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# BODY STRUCTURE MODEL CHARACTERISTICS IN FEMALE STUDENTS OF FACULTY OF SPECIAL EDUCATION AND REHABILITATION (FASPER) MEASURED BY THE METHOD OF MULTICANAL BIOELECTRIC IMPEDANCE

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**Abstract**

The goal of this research was to define the initial body structure model of female students of Faculty of Special Education and Rehabilitation (FASPER), University of Belgrade, as a person whose professional and work commitment is working with disabled people and it's perceived as a very responsible, stressful and atypical work profile. The sample was made of 125 participants (female students) of III and IV year of Bachelor studies of FASPER. Research was conducted in a Methodical-research laboratory (MRL) in Faculty of sport and physical education, University of Belgrade in a time period 2012-2017, in accordance with standardized procedure of applying electrical multichannel bioimpedance method with body structure analyzer-InBody 720. It contained twenty (20) variables, eight (8) were basic and twelve (12) were derived. Based on BMI it's claimed that 77.60% participants has a normal body status, but the prevalence of overweight students (BMI<25.00) were 7.20%, apropos the prevalence of obesity (BMI<30.00) was 4.00%. It's also established that the prevalence of underweight students (BMI>18.50) is 11.20%, with 4.00% participants who were significantly thinness underweight i.e. poorly nourished (BMI>17.50). According to the results it was concludet that even 96.8% of sample was not in line with ideal or optimal body structure profile. For example, 63.2% participants has some form of body mass deficits (average of 5.25 kg) with mostly muscle component deficit 78.4% (average muscle mass deficit is 4.28 kg) and with body fat component deficit 43.2% (average deficit of body fat is 2.01 kg). On the other hand, 33.6% participants has a form of surplus (average surplus in body structure is 9.44 kg) where even 54.4% has a surplus of body fat component (average level of surplus of body fat 7.48 kg). The results of 4D body structure model of female students from FASPER can be defined like this: 31.77 L of Total Body Water (53.37%), 8.50 kg of proteins (14.26%), 16.98 kg of body fat (27.10%) and 3.10 kg of minerals (5.18%). Beside the probability that the reason of bad nutrition behaviour of these students is the cause of their increasing fat depots it's also a fact that 69.6% of these students are physically inactive and 21.6% just occasionally active, which mean that 91.2% of students was physically non active pearson, could indicate a most possible reason of body fat componente suficit and body muscle componente deficit as a main body structure characteristics.

**Key word:** PERCENT OF BODY FAT / PERCENT OF MUSCLE MASS / FEMALE STUDENTS, BODY COMPOSITION / UNIVERSITY OF BELGRADE

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## INTRODUCTION

Besides basic morphological characteristics, body height (BH) and body weight (BW), the human body has its own structure. The term body structure defines the composition and interaction of all organic tissues, as a biological set of substances, of which the human organism consists (Heyward & Stolarczyk, 1996).

At the macro level, the human organism consists of four basic elements (segments), as the main biologically measurable substances: water, oily, protein and mineral component. Mathematically, the relations of these basic elements define morphological indices, based on which the representation of individual elements in the body is calculated, which determines the proportions or body structure (Heyward and Stolarczyk, 1996; Dopsaj et al., 2013; Dopsaj et al., 2015). The given data is of crucial importance for clinical practice and defining the state of nutrition of individual, but also they are changeable that is variables of interest for scientific research in applied anthropology (pedagogical, medical, cultural, evolutionary, etc.) (Mott et al., 1999; WHO, 2000; Kyle et al., 2006; Stommel and Schoenborn, 2010).

Students represent a population of people of greatest interest to a society, because they are the carriers of the development of that same society in the immediate, close and distant future. This particularly applies to female students of the Faculty of Special Education and Rehabilitation (FASPER) because they are trained for high profile professions who will during their working age deal with people with a certain degree and type of disability. In other words, a professional work profile will have work characteristics in terms of permanent exposure to stressful situations in relation to activities and specific forms of work and treatment with people with speech disorders, language and communication, visual disturbance, hearing, social behavior, as well as various psychological, physical and muscular-neural deficits. Permanent exposure to such professional work agents increases the risk of excessive negative cumulative impact in terms of health, physical and / or physical status for the future.

The monitoring of habits in physical activity, eating habits, as well as conditions and changes in body status since school days, and even during the student period, is a very important procedure because it provides initial information about the research area, that is, determines the facts about the current morphological status from the beginning of the education period, (Hoffman et al., 2006; Dopsay et al., 2010; Meckel et al., 2011; Hajnalka & Chaba, 2017). In addition to personal socio-social and professional changes that a student population meet in the near future, there are inevitable biological influences that are taking place during growing up and aging, and which modern life and urbanization bring about as a change in the lifestyle of a modern man. Two basic factors of modern lifestyle are reduced physical activity and increased energy intakes, have caused a phenomenon that manifests itself through an enormous increase in the prevalence of obesity, that is, persons with an increased percentage of body fat. The phenomenon became the main determinant of increasing the incidence of non-contagious diseases in a modern man (WHO, 2000).

