28 % of them are overweight and 14.28 % of them are considered obese. Among the 22-year-olds, are undernourished, 72.22 % of them have normal body weight, 16.67 % of them are overweight, whereas 5.55 % of them are in the category 'obese'. The oldest female students, the 23-year-olds show the following distribution: 7.14 % are undernourished, 64.28 % of them have normal body weight, 14.28 % of them are overweight, with another 14.28 % are obese.

Table I. Boys' age (year), height (cm), weight (kg), body mass index (BMI) and the BMI categories in which they belong grouped by years (data: mean and standard deviation).

	I. year (n=9)	II. year (n=8)	III. year (n=4)	IV. year (n=3)	
age (year)	20.39±0.75	21.01±0.75	22.86±0.81)	23.06±0.12	F=22.4 p=0.00 η²=0.77
height (cm)	174.08±6.10	172.37±8.37	182.2±4.76	177.53±3.91	F=2.15 p=0.12 η²=0.24
weight (kg)	71.96±12.62	65.92±12.99	84.2±11.63	72.00±7.54	F=1.99 p=0.14 η²=0.23
BMI	23.69±3.53	22.11±3.54	25.46±4.22	22.81±1.68	F=0.86 p=0.48 η²=0.11

Table II. Girls' age (year), height (cm), weight (kg), body mass index (BMI) and the BMI categories in which they belong grouped by years (data: mean and standard deviation).

	I. year (n= 33)	II. year (n=21)	III. year (n=34)	IV. year (n=34)	
age (year)	20.36±2.70	21.23±0.90	22.05±1.00	22.93±0.59	F=15.88 p=0.00 η^2=0.28
height (cm)	163.70±5.94	164.55±6.28	162.08±10.57	163.17±5.26	F=0.53 p=0.65 η^2=0.01
weight (kg)	65.54±14.48	61.13±11.15	60.78±11.87	61.96±10.78	F=1.01 p=0.39 η^2=0.02
BMI	24.50±5.51	22.69±4.82	23.23±4.38	23.25±3.55	F=0.80 p=0.49 η^2=0.02

No significant differences can be observed in the case of the young females in the case of height, weight, or the BMI for the four age groups. The highest weight average was found among the 19-year-old females (67.10±16.64), since the largest number of overweight and obese students attend that study year. Consequently, the average BMI value is also the highest for this age group (25.05±6.30). In the case of height the highest average value was measured in the group of the 21-year-old women (163.91±7.75).

Having compared the data of the male and female students by age groups, it can be stated that, in the case of weight and height, the detected differences are significant (p<0.05). Taking into consideration the obtained data overall, the authors found that both sexes present an identical situation.

For the male student participants, it can be determined that no significant differences are detected among the measured values of the triceps-, the abdomen-, the scapula-, the hip-, the iliac spine- and thigh skin folds according to the age groups. The fat percentage calculated based on skin folds does not present any significant difference for the five age groups, except for the 23-year-olds, the other four categories can be classified as 'thin'. The highest fat

Table III. Skinfold thickness (mm) in the case of boys by year categories (data: median, 25th and 75th percentiles).

	I. year	II. year	III. year	IV. year	statistic
triceps	9.41 (6.05;12.00)	8.47 (6.25;10.80)	13.17 (7.50;17.87)	6.82 (1.25;13.97)	F=0.62 p=0.59 η^2=0.01
scapula	11.02 (8.15;14.50)	12.55 (8.42;15.65)	15.30 (9.97;22.97)	8.42 (2.27;13.65)	F=0.43 p=0.72 η^2=0.01
abdomen	13.64 (9.55;18.15)	13.00 (8.50;17.00)	16.60 (11.00;24.15)	11.62 (3.25;18.52)	F= 2.59 p=0.56 η^2=0.06
hip	6.21 (3.35;9.50)	4.97 (3.92;5.35)	7.55 (5.00;9.55)	5.52 (1.37;9.55)	F=2.78 p=0.04 η^2=0.06
ilium	13.30 (11.10;16.20)	13.26 (9.05;16.30)	17.1 (13.75;21.55)	11.77 (2.75;18.52)	F=1.41 p=0.74 η^2=0.01
thigh	11.53 (8.00;15.2)	13.00 (8.60;16.85)	21.35 (12.1-30.75)	13.30 (2.45;23.85)	F=1.92 p=0.12 η^2=0.04
summary	11.53 (8.00;15.20)	10.87 (7.32;14.07)	15.18 (10.00;18.32)	12.86 (8.27;17.40)	F=1.59 p=0.23 η^2=0.18

percentage (12.50±3.70) was measured for the students of the 23-year-old category. This value places them into the 'acceptable' category. The lowest fat percentage value was measured for the 20-year-old group (7.23±2.07).

