



ANALYSIS BY BIOELEKTRIC IMPEDANCE OF THE COMPOSITION OF BODY MASS IN STUDENTS

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ABSTRACT

The study has been done in 2009 with 399 female students and 242 students from the Trakia University, Stara Zagora – the Faculty of Economics, the Faculty of Agriculture and the Faculty of Veterinary Medicine and is part of a university research project: "Study the effectiveness of complex program on the composition of body mass in obese students".

The aim of the investigation is the analysis of the content of the body mass of students, through bio-electric impedance.

For fulfillment of the aim, the following *tasks* have been assigned:

1. To carry out measurement, with professional medical apparatus, of the Japanese company "TANITA".
2. To make assessment of the indices measured.

The body fat content in percentage, body water content, muscle mass, bones mass and metabolic age of the persons studied were measured through the analyze by bioelectric impedance.

These results inform those of the subjects for which it is necessary to take effective action to tackle overweight.

Key words: measuring, make a valuation of the body mass

INTRODUCTION

Over-weight is a phenomenon, distributed all over the world, affecting mostly the countries of higher living standard, and it turns to be one of the most significant problems in the urbanized societies. It is connected with the increasing of the risk of a number of socially important diseases, increases the risk of disability and premature death (1, 4, 11, 13). This problem, with the young people and those of average age is important and constant, in view of the serious consequences, mostly on the cardio-vascular and breathing systems and locomotory system, that occur with the increasing of the body mass (12, 14, 18). In Bulgaria, over 3,5 millions of people are with body mass index (BMI) over 25kg/m^2 , i.e. it affects every second person, between the age 15 and 80 years (17). The problem considered is pressing and many developments and

publications have been made on it (2, 3, 10, 15, 19, 20, 21), still, there are some problems that are not settled.

The investigation of BMI with the students from Trakia University has started since 2004 (Dyakova, 2007; Dyakova, Bozhkova, 2008; Dyakova, 2009). The latest data show that the percentage of female students with over weight is almost three times higher, and of the male students – more than five times higher, in comparison with the percentage of persons of their age in Bulgaria (Dyakova, 2009). Higher risk of cardio-vascular diseases, both with women and men is also established (Dyakova, 2009).

The principle used for defining the body content is the analysis of the bio-impedance. With this method of measurement, at stepping on the four electrodes of the platform of the professional medical apparatus, of the Japanese company "TANITA", low currency passes through the body, absolutely safety for the human being (excluding only patients with electric-implants, e.g. pacemakers). Thus the

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resistance is recorded, respectively the quantity of the various tissues in the body. Additionally, the detailing methods Dil – D2O, Dil - NaBr and DXA are used. Thanks to these most contemporary complex methods, the measurement of the mass tissue and all remaining parameters is already as easy as the measurement of the blood pressure (16).

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1. To carry out measurement, with professional medical apparatus, of the Japanese company "TANITA".
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METHODS

The investigation has been conducted with 399 female students and 242 male students from the Trakia University – Faculty of Economics, Agrarian Faculty and Veterinary-Medical Faculty.

For measurement of the content of the body mass, the professional medical apparatus, of the Japanese company "TANITA" - BODY COMPOSITION ANALYZER BC - 420MA

"TANITA" has been used. The following has been measured: body fat content in percentage, body water content, muscle mass, bones mass and metabolic age.

Mathematical-statistic methods for quantitative assessment of the investigated indices have been applied.

ANALYSIS OF THE RESULTS

On **Figure 1**, is expressed the level of fats with the investigated female students, in percentage. Less than the half are with normal level of fats - 48%. Here, all female students having fat tissue higher than 21% and less than 33% are included. The results, with this index show that every second from the investigated female students is with fat level beyond the norm. The analysis shows very high percentage of female students with low fats level – 36,4%. It is well known the ambition of young girls to keep low level of fat tissue, looking for aesthetic (according to them) shape of the figure. The extremely low levels of fat tissues lead to negative consequences, such as: problems with the joints; supporting of the organs; body temperature regulation; vitamins preserving; helping the body with scarce nourishment and etc.