So far, the measurement procedures and procedures in the field of body composition, as well as the degree of nutrition and morphological characteristics in humans, were predominantly based on the Body Mass Index (BMI), that is the measurement of skin folds and / or the volume of different body extremities, and the use given data in terms of their conversion for the needs of estimating certain structural elements using mathematical formulas (Heyward and Stolarczyk, 1996). However, it has been established that this kind of evaluation has major predicament errors, while for BMI it is increasingly confirmed that it is not sufficiently specific and sensitive in the dressed value zones in the function of prediction of the real values of the body composition, and especially in relation to the level of fat in the body (Kyle et al., 2003; Rothma, 2008).

The instruments of the latest generation measuring that use the new body metering technology use the principle of multichannel electrical bioimpedance and with high reliability and measurement fluency provide valid scientific data on the content and structure of the body (InBody 720, 2005; Dopsaj et al., 2017).

The aim of this research is to define the characteristics of the model of the body structure in female students of FASPER University in Belgrade. The analytical and diagnostic aspect of the obtained results will indicate the current level of quantitative characteristics of the observed body space in future professionals working with disabled persons, that is, as women in the work with disabled people. Also, the obtained results will point to the current profile of the body structure in young girls of academic orientation as part of the university population of Belgrade, oriented towards the socio-humanistic profile of education.

## METHODS

This research is non-experimental in character, while in relation to the type belongs to the descriptive-anamnestic study.

### Sample

The sample consisted of 125 students of the III and IV year of basic graduate studies at the FASPER University of Belgrade. The basic descriptive data on subjects were: age = 22.5 ± 1.9 years, BH = 166.7 ± 6.5 cm, BW = 60.3 ± 12.1 kg. In relation to the frequency of physical activity (walking) or physical exercise (sports training, organized or independent recreation or fitness), 87 respondents (69.6%) were not physically active at all or did not practice, that is they had a sedentary lifestyle, 27 respondents (21.6%) were physically active or occasionally exercised (2-3 times a week), 7 subjects (5.6%) were physically active or exercised regularly (4-5 times a week) and only 4 subjects (3.2%) were intensely physically active, that is they practiced intensively (more than 6 times a week). In relation to respondents who were physically active or exercised, the average single daily activity / exercise lasted 49.2 ± 20.2 minutes, or viewed on a weekly basis, the activity / exercise duration was 147.3 ± 126.6 minutes.

### Measurement of body structure

All measurements were made at the Methodological-research laboratory (MRL) of the Faculty of Sport and Physical Education of the University of Belgrade in the period from 2012 to 2017 in the morning hours between 09:00 and 11:00. Measurements were conducted in accordance to a standardized procedure (at least 24 hours before the measurement consumption of alcohol and physical exercise were prohibited, at least 2 hours before measurement it was forbidden to take food and water, at least 5 minutes before the measurement, all respondents stood and the measurement was achieved in lightweight sports clothes, at least 30 minutes before the measurements were completed, physiological discharge was completed, and during the measurement, nobody had anything metal) using the method of electrical multichannel bioimpedance with body structure analyzer of the latest generation - InBody 720 (InBody 720, 2005).

### Variables

This study covers twenty (20) variables, eight (8) basic and twelve (12) derived; that is, index variables, which define the characteristics of the model of the body structure of the examinees.
The basic variables were as follows:

1. BH - body height, expressed in cm,
2. BW - body weight, expressed in kg,
3. FFM - fat free mass, expressed in kg,
4. Proteins - mass of proteins in the body, expressed in kg,
5. Minerals - total weight of minerals in the body, expressed in kg,
6. BF - total body fat, expressed in kg,
7. SMM - Skeletal Muscle Mass, expressed in kg,
8. VFA - Visceral Fat Area, expressed in cm2.

Derived (index) variables were as follows:

1. BMI - Body Mass Index, expressed in kg • $m^{-2}$,
2. Targ_BM - ideal body weight (Target BM), expressed in kg,
3. W_Control - recommended corrections of the actual body weight (Weight Control), expressed in kg,
4. F_Control - recommended body fat correction (Fat Control), expressed in kg,
5. M_Control - recommended correction of skeletal muscle mass (Muscle Control), expressed in kg,
6. Fitness_Skor - quantitative (numerical) assessment of body status, expressed in a scorecard,
7. PBF - percentage of body fat (Percent of Body Fat Mass), expressed in%
8. PSMM - percentage of skeletal muscle in the body, expressed in%,
9. FMI - Fat Mass Index, expressed in kg • $m^{-2}$,
10. SMMI - skeletal muscle mass index, expressed in kg • $m^{-2}$,
11. FFMI - Fat Free Mass Index, expressed in kg • $m^{-2}$,
12. PFI – relation between Protein and Fat mass (Protein Fat Index), expressed in kg.