Similar to the results of the male students, the values measured for the female students at the triceps-, the abdomen-, the scapula-, the hip-, the iliac spine and thigh skin folds no significant difference was determined for the different age groups. The fat percentage calculated according to skin folds also showed no significant difference for the five age groups, they all fall into 'acceptable' category, except for the 20-year-olds, who are classified as 'thin'. The highest fat percentage value was measured for the 23-year-old female students (18.83±6.60), while the 20-year-olds presented the lowest value (16.19±6.13).

Based on the comparison of the skin fold values for the male and female students, it can be stated that there is significant difference in the case of thigh skin fold in the 19-year-old age groups (F(1,25)=4.01; p=0.04; h2=0.14) (Table IV).

Significant differences for the age group of the 20-year-old can be detected in the values of the thigh skin fold (F(1,28)=16.31; p=0.00; h2=0.37), the hip skin fold (F(1,28)=7.60; p=0.01; h2=0.21) and the triceps skin fold (F(1,28)=15.500; p=0.01; h2=0.36). The age group of the 21-year-olds presents significant difference only in the case of the triceps skin fold (F(1,32)=11.24; p=0.00; h2=0.26). The category of the 22-year-old show significant difference in the case of the thigh skin fold (F(1,40)=4.92; p=0.03; h2=0.11), whereas the age group of the 23-year-old presents no significant difference. Comparison of the data based on sex again demonstrates significant difference in the case of the thigh skin fold (F(1,126)=22.80; p=0.00; h2=0.14), as well as the triceps skin fold (F(1,126)=22.99; p=0.00; h2=0.15).

As for measuring the abdominal obesity, "the waist/hip ratio data does not show any significant differences either for the hip-, or waist circumferences, or the waist/hip ratio compared across all five age groups (Table V).

Comparing the values of the male and female participants in the youngest age group, the 19-year-olds the authors found significant difference in the case of waist circumference (F(1,25)=5.15; p=0.03; h2=0.17). The second-youngest age group presents no significant difference whereas. For the 21-year-olds it is again

Table IV. Skinfold thickness (mm) in the case of girls by year categories (data: median, 25th and 75th percentiles).

	I. year	II. year	III. year	IV. year	statistic
triceps	15.82 (10.05;17.25)	13.19 (11.00-15.05)	14.20 (12.35-18.02)	15.45 (11.60-19.27)	F=0.62 p=0.59 η^2=0.01
scapula	13.78 (10.55-18.15)	12.09 (8.50-13.60)	11.35 (9.50;13.22)	12.00 (9.87-16.02)	F=0.43 p=0.72 η^2=0.01
abdomen	13.19 (10.10-16.10)	12.93 (10.15-16.00)	13.80 (11.90-17.50)	17.25 (10.90-20.70)	F=2.59 p=0.05 η^2=0.06
hip	6.38 (4.40-7.10)	6.68 (4.50-8.60)	6.95 (5.07-9.32)	8.20 (5.05-10.85)	F=2.78 p=0.04 η^2=0.06
ilium	15.89 (10.30-21.05)	14.49 (9.75-18.40)	15.2 (10.97-21.32	15.7 (8.65-21.2)	F=0.41 p=0.74 η^2=0.01
thigh	23.15 (18.85-28.45)	19.67 (16.00-22.60)	22.9 (18.27-27.00)	23.40 (19.32-27.65)	F=1.92 p=0.12 η^2=0.04
summary	13.10 (9.10-18.82) 2911.90 mm	12.15 (9.27-16.30) 1660.40 mm	13.30 (10.22-19.00) 3056.50 mm	15.00 (9.62-20.27) 3129.00 mm	F=2.68 p=0.05 η^2=0.06

Table V. Hip circumference, waist circumference and the waist/hip ratio in the case of boys grouped by years (data: median, 25th and 75th percentiles).

