

The somatic profile and motor performance of the students of the faculty of chemical and food technology slovak university of technology in Bratislava in five years period

Authors' Contribution:

A - Study Design
B - Data Collection
C - Statistical Analysis
D - Manuscript Preparation
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Abstract

The aim of our work is to find out level of somatic development and motor performance of students of the 1.st year-class of FCHPT STU in Bratislava in five years period in years 2011 – 2015 (1881 women and 797 men). We used standardized test battery to recognize motor performance. Comparison of the motion efficiency testing results we used the test of statistical significance of differences in mean values of the significance level p -value $<0,05$, in program Statgraphic (One Way – ANOVA). Based on the results of measuring the level of somatic development, we found out that the body height has stagnating tendency for both men and women categories. Body weight had a stable level in men until 2014, but its value is about 5 kg higher than the population average. The women had body weight except in 2014 rising trend. Both in men and women category in 2015 significantly increased body weight. Observing body mass index (BMI) we found out a significant increase in values only for women. The relative value of the body fat in both men and women category at approximately the same level without significant difference index BMI more than men but the value of body fat on the other hand they were worse. In the test results of motor performance, we found out significantly lower levels of aerobic endurance compared to the first measurement in 2011, both men and women. In the case of speed-power capabilities of the arms and torso as well as for the dynamic force abdominal and hip muscles we can't confirm increasing or decreasing tendency. From our research it is clear that aerobic endurance is the ability which has decreasing trend from year to year for both men and women category.

Key words: college students, somatic development, motor performance, comparison of results

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INTRODUCTION

One of the basic biological needs of man is physical activity. Every person moves during the day or engaged in any physical activity and should therefore be chosen physical activity meant as training, have a positive impact on enhancing your health, improve physical fitness for adults but also young population. Monitoring of somatic development and movement performance level of students FCHPT STU in Bratislava, builds on the results of the research study physical education at KTV CHTF in Bratislava which had been realized in year of 2000 [1]. In the group of tests, which had been used for evaluation in year of 2000 we extended by tests EUROFIT 2002 already in year 2012, when we launched a new project to test students FCHPT, who became students at 1st year of study program [2]. We start from previous experiences when using the test battery. Battery tests are adjusting and innovating for more efficient and accurate processing of the data obtained.

The level of motor performance of university students is determined by the performance achieved by primary and secondary schools later [3]. With this performance the acquired study entry and have the opportunity to develop it on our department. Improve low level and help to maintain a good level of body disposal, while providing a wide range of relaxation options after high mental, intellectual workload, this is most wanted to the quality and quantity of physical education in FCHPT STU in Bratislava [2]. For our educational work is necessary to constantly introduce new programs and forms of sports and recreational activities, thereby achieve aim that students did not understand the hour of physical education in the curriculum as a duty, but as a starting base for broader physical activity with which they will absolutely internally identified. The basis is the knowledge level of physical performance of students and understanding their interests based on different types of physical activities. Analysis of the state of somatic development of physical performance of students of the 1st year of study program on FCHPT STU in Bratislava for the years 2011, 2012, 2013, 2014 and 2015 are discussed in this report.

METHODS

The sample is made of the students from FCHPT STU in 2011/2012 with 524 members (142 males and 382 females), students from FCHPT STU in 2012/2013 with 553 members (164 males and 389 females), students from FCHPT STU in 2013/2014 with 596 members (187 males and 409 females), students from FCHPT STU in 2014/2015 with 547 members (160 males and 398 females) and students from FCHPT STU in 2015/2016 with 447 members (144 males and 303 females) that were able to go through the motion efficiency tests. The testing was taking place in sporting areal of Pavol Glesk at Mladá Garda in Bratislava. The testing was implemented in the first semester of 2011/2012, 2012/2013, 2013/2014, 2014/2015 and 2015/2016 respectively. All tested students were familiar with the testing and agreed to the testing. The testing battery was determined by the historical experiences and also the ability to compare the data. Aerobic performance (VO_{2max}) was calculated on the basis of performance in Beep test [5]. Within somatometric indicators, we measured BMI and body fat using digital scales with body analysis OMRON BF-511.