**Statistical data processing**

All raw results are inserted into the standard EXCEL software in order to form a database and perform a logical test of the results. After logical checks, using the descriptive statistical procedures, the necessary parameters of the central tendency and dispersion of data were calculated (Mean, SD, cV%, Std. Error, Skewness, Kurtosis, Min, Max and confidence interval to 95%). The regularity of the distribution of variables was checked using the non-parametric test Kolmogorov-Smirnov (KSZ), while the distribution values were defined using percentile. For all statistical procedures, the software package SPSS Statistics 17.0 (Hair et al., 1998) was used.

## RESULTS

The basic descriptive statistics of the examined body structure variables are shown in Table 1. Table 2 gives the results of the percentile distribution of all tested variables defined in relation to nine characteristic classes of results (2.5, 5.0, 10.0, 25.0, 50.0, 75.0, 90.0, 95.0 and 97.5 percentil).

**Table 1**. Basic descriptive statistics of studied variables

| Varijabla | Mean | SD | cV% | Std. Error | Skew | Kurt | Min | Max | 95% Conf. Interval | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Lower Bound | Upper Bound |
| TV (cm) | 166.7 | 6.5 | 3.9 | 0.58 | 0.24 | -0.01 | 151.7 | 185.7 | 165.5 | 167.8 |
| TM (kg) | 60.31 | 12.11 | 20.1 | 1.1 | 2.17 | 6.73 | 44.4 | 114.7 | 57.2 | 62.5 |
| BMI (kg•m$^{-2}$) | 21.67 | 3.87 | 17.9 | 0.35 | 2.19 | 6.44 | 16.19 | 39.18 | 20.99 | 22.36 |
| FFM (kg) | 43.24 | 5.13 | 11.9 | 0.46 | 0.84 | 1.85 | 33.20 | 61.94 | 42.34 | 44.15 |
| Proteini (kg) | 8.47 | 0.98 | 11.6 | 0.09 | 0.68 | 1.16 | 6.60 | 11.80 | 8.29 | 8.64 |
| Minerali (kg) | 3.08 | 0.41 | 13.3 | 0.04 | 1.05 | 2.62 | 2.20 | 4.64 | 3.01 | 3.15 |
| BF (kg) | 17.00 | 8.27 | 48.7 | 0.74 | 2.46 | 7.48 | 7.40 | 53.70 | 15.53 | 18.46 |
| SMM (kg) | 23.54 | 2.98 | 12.7 | 0.27 | 0.69 | 1.19 | 18.00 | 33.70 | 23.02 | 24.07 |
| VFA (cm$^2$) | 47.75 | 29.31 | 61.4 | 2.62 | 1.93 | 4.64 | 9.50 | 168.0 | 42.56 | 52.94 |
| Targ_TM (kg) | 60.47 | 5.38 | 8.9 | 0.48 | 0.90 | 2.14 | 49.50 | 80.50 | 59.52 | 61.43 |
| W_control (kg) | 0.16 | 9.26 | 5787.0 | 0.83 | -1.77 | 4.31 | -38.70 | 14.60 | -1.48 | 1.80 |
| F_control (kg) | -3.20 | 7.73 | 241.6 | 0.69 | -2.27 | 6.44 | -38.70 | 6.00 | -4.57 | -1.83 |
| M_control (kg) | 3.36 | 2.87 | 85.4 | 0.26 | 0.60 | -0.18 | 0.00 | 13.00 | 2.85 | 3.87 |
| Fitness_Score (bod) | 72.24 | 5.63 | 7.8 | 0.50 | -1.10 | 2.36 | 48.00 | 83.00 | 71.24 | 73.24 |
| Proc_BF (%) | 26.14 | 6.87 | 26.3 | 0.61 | 1.10 | 0.92 | 16.48 | 51.59 | 25.92 | 28.36 |
| Proc_SMM (%) | 39.57 | 3.70 | 9.4 | 0.33 | -0.99 | 0.62 | 26.90 | 45.43 | 38.91 | 40.22 |
| FMI (kg•m$^{-2}$) | 6.11 | 2.87 | 47.0 | 0.27 | 2.34 | 6.98 | 2.74 | 20.21 | 5.60 | 6.61 |
| SMMI (kg•m$^{-2}$) | 8.46 | 0.82 | 9.7 | 0.07 | 0.56 | 0.65 | 6.71 | 11.00 | 8.32 | 8.61 |
| FFMI (kg•m$^{-2}$) | 15.55 | 1.36 | 8.8 | 0.12 | 0.67 | 1.25 | 12.63 | 20.23 | 15.30 | 15.79 |
| PFI (kg) | 0.567 | 0.168 | 29.6 | 0.015 | -0.07 | -0.39 | 0.184 | 1.000 | 0.536 | 0.596 |

Based on the results shown in Table 1, it can be claimed that the variation coefficient values (cV%) in the following variables are above the limits for a homogeneous set: total body mass, BF - 48.7%, visceral fat surface, VFA - 61.4% recommended reduction of the body weight, W_control - 5787.0%, recommended weight body reduction, F_control - 241.6%, recommended muscle weight reduction, M_control - 85.4%, and body fat index, FMI - 47.0%. The remaining fourteen variables have characteristics of a homogeneous set, since the values of the coefficient of variation are below the limit value, or less than 30.0%.