	I. year	II. year	III. year	IV. year	statistic
hip circumference	87.03 (84.60;89.90)	86.01 (76.85;95.47)	99.00 (91.12,107.87)	85.15 (80.32;89.22)	F=2.72 p=0.07 η2=0.29
waist circumference	70.07 (57.65;81.35)	77.57 (60.02;94.05)	87.00 (78.65;94.35)	79.00 (73.65;83.9)	F=2.70 p=0.07 η2=0.28
waist/hip ratio	0.82 (0.71;0.96)	0.89 (0.78;0.97)	0.87 (0.83;0.91)	0.97 (0.92;1.06)	F=1.32 p=0.29 η2=0.15

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Table VI. Hip circumference, waist circumference and the waist/hip ratio in the case of boys grouped by years (data: median, 25th and 75th percentiles).

	I. year	II. year	III. year	IV. year	statistic
hip circumference	87.95 (79.80;93.00)	77.04 (72.1;81.6)	85.07 (78.52;90.70)	88.15 (82.12;92.75)	F=6.27 p=0.00 η^2=0.13
waist circumference	74.10 (72.20;75.60)	66.34 (63.6;68.2)	72.19 (64.90;76.00)	72.81 (67.30;76.72)	F=7.07 p=0.00 η^2=0.15
waist/hip ratio	0.85 (0.80;0.90)	0.86 (0.81;0.90)	0.85 (0.81;0.87)	0.82 (0.78;0.86)	F=1.31 p=0.27 η^2=0.03

Table VII. The ratio of overweight boys according to BMI data, triceps skinfold and waist/hip ratio (data: percentage).

	I. year	II. year	III. year	IV. year
BMI	33.33	12.5	50	0
triceps skinfold	11.1	0	50	33.3
waist/hip ratio	0	12.5	0	0

Table VIII. The ratio of overweight boys according to BMI data, triceps skinfold and waist/hip ratio (data: percentage).

	I. year	II. year	III. year	IV. year
BMI	36.36	19.04	26.47	26.47
triceps skinfold	15.15	9.520	26.5	35.20
waist/hip ratio	27.27	23.81	11.76	2.94

to determine obesity, - one of these being skinfold (triceps, scapula etc.) measuring. Abdominal obesity, on the other hand, is defined by calculating the ratio of waist and hip circumference.

The main goal of this work is to study the nutritional status and the body composition characteristics of students at the Hungarian Language Teacher Training Faculty. During the study, special attention was paid to the comparison of the results for the two genders and the different age groups. The aim was to discover the type of underlying body compositions behind the student's overweight bodies, and as well as circumference values that were measured (WHR), comparing of these data in which level strengthen or weaken them?.

Differences were detected between height and weight both for the young men and women of the study for the given age groups. The average age of the examined students is between 19 and 23 years. This is the age period when young adults' weight, quantity of fat and muscle changes according to the students' nutritional habits, as well as physical activity (including diets, sport activities etc.) (Bodzsár, 2006).

In the case of height and weight, the observed differences between the sexes support the principle that the young men's average weight and height is higher than the women's. The BMI values presented no significant difference, since the higher weight values measured for men can be explained with their higher height values. Having analyzed the values, the authors found that two students would need an urgent change of life style; given their obesity, they need to implement some changes if are to remain healthy.

the waist circumference that shows significant difference $(F_{(1,32)}=16.33; p=0.00; h2=0.34)$. During the analysis of the 22-year-old age group, the authors observed significant difference in several categories, including waist circumference, $(F_{(1,40)}=15.41; p=0.00; h2=0.28)$, hip circumference $(F_{(1,40)}=4.20; p=0.04; h2=0.09)$ and the wais/thip ratio $F_{(1,40)}=4.89; p=0.03; h2=0.12)$ between the two sexes. The oldest age, group, i.e. the group of 23-year-olds also presents significant difference for the waist circumference $(F_{(1,15)}=6.58; p=0.02; h2=0.31)$ and the waist/hip ratio $F_{(1,15)}=10.75; p=0.00; h2=0.50)$.