Somatic development was reviewed according to: Body height, Body weight, BMI, Body fat. The testing battery was made of: sit-up in 60 sec, long jump from standing position, Beep test, both hand throw with 2 kg ball

Comparison of the motion efficiency testing results we used the test of statistical significance of differences in mean values of the significance level p -value <0.05 , in program Statgraphic (One - Way ANOVA, One - Variable Analysis, Two - Sample Comparisum).

RESULTS

Measurement results of somatic indicators

Male: In the case of measuring male somatic indicators we have not recorded any statistically significant differences. Body height of subjects during the five years testing ranged in value 181 cm. These values correspond to the results of the rest of authors, who have dealt with testing the 18-19 year old population, as well as the results of our research from year 2000. In the years 2011-2014 body weight ranged at superior level of 77 kg, what was 5kg increase against the average values of other authors. In 2015 we have recorded statistically significant increase of average body weight by 4-5 kg ($p<0.05$). Body mass index has reached the value 23.5, which was 1 point higher in comparison with other authors [1,2,5,6,7]. Relative values of body fat in reporting period fluctuated between 18 and 19%, what are the average values. There were no statistically significant differences recorded (Tab.1).

Table 1. Comparison results of somatic indicators male in years 2011 - 2015

| | Height [m] | | | | | Weight [kg] | | | | |
|-----------|------------|-------|-------|-------|-------|--|-------|-------|-------|------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 142 | 164 | 187 | 160 | 144 | 142 | 164 | 187 | 160 | 144 |
| x | 181.2 | 181.1 | 181.5 | 180.9 | 181.4 | 76.9 | 76.3 | 77.4 | 76.1 | 81.2 |
| sd | 7.5 | 6.523 | 6.943 | 6.93 | 7.1 | 10.86 | 13.35 | 12.76 | 12.37 | 10.9 |
| min | 161 | 162 | 162 | 163 | 165 | 53 | 43 | 49.6 | 54.6 | 51 |
| max | 202 | 198 | 203 | 197 | 203 | 115 | 135.8 | 140.6 | 119.3 | 115 |
| (p<0.05)* | | | | | | 2015-2011, 2015-2012, 2015-2013, 2015-2014 | | | | |

*statistical differences between years

Table 2. Comparison results of somatic indicators male in years 2011 - 2015

| | BMI | | | | | Body fat [%] | | | | |
|-----------|-------|-------|-------|------|-------|--------------|-------|-------|-------|-------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 142 | 164 | 187 | 160 | 144 | 142 | 164 | 187 | 160 | 144 |
| x | 23.46 | 23.25 | 23.69 | 23.3 | 23.64 | 18.3 | 17.85 | 18.61 | 18.14 | 19.03 |
| sd | 3.103 | 3.773 | 3.716 | 3.36 | 3.61 | 7.61 | 7.47 | 6.74 | 6.67 | 7.68 |
| min | 18.59 | 15.3 | 16.6 | 17.4 | 16.7 | 4.8 | 5 | 6.4 | 5 | 5.1 |
| max | 34.72 | 37.6 | 45.1 | 35.6 | 36.9 | 38.3 | 42.3 | 39.7 | 35.1 | 40.2 |
| (p<0.05)* | | | | | | | | | | |

*statistical differences between years

Female: In case of females measuring of somatic indicators we have recorded statistically significant differences in mean values of body height, body weight and BMI. Body height during five year testing was at an average level of 168 cm. Compared to the years 2012, 2013 (167.2-168.2; 167.2-168.7) ($p<0.05$), in 2015 we have recorded differences. The average female body weight during 5 years was 63 kg. The significant increase was recorded in 2012 (increase of 3.2 kg), in 2013 (increase of 3.8 kg), in 2014 (increase of 2.8 kg) and in 2015 (increase of 7.7 kg) compared to year 2011, when it was at an average level of 18-19-years old women. However, in 2015 we have recorded an increase comparing to 2012 (increase of 4.5 kg), 2013 (increase of 4 kg) and 2014 (increase of 5 kg). Measured body-weight values in 2001 and in year 2000 were the same. As with the body weight, the body mass index has prominently increased in 2012 (about 1), in 2013 (about 1,2), in 2014 (about 1) and in 2015 (about 1,6) comparing to 2011. Body mass index has reached the average value of 21.7, which was 1 point higher as the value of other authors. The value of BMI in 2011 was similar to that we have measured in 2000 [1]. Relative values of body fat in reporting period ranged at 30 %, which are limit mean values. There were no statistically significant differences recorded (Tab.2).

