

# The Influence of Selected Somatometric Indicators on Students' Aerobic Performance at the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava

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**Abstract:** The aim of our work is to identify the differences in selected somatometric indicators between men and women and their impact on aerobic performance. The research sample consisted of students of first year of Faculty of Chemical and Food Technology in Bratislava in the number of 596 (187 men and 409 women). Aerobic performance ( $VO_{2max}$ ) was calculated on the basis of performance in Beep test. Within somatometric indicators, we measured BMI (body mass index) and body fat using digital scales with body analysis OMRON BF-511. In the first chapter we were looking for differences in the values of body mass index between men and women. We found out statistically significant differences in the categories of underweight, overweight and obesity. In the second chapter, we focused on mutual comparison of maximal aerobic capacity with selected somatometric indicators. As a first somatometric indicator, we used BMI index. Our assumption that  $VO_{2max}$  values are significantly lower among students with underweight and normal weight as students with overweight, resp. obesity was not confirmed. As a second somatometric indicator, we used body fat levels. In the mutual comparison we observed statistically significant differences in the category of very poor ( $P < 0.01$ ) and above average ( $P < 0.05$ ) where students with low-normal body fat achieved better values than students with high-very high body fat.

**Key words:** Obesity, motor performance, body fat, BMI,  $VO_{2max}$ .

## 1. Introduction

Human health significantly affects the quality of life, which is conditioned by several factors. Factors such as hereditary and other diseases can only less influence healthy lifestyle. Factors which can affect the health status and quality of life are a healthy and balanced diet, plenty of exercise, fluid intake and avoiding alcohol consumption, smoking tobacco and drug consumption.

One of the results of civilization degeneration is the increasing obesity of young people and reduction of their physical performance. Obesity is not always the same as the excess weight. We know the kind of people, respectively students who have an increased weight

and despite the fact they are not obese. The cause of this condition may be robust skeleton or an increased amount of muscle mass. Therefore, body weight is not essential in indicating the obesity, what is essential is the body fat. Increased percentage ratio of body fat has adverse effects on the health of humans and decreases motor performance. This moment was observed for a long time and has increasing trend. Major extend of obesity is caused by the lack of physical activity and poor eating habits.

The main role of the teaching staff is to focus on physical education to create a positive relationship to movement and then guide students to a healthy lifestyle. In our work, we focus in the first phase to detect differences between BMI (body mass index) men and BMI women, fat volume and maximum oxygen

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consumption. In the next phase, we focus on mutual comparison of the maximum oxygen consumption ( $VO_{2max}$ ) with selected somatometric indicators. Following the somatic development and level of motor performance of students Faculty of Chemical and Food Technology in Bratislava, we build on the results of the research of study physical education at Department of Physical education and Sport in Bratislava implemented between 2000 and 2012 [1, 2].

## 2. Materials and Methods

### 2.1 Aim of Study

The aim of our work is to identify the differences in selected somatometric indicators between men and women and their impact on aerobic performance.

### 2.2 Hypothesis

H1: We assume that the BMI index will be significantly lower for men than for women;

H2: We assume that values of fat are significantly lower for men than for women;

H3: We assume that the values of  $VO_{2max}$  will be significantly higher for men than for women;

H4: We assume that the values of  $VO_{2max}$  will be significantly lower for students with underweight and normal weight, resp. low and normal fat content as students of overweight and obesity, resp. high and very high fat content.

### 2.3 Tasks of study

T1: Determine the values of body mass index for men and women, and then compare them;

T2: Find out the value of fat for men and women, and then compare them;

T3: Find out  $VO_{2max}$  values for men and women and then compare them;

T4: Mutually compare the values of  $VO_{2max}$  with selected somatometric indicators.

### 2.4 Methods

The research sample consisted of students of first

year of Faculty of Chemical and Food Technology in Bratislava in the number of 596 (187 men and 409 women) who were from health aspects and able to pass the motor performance tests. Tests and measurement of students took place in the sport resorts of Pavol Glesk at Mladá Garda in Bratislava. The research was done in beginning of the winter semester in academic year 2013/2014 (September and October 2013).

Aerobic performance ( $VO_{2max}$ ) was calculated on the basis of performance in Beep test [4]. Within somatometric indicators, we measured BMI and body fat using digital scales with body analysis OMRON BF-511.