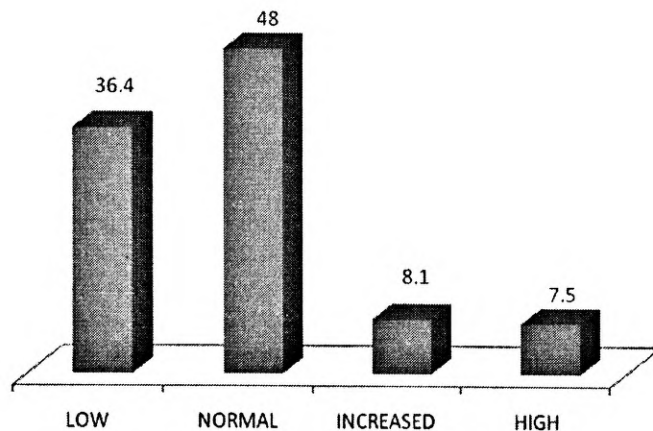


Figure 1. Level of fats with females (percentage)

The percentage of the female students with increased and high level of fat tissue is close 8,1% and 7,5% respectively. With „increased level”, all investigated persons with fat mass higher than 33%, and lower than 39% are included. With „high level” the female students with fat mass over 39% are included. These female students are in the so called risky group and the decreasing of their fat mass

could lead to the decreasing of the risk from cardio-vascular diseases, high blood pressure, diabetes, cancer and etc.

On **Figure 2** the percentage of the investigated female students, with bones mass „in norm” and „under the norm” is expressed. The bones mass shows the quantity of the bones in the organism, the dry substance, including the level of minerals, for example calcium and

others. For persons, with body mass under 50 kg it is assumed for normal level of bones mass - 1,95 kg, for persons with body mass from 50 to 75 kg – 2,4 kg, and for persons with body mass over 75 kg – 2,95 kg. With the investigated quota, 62,3% are with bones mass in the norm. As per our opinion, the percentage

of persons with bones mass „under the norm” is too high (37,7%). It is well known, that the formation of healthy and strong bones is a process, requiring a long period of trainings with physical exercises and balanced nourishment. To this effect, the conducted investigation informs about the necessity of it.

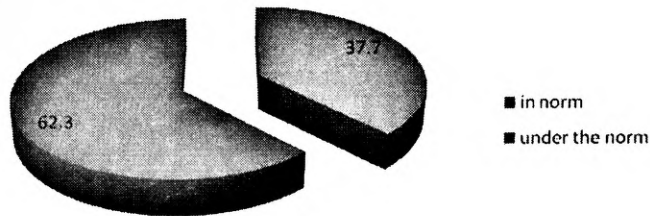


Figure 2. Level of bones mass with female students (percentage)

Water in the body has very important significance for the organism. With normal level of water in the organism are 80,6% of the investigated persons (**Figure 3**). With them, the total water in the body is from 45% to 60%. The comment here is that with this index, in healthy aspect, the things are positive. With „high” level of water in the body are 10,9% of female students (with water in the organism

over 60%). The observations show that usually these are persons with very low level of fat tissue. Vice versa – 8,5% of the investigated female students are with low water content in the organism (less than 45% of water in the organism). At the measurements, we have noted that most often, these are persons with over-content of fat mass.

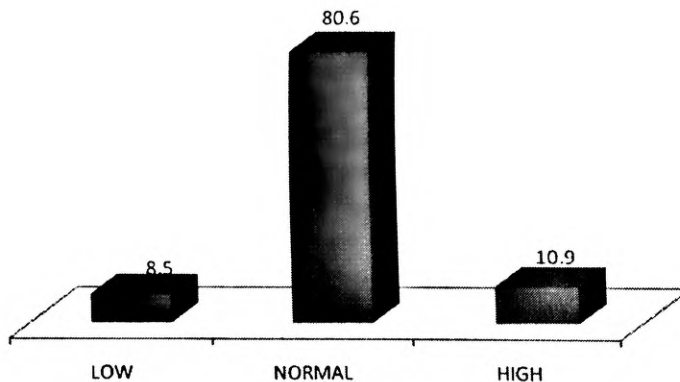


Figure 3. Level of water with female students (percentage)

The level of muscle mass with the female students (in percentage) is shown on **Figure 4**. It is well known, that in the weight of the muscle mass are included the skeletal and smooth (cardiac and digestive) muscles and the water contained in them. In the apparatus BODY COMPOSITION ANALYZER BC -

420MA “TANITA”, by which the measurement has been conducted, a function is incorporated, calculating and presenting the level of the muscles mass in the organism. Grounding this data, it is established that a big percentage of the investigated persons – 72,2 are with muscle mass in the norm. With 8,9%,

the level of the muscle mass is low and these persons need regular and prolonged trainings with physical exercises and sport. With increased (17,7%) and high (1,2%) level are the female students from this investigation, that to a great extent could claim, that it is due

to the regular trainings with motive activities and sport. This part of the female students, as well as the female students with muscle mass „in the norm” are with ensured motor, consuming energy, as being the muscles.