DISCUSSION

In studies with a large number of participants, the BMI is a suitable indicator to present nutritional status, the different levels of overweightness and obesity, however, due to its limiting character, it does not always provide precise information (Garn *et al*., 1986). It reveals the correlation between height and body weight, it does not differentiate between body fat, muscle fat and skeletal fat (Freedman & Bettylou, 2009). The BMI is in close correlation with height during the body's developmental process (Sperrin *et al*., 2016). Due to these reasons, the authors used other methods in order

The results of this study portray that the participating women fall under the overweight and obese categories more frequently, as opposed to the results obtained by Zin *et al*. (2014). In their research, Zin *et al*., studied medical students in Malaysia, and observed that the overweight and obese categories appear more frequently in the case of male students. With the present study, this observed difference can be explained with the low number of male participants in this

sample. The ratio of overweight men in the mentioned study is the same as in the results of this study. Zin *et al*., observed 10 % overweight men. In the case of women, the situation is better in Malaysia, both in the overweight (11.00 %) and obese (5.00 %) categories.

In Portugal, 36.4 % of young adults are overweight, 15.1 % of them are obese according to BMI data (Marques-Vidal *et al*., 2011). In Spain the situation is the same: 34.2 % of young adults are overweight and 13.6 % of them are obese (Rodríguez-Rodríguez *et al*., 2011). In Nigeria the ratio of overweight young adults' is as follows: 17.5 % of the men and 24.8 % of the women (Ejike & Ijeh, 2012). A study conducted in Hong Kong showed that 13.02% of young adult men and 26.7 % of young adult women were overweight. The survey also revealed a correlation between body weight and education level (Cheung *et al*., 2011). A survey conducted in Lebanon demonstrated that 37.5 % of the male participants were overweight and a further 12.5 % obese. For female participants this ratio was 13.6 % who were overweight and 3.2 % who were obese (Yahia *et al*., 2008). The sex distribution of the participants in the Teheran study showed that 7.9 % of the male medical students and 22.5 % of the female medical students belonged to the overweight category (Nojomi & Najamabadi, 2006). In another study conducted in Malaysia, Thant found that 24.0 % of the medical student men were overweight and 10.0 % of them were obese, while in the case of women, 11.0 % were overweight and 5 % were obese (Thant, 2014).

In comparison to the students of the Lebanon study, the percentage in the case of the male participant in this present research the frequency of overweight students is low (25.0 %) while none of the young men fall under the obese category. In the case of female students, the frequency is higher both for the overweight (19.67 %) and obese (7.34 %) students, too. Compared with the medical students in the Teheran study, the frequency of overweight and obese students is lower in the case of men (7.9 %), as well as in the case of women (22.5 %) too (Nojomi & Najamabadi).

The majority of the students in the at the Hungarian Language Teacher Training Faculty study belong to the category 'normal nutritional status', which holds true both for the male and female participants. These results are cause for optimism, especially given that the WHO, as well as the Serbian National Health Institution report a high rate of obesity in both childhood and adulthood (Results of the National Health Survey of the Republic of Serbia 2013; WHO, 2017). The students who volunteered for this study are no longer classified as adolescents'. As young adults leaving their parents' home, they alone are responsible for keeping a healthy life style and taking care of their normal body weight.

The authors hypothesized that there would be a significant difference in the case of skin folds between the young men and women derived from developmental principles. The differences between the two sexes can be explained, on the one hand, by the differences of expansion of the trunk skin folds, while on the other hand, the opposing changes of limb skin folds in the two sexes (Bodzsár). Regular sport activity can also influence this rate, thickness of skin folds depends on the type of the sport (Garrido-Chamorro *et al*., 2012; Popovic *et al*., 2013). The significant differences between the age groups in the case of thigh and triceps skin folds further support the authors' hypothesis.

The fat percentages calculated based on skin fold values show that the majority of the female students can be classified as having 'acceptable' weight. The majority of young men fall under the 'thin' category based on their body fat percentages. These data are significantly different from the classification given by BMI. The values calculated based on skin fold values also take into consideration the differences between the sexes and age groups (Sarría *et al*., 2008).