Based on the measure of flattening and curvature of the distribution of results, it can be claimed that in seven variables there is an emphasized platitude of the distribution of the same (TM, BMI, BF, VFA, W_control, F_control and FMI), that is, the measured respondents are less distributed in the zone of the average but the distribution form is asymmetric screwed to higher values of variables. At the same time, it means that for all the above mentioned variables most of the measured values of the examinees are concentrated at lower values.

**Table 2.** Results of percentile distribution of all tested variables

| Varijable | Percentili (‰) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***2.5*** | ***5*** | ***10*** | ***25*** | ***50*** | ***75*** | ***90*** | ***95*** | ***97.5*** |
| TV (cm) | 153.7 | 155.7 | 159.0 | 162.0 | 166.1 | 170.5 | 175.6 | 177.3 | 181.3 |
| TM (kg) | 44.6 | 45.6 | 48.6 | 53.6 | 58.0 | 64.1 | 73.6 | 83.6 | 102.8 |
| BMI (kg•m$^{-2}$) | 16.66 | 17.57 | 18.21 | 19.43 | 20.84 | 22.49 | 27.20 | 29.59 | 36.45 |
| FFM (kg) | 34.66 | 35.76 | 36.84 | 39.37 | 43.11 | 46.30 | 49.43 | 51.24 | 57.45 |
| Proteini (kg) | 6.80 | 7.00 | 7.20 | 7.70 | 8.50 | 9.00 | 9.70 | 9.97 | 11.18 |
| Minerali (kg) | 2.42 | 2.52 | 2.55 | 2.80 | 3.02 | 3.26 | 3.49 | 3.79 | 4.26 |
| BF (kg) | 7.71 | 9.63 | 10.80 | 12.00 | 14.30 | 19.35 | 27.78 | 31.88 | 50.64 |
| SMM (kg) | 18.42 | 19.03 | 19.76 | 21.25 | 23.70 | 25.30 | 27.14 | 28.07 | 31.73 |
| VFA (cm$^2$) | 11.59 | 15.04 | 19.36 | 29.80 | 40.90 | 58.65 | 82.28 | 108.31 | 155.09 |
| Targ_TM (kg) | 50.8 | 52.2 | 54.3 | 56.8 | 60.2 | 63.3 | 66.8 | 69.8 | 74.9 |
| W_control (kg) | -32.7 | -17.6 | -13.4 | -2.6 | 2.0 | 5.7 | 8.7 | 11.4 | 13.0 |
| F_control (kg) | -32.7 | -17.6 | -13.7 | -6.2 | -0.4 | 1.3 | 3.1 | 4.0 | 5.0 |
| M_control (kg) | 0.0 | 0.0 | 0.0 | 0.8 | 3.3 | 5.1 | 7.5 | 8.3 | 8.7 |
| Fitness_Score (bod) | 57.0 | 62.0 | 66.0 | 69.0 | 73.0 | 76.0 | 78.0 | 79.0 | 81.7 |
| Proc_BF (%) | 17.2 | 19.7 | 20.4 | 22.1 | 25.0 | 31.3 | 37.4 | 40.6 | 45.8 |
| Proc_SMM (%) | 29.6 | 32.4 | 34.4 | 37.1 | 40.7 | 42.4 | 43.3 | 43.8 | 44.8 |
| FMI (kg•m$^{-2}$) | 3.00 | 3.61 | 3.83 | 4.38 | 5.09 | 7.12 | 10.03 | 11.89 | 16.68 |
| SMMI (kg•m$^{-2}$) | 7.13 | 7.22 | 7.38 | 7.96 | 8.37 | 8.88 | 9.53 | 9.88 | 10.53 |
| FFMI (kg•m$^{-2}$) | 13.31 | 13.53 | 13.76 | 14.74 | 15.34 | 16.28 | 17.22 | 17.75 | 18.92 |
| PFI (kg) | 0.23 | 0.29 | 0.33 | 0.43 | 0.59 | 0.69 | 0.77 | 0.80 | 0.94 |

Figure 1 shows the distribution of respondents in relation to the variables that define the general nutritional status (BMI).

Based on BMI distribution, it can be argued that 77.60% of subjects are in normal nutritional status (Table 1, BMI from 18.50 to 24.99), but that prevalence of subjects with overweight (BMI = 25.00 to 29.99) is 7.20%, that is prevalence of obesity (BMI <30.00) 4.00%. It was also found that the overall prevalence of insufficient nutrition (BMI ≥ 18.49) was 11.20%, where as much as 4.00% of subjects were significantly unfed (BMI ≥ 17.49).

Figure 2 shows the results of the prevalence of respondents classified in relation to the three categories: subjects with some deficit or surplus of the morphological component that is respondents with optimal body status.