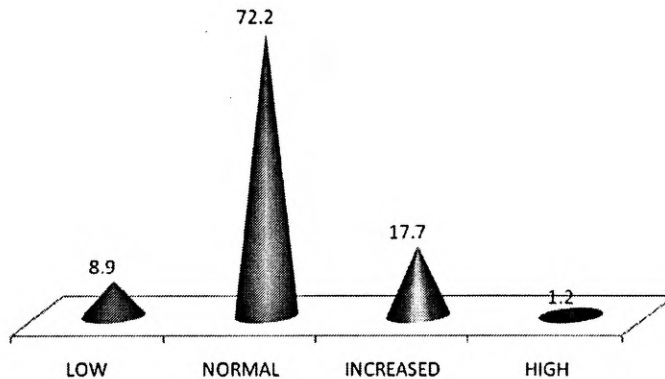


Figure 4. Level of muscles mass with female students (percentage)

The term “metabolic age” spread in the area of Health protection and Fitness. This characteristics takes into consideration the basic metabolism and all main body indices and defines the age, referred to this type of metabolism. If the metabolic age is bigger than the biological one, this is a sign that metabolism is to be improved (16). The assessment of the results got shows that 57,1% of female students are with metabolic age

under the biological one, and 1,9% are with metabolic age, equal to the biological one (Figure 5.). It is supposed, that this part of the investigated quota is with good metabolism. Too big is the part of the investigated persons, with metabolic age over the biological one – 41%. The inclusion with them, of more active physical exercises and change of the regimen of nourishment, could decrease their metabolic age.

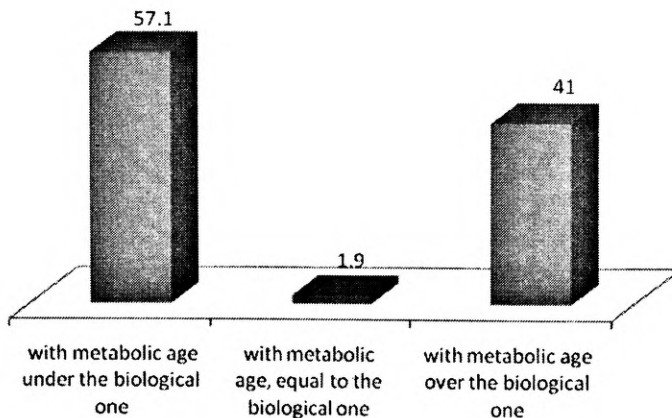


Figure 5. Percentage of the investigated persons, distributed according to their metabolic age, compared to the biological one (female students)

On Figure 6, the level of fats with the investigated male students is expressed in percentage. More than the half are with normal level of fats – 61,3%. Here, all students with

fat tissue higher than 8% and less than 20% are included. The results show that 38,7% of the investigated students are with level of fats beyond the norm. With low fat level (under 8%) are 8,7% of the investigated persons.

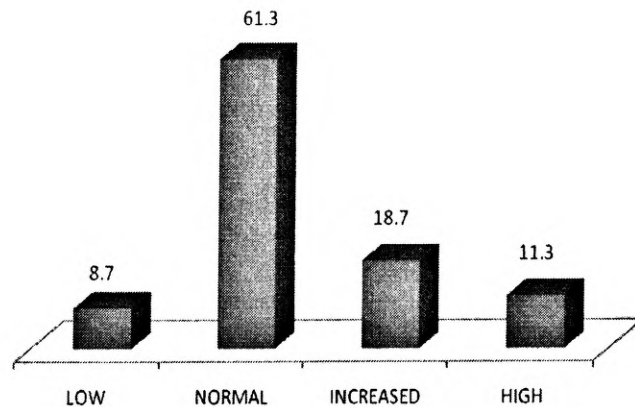


Figure 6. Level of fats with male students (percentage)

The percentage of the male students with increased and high level of fat tissue is 18,7% and 11,3% respectively. With „increased level” are included all investigated persons, with fat mass higher than 20% and less than 25%. With „high level” are included the male students with fat tissue over 25%. These students are in the so called risky group, and the decreasing of their high percentage of fat mass could lead for decreasing of the risk for all consequences arising from this factor.