In the case of abdominal obesity calculated based on the waist/hip ratio, Serbia is in a worse situation, given that in Nigeria the ratio of overweight young adult women is 1.2 %, and 4.3 % in the case of young adult men. However, the results obtained in this study are several times that rate: 20.0 % of men and 19.48 % of women belong to the overweight category. Taking into consideration the economical status of the two countries and the differences between African and European races these differences are understandable.

There are some studies, both arguing for and against the BMI index, skin fold measuring and waist/hip ratio (Sarría *et al*.; Janssen *et al*., 2004; Schmidt *et al*., 2011). The present authors' work also proves that there are significant differences among results given by the three methods in the case of sex and age, too. These results partially resemble the study made by Aly, who found that the BMI index classifies more people as overweight than the triceps skin fold value (Aly, 2014).

CONCLUSIONS

This paper describes the morphological study focusing on the nutritional status of young adult teacher training students. The results show that the three methods (body mass index-, skin fold thickness- and waist/hip ratio study) are suitable for filtering out the individuals belonging to a high-risk category, enabling them to receive serious help in order to change their life style and reach a normal (healthy) body weight. The majority of the participating students fall

under the normal body weight category in the case of BMI, skin fold thickness and waist/hip ratio too. The ratio of overweight students is significantly lower than the European average (Eurostat Statistics Explained, 2014).

Another important part of the results of this work is the data about the teacher training students because as future teachers, they will be responsible for the well-being of the pupils in their care. They will be setting an example for the children both with their educational work, as well as with their own life style, and as such, play an important role in teaching the children to avoid childhood obesity and guiding them in their education towards a healthy life style.

BORSOS, É.; HALASI, S.; IHÁSZ, F.; CZÉKUS, G.; HORÁK, R.; LEPES, J. & STAJER, A. Examen morfológico de adultos jóvenes relacionado con la obesidad. *Int. J. Morphol., 36(1)*:121-129, 2018.

RESUMEN: Este estudio presenta una comparación transversal de la característica morfológica de estudiantes de lengua húngara pertenecientes a la Facultad de Formación de Docentes en Subotica, Serbia, en función de su estado nutricional estimado con el estado de alimentación. La muestra estuvo compuesta por 146 adultos jóvenes, cursando los cuatro años en la Facultad, con edades comprendidas entre los 19 y los 23 años. Se realizaron las siguientes mediciones antropométricas: peso corporal, altura, grosor de la piel (pliegues cutáneos medidos en la escápula, tríceps, bíceps, ilion, cadera, muslo y abdomen) y circunferencias (cintura, cadera). Los autores calcularon y analizaron los datos, incluidos: el IMC (índice de masa corporal) con la fórmula, el grosor del pliegue cutáneo y con la ecuación del pliegue cutáneo de 4 sitios y la relación cintura-cadera. La estadística descriptiva se usó para describir las características morfológicas. Se realizaron análisis independientes de T-test y ANOVA para comparar los estudiantes de acuerdo al sexo y la edad. Los principales resultados del presente estudio son: (1) no se encontraron diferencias significativas entre los grupos de edad en el caso de la altura o el peso corporal, para los hombres jóvenes o las mujeres jóvenes; (2) se pudieron observar diferencias entre la altura y el peso en el caso del hombre y la mujer como características para este grupo etario; (3) las estudiantes, tienen con mayor frecuencia sobrepeso u obesidad, en relación a los estudiantes varones; (4) la mayoría de los estudiantes participantes pueden clasificarse en la categoría de un estado nutricional normal, lo cual es válido tanto para los hombres como para las mujeres jóvenes del estudio; (5) los porcentajes de grasa calculados basados en los valores del pliegue de la piel muestran que, en términos de peso, la mayoría de las alumnas se clasifican en la categoría "aceptable", mientras que la mayoría de los hombres jóvenes se clasifican como "delgados"; (6) en el caso del sobrepeso abdominal, el 20,0 % de los hombres y el 19,48 % de las mujeres pertenecen a la categoría 'obeso'. Esta información de los alumnos de la Facultad es vital, ya que estos jóvenes desempeñarán un papel importante como futuros docentes y como un modelo de conducta, ayudando de esta forma, a evitar la obesidad infantil y guiando a los niños a lo largo de su educación hacia un estilo de vida saludable.

PALABRAS CLAVE: Adultos jovenes; Obesidad; IMC; Plieges cutaneos; Índice cintura-cadera.

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