Table 3. Comparison results of somatic indicators female in years 2011 - 201

| | Height [m] | | | | | Weight [kg] | | | | |
|---------|---------------------|-------|-------|-------|-------|---|-------|-------|-------|-------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 382 | 389 | 409 | 398 | 303 | 382 | 389 | 409 | 398 | 303 |
| x | 167.9 | 168.2 | 168.7 | 167.9 | 167.2 | 58.5 | 61.7 | 62.3 | 61.3 | 66.2 |
| sd | 5.855 | 6.193 | 6.334 | 6.42 | 6.37 | 8.191 | 11 | 10.51 | 10.97 | 12.76 |
| min | 151 | 150 | 150 | 152 | 150 | 40 | 41.9 | 39.6 | 35.8 | 35.4 |
| max | 186 | 187 | 191 | 192 | 188 | 100 | 117.5 | 116.7 | 123 | 125.8 |
| p<0.05* | 2015-2012,2015-2013 | | | | | 2011-2012, 2011-2013,2011-2014,2011-2015, 2015-2012,2015-2013,2015-2014 | | | | |

*statistical differences between years

Table 4. Comparison results of somatic indicators female in years 2011 - 2015

| | BMI | | | | | Body fat [%] | | | | |
|---------|--|-------|-------|-------|-------|--------------|-------|-------|-------|-------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 382 | 389 | 409 | 398 | 303 | 382 | 389 | 409 | 398 | 303 |
| x | 20.74 | 21.78 | 21.96 | 21.76 | 22.37 | 30.15 | 29.96 | 30.28 | 30.04 | 30.63 |
| sd | 2.62 | 3.37 | 3.25 | 3.49 | 4.46 | 6.62 | 6.43 | 6.52 | 7.19 | 7.92 |
| min | 14.69 | 15.8 | 14.7 | 14.4 | 16 | 6 | 7 | 7 | 8.4 | 5.8 |
| max | 33.66 | 38.8 | 43.4 | 38.5 | 53.6 | 51.2 | 50.6 | 50.5 | 53.1 | 56.8 |
| p<0.05* | 2011-2012, 2011-2013, 2011-2014, 2011-2015, 2015-2012, 2015-2014 | | | | | | | | | |

*statistical differences between years

Measurement results of motor performance

In 60 second-sit-up test, that evaluates the dynamic power of the abdominal and hip muscles, was for men the average value of 45 sit-ups recorded. Nearly, in all monitored years, we found the statistically significant difference in mean values. The highest relative values were measured in 2012, when the average performance was 48 sit-ups, which is 3 more than in 2011, 2014 a 2015 and up to 6 more as in 2013. Compared to other authors [1,2,5,6,7], as well as with our research in 2000, were the relative values in 2012 significantly higher, contrariwise in 2013 significantly lower (Tab.5).

Females reached the average value of 37 sit-ups. Nearly, in all monitored years, similar to the men, we have also found the statistically significant differences in mean values. We have recorded the highest relative values in 2012, when the average amount of sit-ups ranged at 39, which is 2 more than in 2011, 4 more than in 2013, 3 more than in 2014 and 2 more as in 2015. Relative to other authors, as well as with our research in 2000, were the relative values from 2012 significantly higher and in years 2013, 2014 and 2015 contrariwise significantly lower (Tab.7).

In long jump test, that evaluates explosive power of the lower limbs, we have recorded the average value of 2.17 metres for men. Statistically significant growth was registered in 2013 and 2014 (about 7 cm more or about 6 cm less for year 2013 and about 6 cm more or about 7 cm less for year 2014) compared to years 2011 and 2012. Also in 2013 we have recorded increase (o - 13 cm, resp. o - 8 cm) compared to years 2014 and 2015. Only in 2013, the probands achieved compared to other population average values. In years 2011, 2012, 2014 and 2015 were the performances below average. (Tab.5).

Females got an average value of 1.64 metres, which corresponds with identified values from our research in 2000. However, compared to other authors, these values are considerably lower (about 10 cm less). The lowest values were found in 2015, where over other years the decrease of about 5-7 cm appeared (Tab.7).