On **Figure 7** the percentage of the investigated male students, with bones mass “in the norm” and “under the norm” is expressed. For persons with body mass under 65 kg it is assumes for normal level of bones mass - 2,66 kg, for persons with body mass from 65 to 95 kg –

3,39 kg, and for persons with body mass over 95 kg – 3,69 kg. With the investigated quota, 51,5% are with bones mass in the norm. Almost half of the investigated persons are with bones mass „under the norm” - 48,5%. Usually, the low level of the bones mass is connected with low level of the muscle mass. Taking into consideration the results, expressed on **Figure 9**, we could deem that the probable reason for the low level of the bones mass, with the investigated quota is the non-balanced nourishment. To this effect, the conducted investigation speaks about the availability / presence of the necessity of educational work with the male students on matters, connected to the nourishment.

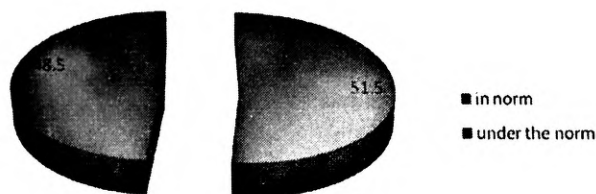


Figure 7. Level of the bones mass with the male students (percentage)

With a normal level of water in the organism are 82% of the investigated persons (**Figure 8**). With them, the total water in the body is from 50% to 65%. With „high” level of water in the body are 11% of students (with water in the organism over 65%). The optimum values of water in the

organism are of great significance for the human health. All organs and systems work better when they are adequately hydrated. The proper functioning of the metabolism is in direct relation with the presence of optimum values of water in the organism. With the investigated male

students 7% are with low water content in the organism (less than 50%).

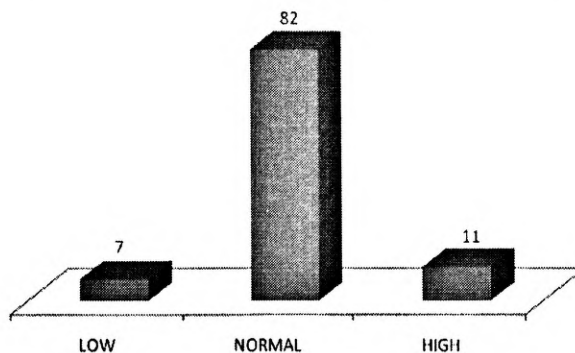


Figure 8. Level of water with male students (percentage)

The level of the muscle mass of male students (in percentage) is shown on **Figure 9**. Big percentage of the investigated persons – 77% are with muscle mass in the norm. With 3,4% the level of the muscle mass is low and these persons

need regular and prolonged trainings with physical exercises and sport. With increased and high level of muscle mass are 14,2% and 5,4% respectively of the students in this investigation.

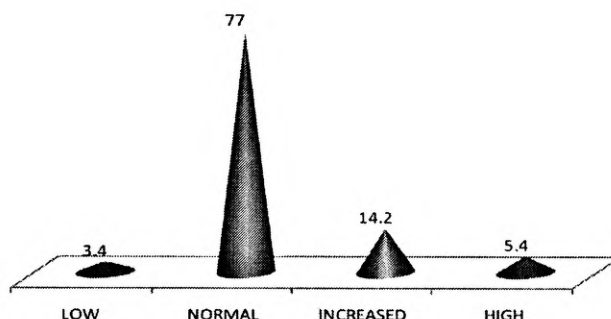


Figure 9. Level of muscle mass with male students (percentage)

It is well known the ambition of young men to train with force exercises, to maintain good body muscles. Of course, not all succeed to achieve that. To this effect, we could indicate that a comparatively low percentage of the investigated persons should make more efforts in this direction.

students are with metabolic age under the biological one, and 1,1% are with metabolic age, equal to the biological one. This part of the investigated quota is with good metabolism. When the metabolic age is bigger than the biological one, this is an indication of a necessity for improvement of the metabolism. With a great part of male students, included in this investigation, this necessity is available - 39,8%.