In research, we were looking for consequences of BMI and body fat on aerobic performance. We merged group of underweight-standard and overweight-obese people in the case of BMI. In case of body fat, we merged group of low-standard and high-very high people. We decided for this step on the basis of the low number of variables in some instances. We characterized each variable in absolute and subsequently expressed in relative terms. By looking for differences between the relative values of the variables, we used the test of significance of the difference of the relative values [3].

About significant relationships, we decided on 1% and 5% level of statistical significance.

## 3. Results

### 3.1 Differences between Men and Women in Somatic and Functional Parameters

When looking for differences in the values of body mass index between men and women, we found out statistically significant differences in the categories of underweight, overweight and obesity. In case of underweight, the relative values are higher in women than in men ( $P < 0.01$ ). In case of overweight and obesity there are significantly lower relative values in women than in men ( $P < 0.01$ ,  $P < 0.05$ ) (Table 1). In the norm category of BMI index, there is about 8% more women than men, but statistically significant

**Table 1** Differences in relative values between men and women in BMI (%).

BMI	Underweight	Norm	Overweight	Obesity
Women	9.4	75.1	13.7	1.8
Men	2.8	67	24.7	5.5
Z-points	3.49	1.95	3.01	2.04
P-value <	0.01	-	0.01	0.05

**Table 2** Differences in relative values between men and women in body fat (%).

Body fat	Low	Normal	High	Very high
Women	6.9	59.5	22.4	11.2
Men	3.9	53.9	22.5	19.8
Z-points	1.58	1.28	0.03	2.56
P-value <	-	-	-	0.05

**Table 3** Differences in relative values between men and women in aerobic performance (%).

VO <sub>2max</sub>	Very poor	Poor	Below average	Average	Above average
Women	89.8	7.1	2.3	0.5	0.25
Men	51.1	28.6	14.3	3.9	2.2
Z-points	9.66	5.97	4.44	2.27	1.74
P-value <	0.01	0.01	0.01	0.05	-

differences were not detected. This category represented the largest proportion of students, both men and women. Our assumption that the BMI index will be lower in men than women was not confirmed. Up to 84.5% of women had a BMI index in categories standard and underweight. In men, we have in these categories recorded only 70% share. Based on the observed results, we found out alarming state of the male population, where almost 1/3 is overweight or obese and this is about 15% more than that in women category.

In the next section, we focused on comparing the amount of body fat in men and women category. Statistically significant differences were observed only at very high level of fat ( $P < 0.05$ ), where in men category, the proportion of fat was up to 8.6% higher than in women (Table 2). In other categories, we did not recorded significant differences as they were minimal. A high proportion of body fat suffers nearly 1/5 of men and women. Over 33% women reach high to very high body fat. For men this value is above 42%, which we consider as critical. A normal value of fat was found in 60% of women and 54% men. Our

assumption that men will have a lower percentage ratio of body fat than women was not confirmed.

When looking for differences in VO<sub>2max</sub> values between men and women, we found statistically significant differences in almost all categories. Only in the case of above average values of VO<sub>2max</sub>, we did not find any significant differences as only 0.25% of women, resp. 2.2% of men achieved above average values. Also in category of average values of VO<sub>2max</sub> was low number of both men and women. Although more men than women achieved an average values of VO<sub>2max</sub> (3.9% vs. 0.5%,  $P < 0.05$ ). In poor and below average values, we found statistically significant differences at  $P < 0.01$ . Poor values of VO<sub>2max</sub> reached to 28.6% of men and only 7.1% of women. A similar moment was recorded in the below average values of VO<sub>2max</sub> (14.3% vs. 2.3%). We found the most significant difference in VO<sub>2max</sub> values in the category of very poor ( $P < 0.01$ ). Almost 90% of women achieved a very poor performance, and we consider it to be critical for this age group. In men, although this values of VO<sub>2max</sub> was better (51.1%), it is still insufficient (Table 3).