In the beep test, that evaluates aerobics endurance, for men we have recorded an average value of 51 sections, representing the value of maximum oxygen consumption VO_{2max} 33 ml.kg⁻¹.min⁻¹. This value is below average. We noticed significant decrease of mean values in

2012 (about 5 sections), in 2013 (about 13 sections), in 2014 (about 10 sections) and in 2015 (about 7 sections) compared to 2011. On the other hand, in years 2014 and 2015 we noticed significant growth compared to year 2013 (about 3-6 sections). Relative to other authors are the mean values of FCHPT getting significantly lower every year (Tab.6).

We recorded the average value of 26 sections for women, representing the value of maximum oxygen consumption a VO_2max 23,8 ml.kg⁻¹.min⁻¹. This value is considerably below average. Compared to year 2011, when we have noticed the highest average value of 32,4 sections, in 2012, 2013, 2014 and 2015 we have founded statistically significant decrease of mean values (about 6 sections, about 10 sections, about 10 sections and about 6 sections) ($p < 0.05$). Compared to other authors were the mean values of FCHPT in years 2012, 2013, 2014 a 2015 significantly lower (Tab.8).

In 2 kg ball throw test, that evaluates the level of expressways-power capabilities of upper limbs and trunk, we have noticed the average value of 9,44 metres . In years 2013, 2014 and 2015 we have recorded statistically significant decrease of mean values compared to year 2011 (about 0.46 m less, about 0.56 m less, about 0.43 m less). Statistically significant decrease of mean values were recorded in 2013 and 2014 compared to 2012 (about 0.51 m less, about 0.38 m less). Compared to other authors were the mean values of FCHPT in years 2013, 2014, 2015 below average [1,2,5,6,7]. However, in 2011 values were more than average (Tab.6).

Women reached the average value of 6 metres. The highest average value was noticed in 2011 (6.12 m) and the lowest in 2012 (5.92 m). Between years 2011 and 2012 we recorded only one statistically significant difference of mean values at level of $p < 0.05$ (0.2 m). In other years the mean values ranged at level about 6 metres. Relative to other authors are the mean values of FCHPT getting significantly lower every year (Tab.8).

Table 5. Comparison results of sit-ups and long jump male in years 2011-2015

| | Sit-up [n] | | | | | Long jump [m] | | | | |
|---------|---|-------|-------|------|-------|---|------|------|-------|------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 142 | 164 | 187 | 160 | 144 | 142 | 164 | 187 | 160 | 144 |
| x | 44.99 | 48.39 | 42.25 | 45.1 | 44.89 | 2.17 | 2.18 | 2.24 | 2.11 | 2.16 |
| sd | 10.21 | 10.02 | 9.38 | 10.4 | 9.68 | 0.29 | 0.26 | 0.25 | 0.265 | 0.27 |
| min | 18 | 20 | 20 | 20 | 16 | 1.3 | 1.4 | 1.65 | 1.5 | 1.4 |
| max | 70 | 80 | 65 | 80 | 72 | 2.86 | 2.85 | 3.1 | 2.86 | 2.7 |
| p<0.05* | 2011-2012,2011-2013,2012-2013,2012-2014, 2012-2015,2013-2014,2013-2015 | | | | | 2011-2013,2011-2014,2012-2013,2012-2014, 2013-2014,2013-2015 | | | | |

*statistical differences between years

Table 6. Comparison results of beep test and 2 kg ball throw male in years 2011-2015

| | Beep test [n] | | | | | 2 kg ball throw [m] | | | | |
|---------------|---|-------|-------|------|-------|---|-------|-------|------|------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 142 | 164 | 187 | 160 | 144 | 142 | 164 | 187 | 160 | 144 |
| x | 57.84 | 52.93 | 45.11 | 47.8 | 50.7 | 9.74 | 9.69 | 9.28 | 9.18 | 9.31 |
| sd | 23.49 | 20.03 | 19.34 | 21.1 | 20.92 | 1.956 | 1.852 | 1.809 | 1.76 | 1.88 |
| min | 6 | 12 | 12 | 9 | 11 | 4.5 | 2.86 | 5.6 | 3.7 | 2.8 |
| max | 138 | 104 | 103 | 104 | 112 | 14.6 | 13.9 | 17 | 14 | 13.6 |
| p-value<0.05* | 2011-2012,2011-2013,2011-2014,2011-2015, 2012-2013,2012-2014,2012-2015 | | | | | 2011-2013,2011-2014,2011-2015, 2012-2013,2012-2014 | | | | |