The assessment of the results got, reflected on **Figure 10**. shows that 59,1% of the male

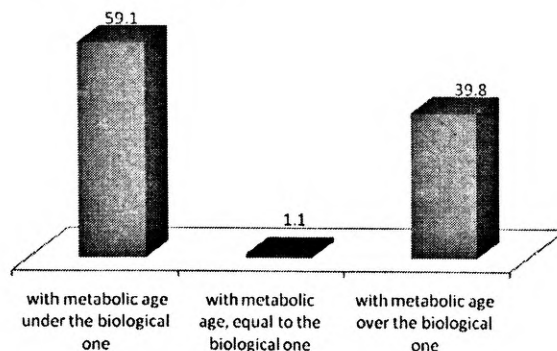


Figure 10. Percentage of the investigated persons, distributed according to their metabolic age, compared to the biological one (*male students*)

CONCLUSIONS AND RECOMMENDATIONS

The results got with the analysis of bio-electric impedance in the present investigation, give us ground to make the following conclusions:

1. Detailed assessment is made of the content of the body mass. As regards the all investigated indices, with the highest percentage are the students „in the norm” with both genders. An information is got of those from the investigated persons, for whom it is necessary to undertake effective steps for overcoming the over-weight.
2. Scientific approach has been introduced in the work with students for overcoming the body mass „beyond the norm”.

We *recommend* the application of the analysis, through bio-electric impedance in the Universities, in view of overcoming the health risks, connected with the components of the body mass.

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REFERENCES

1. Баев, Ст. Здравно състояние на населението. НСИ, „Статистически барометър", бр.7/22.05.1997.
2. Благосклонная, Я., А. Бабенко, Е. Красилникова. Наднормено тегло. Как да отслабнем. С., Скорпио ВИ, 2003.
3. Витков, И. Надеждна и контролирана редукция на теглото. Мед. и фарм., бр.3, 2003.
4. Димитров, И. Социална медицина. Пловдив, 2002
5. Дякова, Г. Изследване телесното тегло на студенти от Тракийски университет. Сп. Спорт и наука, С., бр. 2, 2007.
6. Дякова, Г. Изследване на зависимостта между намалена двигателна активност - физически качества и морфофункционални показатели на студенти. Сп. Спорт и наука бр. 1, С., 2008.
7. Дякова, Г. Разпространение на телесна маса извън нормата при студентки – състояние и тенденции. Сб. "Личност, Мотивация, Спорт." 2008.
8. Дякова, Г. Изследване нагласата към здравословен начин на живот на студентки. Сб. "Личност, Мотивация, Спорт." Том 14, 2008.
9. Дякова, Г, Проучване честотата на наднормено тегло при студенти. Национална конференция „Национална сигурност, физическа подготовка, спорт", София, 2009.
10. Дякова, Г., Божкова А. Някои подходи за формиране на здравословен начин на живот при студентите. Сп. Спорт и наука бр. 2, С., 2011.
11. Маркова, С. Социална медицина и обществено здраве. 1998.
12. Мерджанов, Ч. Едно компрометиращо първенство. Универс. изд. "Свети Климент Охридски", 1995.
13. Николова, П., Д. Томов. Хигиена и здравеопазване. бр.5, 1994.
14. Топузов, И. Спортна медицина и хигиена. Унив. изд. "Н. Рилски", Блгр., 2007.
15. Топузов, И. Рехабилитация на затлъстяване от геноиден тип и целулит с комплексна кинезотерапия. Авт. С. 2002.
16. <http://biodoctor.org/medicinski-praktiki/detayliziran-kontrol-na-telesniya-sustav/> -12.03.2009.
17. <http://www.nsi.bg> 13.02.2009.
18. <http://www.who.int/bmi/> - 22.05.2007.
19. J. Erik Oliver Fat Politics: The Real Story behind America's Obesity Epidemic Oxford University Press. USA, 2006.
20. Larson, L. Fitness, Helth and Work Capacity, New York. 1994.
21. Paffenbarger, R. and all. Measurement of Physical Activity to Assess Helth Effects In Free-living Populations. Medicine and Science in sport and Dance, 1993.