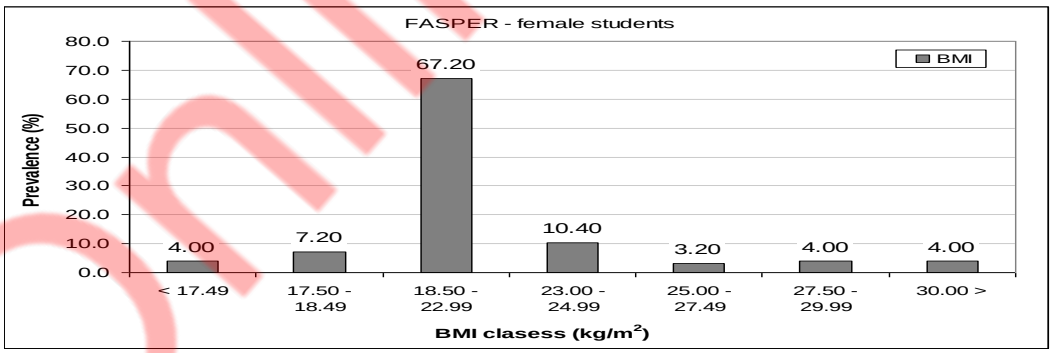


**Figure 1.** Distribution of respondents in relation to BMI defined according to WHO criteria (subclass category)

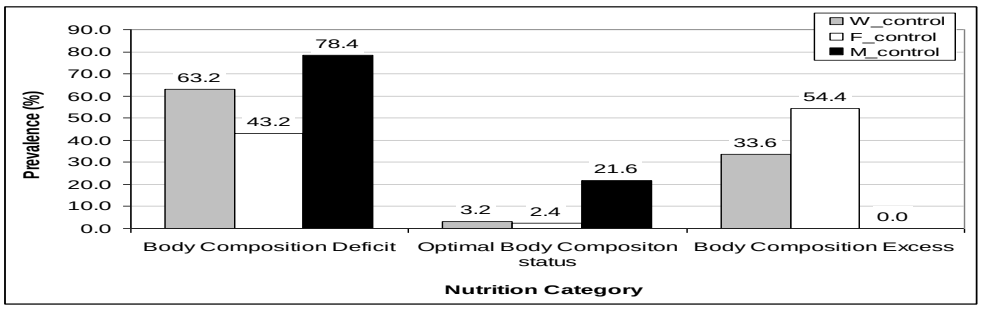


**Figure 2.** Prevalence of subjects classified in relation to three categories: respondents with some of the deficit or surplus of the morphological component and respondents with optimal body status

The results of the prevalence of deficiencies of various morphological components (Figure 2) showed that there is a higher incidence of deficiency, than the frequency of the surplus, that is, respondents with optimal body status. It is generally established that even 63.2% of subjects have some form of deficiency in weight (W_control, weight deficiency average of 5.20 kg), with the highest deficiency of muscular component 78.4% (M_control, average of 4.28 kg muscle mass deficit), i.e. deficiency of the mass component 43.2 % (F_control, average weight deficit of 2.01 kg). In comparison to the surplus, 33.6% of the subjects have a certain surplus (W_control, with an average body weight of 9.44 kg), where even 54.4% have a surplus fat component (F_control, at an average level of a weight of 7.48 kg). In the overall study sample, only 3.2% of respondents had an optimal body structure, of which only 2.4% compared to fat, and 21.6% relative to the muscle component.

Figure 3 shows the results of the defined 4D model of body structure of FASPER student measured by the multichannel bioelectric impedance method. The model is presented in absolute (kg) and relative (% of BM) values.

The results of the 4D models of the body structure of the examined students can be defined as follows: 31.75 L of water (53.37%), 8.50 kg of protein (14.26%), 16.98 kg of fat (27.10%) and 3.10 kg of minerals (5.18% of TM).