*statistical differences between years

Table 7. Comparison results of sit-ups and long jump female in years 2011-2015

| | Sit-up [n] | | | | | Long jump [m] | | | | |
|---------|--|-------|-------|-------|-------|---|-------|-------|-------|-------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 382 | 389 | 409 | 398 | 303 | 382 | 389 | 409 | 398 | 303 |
| x | 37.46 | 39.54 | 35.64 | 36.25 | 37.28 | 1.66 | 1.64 | 1.68 | 1.62 | 1.59 |
| sd | 9.27 | 8.8 | 8.34 | 9.07 | 8.46 | 0.221 | 0.229 | 0.217 | 0.216 | 0.233 |
| min | 12 | 17 | 12 | 10 | 11 | 1 | 0.62 | 1 | 1 | 0.8 |
| max | 66 | 71 | 61 | 62 | 67 | 2.75 | 2.32 | 2.8 | 2.22 | 2.2 |
| p<0.05* | 2011-2012,2011-2013,2012-2013,2012-2014 2012-2015,2013-2015 | | | | | 2011-2014,2011-2015,2012-2015, 2013-2014,2013-2015 | | | | |

*statistical differences between years

Table 8. Comparison results of beep test and 2 kg ball throw female in years 2011-2015

| | Beep test [n] | | | | | 2 kg ball throw [m] | | | | |
|---------|---|-------|-------|-------|-------|---------------------|------|------|------|------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2011 | 2012 | 2013 | 2014 | 2015 |
| n | 382 | 389 | 409 | 398 | 303 | 382 | 389 | 409 | 398 | 303 |
| x | 32.4 | 26.56 | 22.47 | 22.4 | 25.84 | 6.12 | 5.92 | 5.98 | 6.08 | 6 |
| sd | 11.83 | 11.31 | 10.98 | 11.08 | 10.19 | 1.15 | 1.22 | 1.25 | 1.19 | 1.17 |
| min | 11 | 9 | 6 | 5 | 8 | 1.5 | 3.1 | 1.3 | 1.7 | 2.6 |
| max | 80 | 80 | 81 | 75 | 65 | 10.5 | 12.2 | 15 | 13 | 10.3 |
| p<0.05* | 2011-2012,2011-2013,2011-2014,2011-2015, 2012-2013,2012-2014,2015-2013,2015-2014 | | | | | 2011-2012 | | | | |

*statistical differences between years

CONCLUSION

Based on the results of measuring the level of somatic development, we found out that the basic parameters of the somatic body height has stagnating tendency for both men and women categories. Body weight has a stable level in men until 2014, but its value is about 5 kg higher than the population average. In 2015 there was an increase in body weight of 4 kg compared to other reference year. The women have body weight except in 2014 rising trend. Both in men and women category in 2015 significantly increased body weight. Observing body mass index (BMI) we found out a significant increase in values only for women category, men BMI values were at the same level throughout the five-year research, but these values are 1 point higher than in the population average. The relative value of the body fat in both men and women category were at approximately the same level without significant difference. In men, the value of body fat was on average. In women it reaches also average values, but the limit. Interestingly, women achieved averaged index BMI more than men but the value of body fat on the other hand they were worse.

In the test results of motor performance, we found out significantly lower levels of aerobic endurance compared to the first measurement in 2011, both men and women. All measured values were lower than the average population. In the case of speed-power capabilities of the arms and torso as well as for the dynamic force abdominal and hip muscles have both men and women experienced intermittent tendency. Strong signs of either increasing or decreasing, we can't confirm.

From our research it is clear that aerobic endurance is the ability which has decreasing trend from year to year for both men and women category. One from the reasons for this fact can be the rising body weight, resp. overweight. Another reason also may be that students are less likely to devote activities in which would be endurance capability dominated. Our task as teaching staff is to provide students with a form of physical activity which combines both power capability but also endurance, speed and coordination skills.

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