**Table 4** Differences in relative values between the various levels of BMI in aerobic performance (%).

BMI/ $VO_{2max}$	Very poor	Poor	Below average	Average	Above average
Underweight + Norm	76.3	14.6	6.1	1.9	1.1
Overweight + Obesity	82.8	11.2	6	0	0
Z-points	1.16	1	0.02	3.02	2.24
P-value <	-	-	-	0.01	0.05

**Table 5** Differences in relative values between the various levels of body fat in aerobic performance (%).

Body fat/ $VO_{2max}$	Very poor	Poor	Below average	Average	Above average
Low + Normal	73.5	15.5	7.4	2.2	1.4
High + Very high	84.7	11	3.8	0.5	0
Z-points	3.29	1.59	1.86	1.89	2.25
P-value <	0.01	-	-	-	0.05

### 3.2 Mutual Comparison of $VO_{2max}$ with Selected Somatometric Indicators

In the next chapter, we focused on mutual comparison of maximal aerobic capacity with selected somatometric indicators. As a first somatometric indicator, we used BMI index. Our assumption that  $VO_{2max}$  values are significantly lower among students with underweight and normal weight as students with overweight, resp. obesity was not confirmed.

Although statistical difference was recorded in the average ( $P < 0.01$ ) and above average ( $P < 0.05$ ) of  $VO_{2max}$  values, only students with underweight and normal weight reached average and above average performance of  $VO_{2max}$  (1.9% resp. 1.1%) compared to students with overweight and obesity (0% respectively). In other categories  $VO_{2max}$ , we did not find any significant difference (Table 4). Nevertheless, better values of  $VO_{2max}$  were reached by students with underweight, resp. normal weight. The highest difference of relative values (6.5%) was recorded in the category of very poor  $VO_{2max}$  to the detriment of students with overweight and obesity. Three quarters of the young population (we monitored sample of university population), regardless of BMI index, reach a very poor performance in  $VO_{2max}$ .

In the mutual comparison of  $VO_{2max}$  and body fat levels, we observed statistically significant differences in the category of very poor ( $P < 0.01$ ) and above average ( $P < 0.05$ ) where students with low-normal

body fat achieved better values than students with high-very high body fat. A similar trend is shown in other categories of  $VO_{2max}$  (Table 5). Although the students with low and normal volume of body fat achieved in all categories of  $VO_{2max}$  better values than students with high and very high body fat, statistical difference was recorded in only two cases. Based on this fact, our hypothesis was not confirmed.

## 4. Conclusions

Based on the comparison of measurement results of somatic indicators and aerobic performance between men and women, we observed in the case of BMI index that 30% of students are overweight or obese. Up to half of female students are overweight or obese compared with men (15%). Within somatic indicators, we have focused on the measurement of body fat which has a higher information value. Values we have recorded have a similar tendency as in BMI index but are much higher. Up to 42% of male and 33% of female students has high and very high body fat values. These findings demonstrate an alarming state which may lead to different cardio vascular diseases in the future, resulting from the high proportion of body fat. This condition causes serious health problems in addition to the reduced motor performance, which negatively affects the quality of life. Motor performance was measured using a beep test on which base we found the maximum oxygen consumption. Very poor and poor

aerobic performance achieved up to 97% of female students and 80% of male students. The physical condition of the young population is very serious but not invariable. We can reduce the proportion of body fat and increase aerobic performance with changing eating habits and the inclusion of physical activity in daily life. In examining the links between BMI and aerobic performance, we did not find any statistical significant context. However, our results show that a large proportion of tested students achieved very poor  $VO_{2max}$  values irrespective of BMI index. Compared to research [2] in 2012, the number of tested students increased with a very poor  $VO_{2max}$  values (+8.4%) and on the contrary, the number of students decreased with poor  $VO_{2max}$  values (-5%). Similar trend was recorded also by comparing aerobic performance with body fat. We also did not reveal any statistically significant relations. Compared to 2012 we recorded, similarly like the BMI index case, increase of students with very poor  $VO_{2max}$  values (+7.7%) while the decrease in the number of students with poor  $VO_{2max}$  (-4%). Whereas the values of body mass index and body fat had a

similar trend, the subsequent comparison of these indicators in relation to aerobic performance was almost identical. Regardless of amount of body fat, resp. degree of body mass index majority of the sample reaches very poor to poor aerobic performance. This fact is probably due to a lack of physical activity of aerobic character.

## References

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