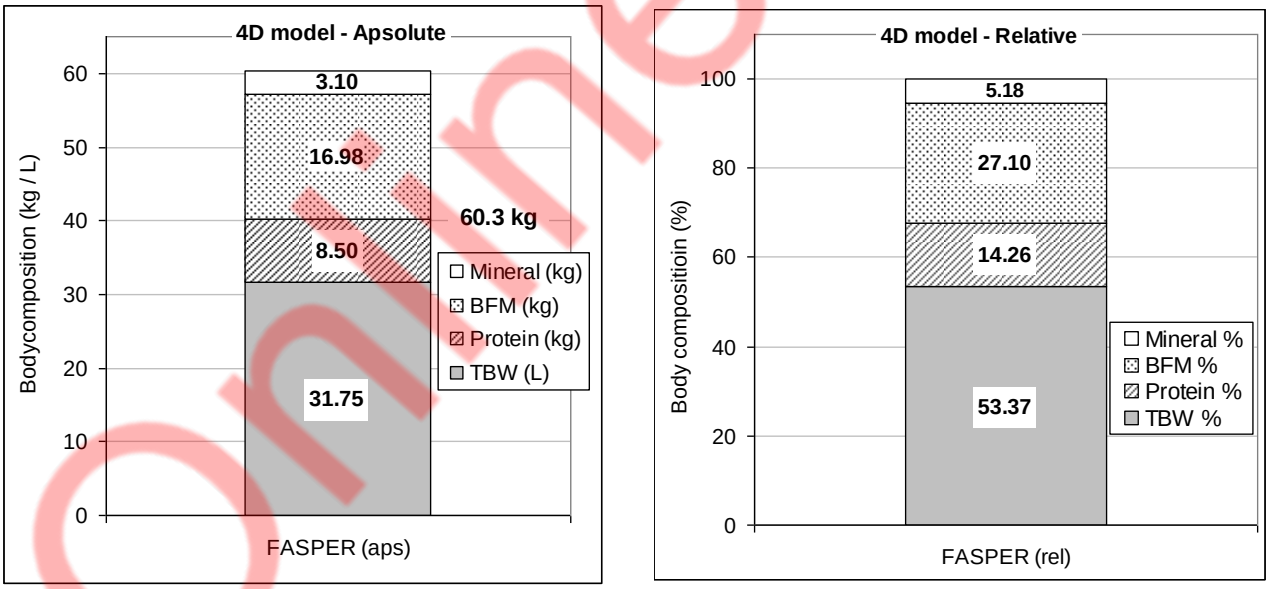


**Figure 3.** The results of the defined 4D model (absolute, in kg, and relative, in% of BM) of the body structure of FASPER student measured by the method of multichannel bioimpedance.

## DISCUSSION

Modern society implies constant technological advancement, that is, it has a constant need to innovate all the necessary knowledge and knowledge, which depends on social progress. Part of the given technology of progress can also be recognized in the need for continuous collection of information on the characteristic and important parts of society, in which the quality of life, with all its positive and negative sides makes an important segment (WHO, 2000). In this way, a permanent information base is provided, which forms the

basis for decision making in terms of planning, programming and correction of the existing system of organization of society in accordance with future and contemporary needs (Dopsaj et al., 2010).

The body structure in humans, or morphological space as a term, implies a field of research in a science that studies the shape and composition of the body, and studies the basic dimensions that describe given form and composition (Heyword and Stolarczyk, 1996). In relation to the mentioned biological system and the various components from which the human body is composed, the body status ie, the status of nutrition is a biologically extremely adaptive characteristic and depends directly on the ratio of calorie intake and calorie consumption. In other words, the physical status is directly subject to changes that depend on the diet, lifestyle and habits of physical exercise, both positive and negative (WHO, 2000; Kyle et al., 2006; Hull et al., 2007).

From the aspect of the standards of healthy and young people in the Republic of Serbia, it can be confirmed that in comparison to the BH, the sample of FASPERA students is on the 20th percentile, which means that the students belong to the category below the average high female persons (Dopsaj et al., 2010, p. 202-204). In comparison to BM and BMI, the sample tested is with 60.31 kg and 21.67 kg • $m^{-2}$ of average values is in the category of average body weight and the category of average body weight index (Dopsaj et al., 2010, pp. 205-207).

According to the results of the study, which examined the morphological characteristics of physically active students of Belgrade University in 12 faculties, where in the total sample which represented 0.30% of the population there were 113 female students (Dopsaj et al., 2015) it is determined that the overall prevalence of overweight and obese student, defined by BMI, 10.30%, while obesity is only 2.21%. Also, the prevalence of insufficient nutrition was 3.68%. Comparing these results, it can be argued that the overall prevalence of overweight and obesity in FASPERA students is somewhat higher than that of the University (11.20 vs 10.30%, repetitive), but the prevalence of obesity is almost twice as high (4.00 versus 2.21%, respectively). However, the prevalence of insufficiently nursed students in FASPER students is about 2.5 times higher than in students from the Belgrade University (11.20 vs. 3.68%, respectively). In other words, the tested sample of FASPER students, comparing them to physically active students of the Belgrade University, shows the characteristics of bimodal nutrition, that is a tendency accentuated toward a 2.5 times higher prevalence of skinny and about 2 times greater prevalence of obese population.

In relation to other fat tissue components, physically active students of the Belgrade Faculty have a 14.71% less total amount of fat tissue (BF), and 11.18% less internal fat and visceral fats (VFA), and 9.83% less fat tissue than a tested sample of female FASPER students. These results indicate that in comparison to the mentioned fat components of the tested FASPERA students, they have all the indicators of fat, both absolute and relative, for about 10 to 15% higher than physically active students of the Belgrade University (Dopsaj et al., 2015). In addition to the existing probability that the cause of increased fat depos in FASPER students is the nutrition, and the fact that even 69.6% are not at all physically active, and that 21.6% is only occasionally active, that is 91.2% is not adequately physically active, which indicates the reason why a fat content component is in surplus (Table 1).

Consequently, and in relation to students of BU that are physically active, in the tested sample, FASPERA female students research show completely inverted results in relation to the status of the contractile component. Namely, they had a 7.13% less protein in the body (Protein), and even a 18.3% worse protein and fat index in the body (PFI) compared to physically active students of Belgrade University (Dopsaj et al., 2015).

If we compare the relative values of the body structure of the 4D model defined on both of these mentioned samples, FASPERA students had a 3.8% lower percentage of total water in the body (53.37 vs 55.48%, respectively), they had a 4.6% lower percentage of protein as contractile components in the body (14.26 vs 14.94%, respectively) had a higher body fat percentage by 11.16% (27.10 vs. 24.28%, respectively) and had a 2.5% lower body mineral (5.18 vs 5.31%) compared to physically active student of the Belgrade University (Dopsaj et al., 2015).

The characteristic thing is that in comparison to the almost identical level of nutrition between the two analyzed samples (current study BMI = 21.67, students of the University of Belgrade 21.71 kg • $m^{-2}$), the sample of the FASPERA students had a reversely proportional different structure of the body, so there was a significant fat tissue surplus (absolutely 2.12 kg fat more), and at the same time a significant deficit of pure contractile, that is protein tissue (absolutely by 0.65 kg less, Table 1). Body status where BMI is in the zone of absolutely normal values, but where there is a surplus fat component and the contractual deficit is certainly not a desirable model of body structure, especially when it comes to young women, female students aged 22.5 ± 1.9 years.

Namely, it is determined that with the increase of the body mass index (BMI) that is body mass, at the expense of the fat component, the health risk for five chronic non-contagious diseases significantly increased, that are: high blood pressure, diabetes, chronic kidney disease, asthma and arthritis diseases. In previous studies, it was found that the prevalence of hypertension and arthritis in subjects with BMI values ranged from 24.0 to 25.0 at the level of 18.5 and 7.7, while in people with BMI values from 30.0 to 31.0 at the level of 30.7 and 11.7 respectively (Stommel and Schoenborn, 2010).

It has also been found that in BMI of female the BMI is growing by itself with age, increasing by a constant of 1.82 kg • $m^{-2}$ per decade from 20 years to 50 years of age, that is, from an average value of 21.3 ± 1.9 kg • $m^{-2}$ grows to 27.5 ± 4.6 kg • m-2 in said age (Casey et al., 1992). The likelihood that a woman will have high BMI value will also increase statistically significant with age, so the correlation between BMI values between ages 50 and 20 at r = 0.44, 50 and 30 years at r = 0.80 a 50 and 40 years at r = 0.87 (Casey et al., 1992).

Very similar results were found by our researchers, because the results of the study dealing with basic morphological indicators of adults found that the BMI value in women from Vojvodina aged from 33.0 to 40.0 years is in the range of 25.67 ± 4.51 kg • $m^{-2}$, where the prevalence of overweight women is over 30.0%, while prevalence of obesity exceeds 16.0% (Pavlica et al., 2008). Women from Belgrade, aged 35.2 ± 9.5 years, were 167.04 ± 6.62 cm tall, weighed 67.66 ± 13.39 kg, with BMI of 24.27 ± 4.66 kg • $m^{-2}$. The percentage of muscle mass in the mentioned sample was 29.09 ± 8.47%, while the percentage of fat tissue was 29.09 ± 8.47%, with the surface of visceral fat of 77.92 ± 40.23 $cm^2$. The results of the 4D model of the body composition were as follows: the weight of the water is 34.58 L or 51.11%, the protein mass is 9.25 kg or 13.68%, the weight of the minerals is 3.30 kg or 4.88%, and the weight of the fat is 20.25 kg or 30.32%. It was found that there is a high percentage of women in the pre-hospital and obese category and according to BMI (about 40.0%), as well as according to Proc_BF (about 36%) (Djordjevic-Nikic et al., 2013).

One American study dealing with changes in body structure in first-year students showed that, despite excellent conditions for physical exercises within the college, which students had at their disposal, body weight in students during the first year of studies increased by 1.28 kg, fat percentage in the body by 0.20% increased, BMI increased by 0.47 kg • $m^{-2}$, and also body fat mass increased by 0.43 kg (Hoffman et al., 2006). The second study found that besides increasing all morphological status variables during the first year of the study, during the summer break, the trend continuously increased in the observed morphological variables, where the body weight increased by 1.3 kg during the school year increased by 0.1 kg and through the discharge, while the percentage of fat that increased during the school year by 0.9% increased further by 1.7% and over the holiday, while BMI increased by 0.8 kg • $m^{-2}$ during the summer break (Hull et al., 2007). It was found that the body structure in students statistically significantly correlates with the degree of physical activity, that is, with the level of metabolic consumption expressed in MET (hrs • $wk^{-1}$), and that exactly the level of physical activity inverted correlates with the percentage of fat in the body (r = -0.40), that is, the amount of total fat in the organism (r = - 0.26) (Zanovec et al., 2009). Also, changes in the body structure towards an increase in BMI, increase in the percentage of body fat, or a reduction in the mass of the contractile component (proteins and skeletal muscles) adversely affect the state of general and specific physical abilities, and changes in weight gain and percentage of fat with a decrease in aerobic endurance, as a negative adaptation to the sedentary lifestyle, is much more apparent in the initiation of more leaner students than in those who have already come to study with superfluous body status (Meckel et al., 2011).

Compared to the sample of students of the Criminal Police Academy in Belgrade, where the prevalence of obesity was only 12.50% (compared to Proc_BF more than 30.0%), in our examined sample, the same prevalence was 29.60%, which is 2.37 times more and is much more similar to the prevalence of the student population in America (from 20%, Hull et al., 2007), that is, the student population in Israel (from 29.9%, Meckel et al., 2011).

At the beginning of the third millennium a new phenomenon was observed, and especially in the young female population - a tendency towards a "skinny" look (Cheney, 2011), where the phenomenon of new body status emerged due to various habitual, nutritional and social factors. Namely, the methodological approach of crossing two criteria of obesity (BMI and% BF) revealed the profile of the new subclass of morphological status (Romero-Corall et al., 2008), which is: skinny or and lean fat, are skinny or have normal (lean) BMI values, but at the same time a high level of fat percentage in the body. The latest research on the general student population of the Belgrade University has shown that the prevalence in relation to the category of malnourished-fat is at the level of 1.07%, while compared to the category normal-fat at the level of 6.59% (Dopsaj, 2018). Compared to the data from the current study, the prevalence among FASPERA students is for underweight-fat at the level of 1.6%, while for the category it is normal-fat at the level of 10.4%. In other words, the overall prevalence for the category of lean-fat person was at the level of 12.0% (14 out of 125).

Generally speaking, the body structure of the FASPERA female students, where there is a suffusion of the fat tissue component of 3.20 kg, with a deficit of 3.36 kg of the contractile component (Table 1), only indicates the apparent qualitative and quantitative imbalance of the diet, towards increased energy intake, from the category of "fast food" or "sweet food" and reduced energy consumption, especially in the shortage of systematic exercise, which consequently increases fat metabolism and protein synthesis, exercise with some of the types of extra load (fitness or gym). It was found that even a very small positive daily energy balance of only 2-3% (about 112 Kcal / day) resulted in an increase in the total TM of female students per semester of about 1.4 kg, or about 0.70% of body weight, of which the fat component increases by 1.9 kg, or by 2.60% (Hull et al., 2007).

Unfortunately, based on the results of this study, it can be generally concluded that the morphological status of FASPERA students from the tested sample at the level of persons with normal BMI (generally normal weight), but with an increased percentage of fat tissue and a decreased percentage of muscle tissue. This profile of the body structure does not represent an adequate values of nutrition as an acceptable initial morphological basis that preserves the organo-metabolic status of young female persons needed for all professional and life requirements in the future.

## CONCLUSION

Based on BMI distribution, it can be claimed that 77.60% of subjects are of normal nutritional status, but also that the overall prevalence of subjects with overweight (BMI <25.00) and obese at the level of 11.20%, or only the prevalence of obesity (BMI <30.00) are at the level of 4.00%. Also, the prevalence of insufficient nutrition (BMI> 18.50) was found to be 11.20%, with as many as 4.00% of subjects and significantly malnourished (BMI> 17.50).

It was found that as many as 96.8% of subjects responded to the ideal nutrition profile. In relation to the deviation of the deficit, 63.2% of respondents have some form of deficiency in body weight (a 5.25 kg body weight deficit), with the highest deficiency of the muscular component of 78.4% (muscle mass deficit of 4.28 kg) compared to the deficit mass components 43.2% (average weight deficit of 2.01 kg). There are 33.6% with the profile of some surplus, of subjects (an average surplus of body weight of 9.44 kg), where as much as 54.4% has a surplus fat component (at an average level of a weight of 7.48 kg). Unfortunately, only 3.2% of respondents had an optimal body structure in all observed structural segments.

The results of the 4D model of the body structure of FASPERA students can be defined as follows: 31.75 L of water (53.37%), 8.50 kg of protein (14.26%), 16.98 kg of fat (27.10%) and 3.10 kg of minerals (5.18% of TM).

In addition to the existing probability is that FASPERA students, the nutrition is the reason for the increased fat components, and the fact that even 69.6% of them are not physically active at all, or 21.6% at times, that is 91.2% are not adequately physically active, indicates a possible reason why a deficiency of the fat component, on the one hand, or a deficiency of the muscular component, on the other side.

Unfortunately, based on the obtained results of this study, it can be generally concluded that the morphological status of the FASPERA students studied is at the level of persons with normal BMI (generally normal weight), but with fatty tissue suffusion and muscle tissue deficit. This profile of the body structure does not represent an adequate nutritional value as an acceptable initial morphological basis that provides the organo-metabolic status of young female persons needed for all professional and life requirements in the future.

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