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## **MOTION EFFICIENCY AND FUNCTIONAL ABILITY OF UNDERGRADUATES**

### **INTRODUCTION**

There is a lot of research considering low motor efficiency of the undergraduates and that level is on the decrease (1-4). Among scientific papers there are few articles considering the group of students of physiotherapy. That is why this group was chosen as subjects in the research.

### **MATERIALS AND METHODS**

87 students of the Institute of Physiotherapy were involved in this research. The group consisted of 32 men and 55 women. We have evaluated the whole group of students and then separately according to gender, and trained and untrained students. The average age of the students was 21. The measurements were done between 18th November and 16<sup>th</sup> December 2009 at the IFBLR Piešťany. This published part of the research is aimed at the evaluation of the markers of motor efficiency and functional efficiency as well as measurement of the trunk and hand muscles power, explosive power of the legs, trunk flexibility, blood pressure levels and blood circulation ability. These markers were evaluated with standardised motor tests, hand grip with manual dynamometer of soviet origin (DRP90) and blood pressure with Omron M10 IT apparatus. The results show average values of the group and some of the relevant outcomes were analysed using the test.

### **RESULTS**

#### **a) Sit-up test**

The sit-up test refers to the measurement of the abdominal muscle power; however, it is well known that during the exercise, other muscle groups are involved as well. The test has various modifications in terms of time shift of the movement sequences, structure of the movement, and initial and terminal posture of the subject.

In our research, the subject was lying on the back with the hands in occiput, legs stretched with ankles fixed by the other person to the floor. The sitting position was reached with 90 degrees flexion of the trunk to the legs. With every return to the lying position, the subject was supposed to touch the floor with his occiput. Total number of the sit-ups was counted for 30 seconds.

In our research, no significant differences were found between men and women in this test. The results of several research studies favour men in the results of muscle power tests rather than women, thus the sit up test should favour men in our outcomes as well. The results of the test at IFBLR: men 19.30 cycles, women 18.90 cycles. The whole group had average value of 19.1 cycles (Figure 1). Less surprising was little difference in the results between trained men and women. It can be said that trained women have strengthened more their abdominal and lumbar muscles. The difference between trained and untrained men was statistically significant, just as the difference between trained and untrained women (favouring trained in both cases).

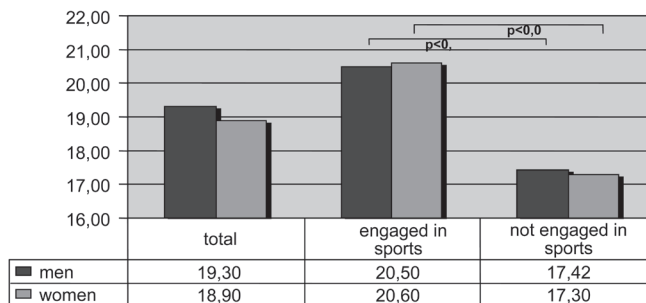


Figure 1.

### b) Hand grip power

As expected, men's hand grip power was much higher (see table 1). In men it was 895 N and in women 459 N. This difference was statistically significant at level  $p < 0.01$ . We have confirmed the well known fact about the lower level of the muscle power in women in comparison with men. This comes from several researches of the muscle power of women regardless of their profession (that means it is considering not only female students). Trained men had better results compared to trained women. In this group the difference was even more notable (men 902N, women 442N) and was again statistically significant. For further analysis of these results it would be necessary to know what kind of sports the subjects are engaged in (separately men and women) and according to these findings, evaluate the influence of the sport on their muscle power level. Higher values of the hand muscle power in men rather than

in women were found in the untrained group of the students as well. In this group the difference was smaller than in trained group, but this data were also statistically significant. The difference between trained and untrained group was surprisingly small.

**Table 1.** Informative table of the hand-grip values of both hands in Newtons

| Age      | Men          |         |           | Women        |         |           |
|----------|--------------|---------|-----------|--------------|---------|-----------|
|          | Insufficient | Good    | Excellent | Insufficient | Good    | Excellent |
| 15 – 20y | Below 39     | 39 – 44 | Over 44   | Below 31     | 31 – 34 | Over 34   |
| 21 – 30y | Below 45     | 45 – 55 | Over 55   | Below 27     | 27 – 36 | Over 36   |
| 31 – 40y | Below 38     | 38 – 44 | Over 44   | Below 25     | 25 – 32 | Over 32   |
| 41 – 50y | Below 34     | 34 - 43 | Over 43   | Below 24     | 24 – 29 | Over 29   |

**Table 2.** Normative of jumps value in cm

| The power level |      |      |      |           |
|-----------------|------|------|------|-----------|
|                 | Poor | Fair | Good | Excellent |
| Men             | 580  | 750  | 800  | 930       |
| Women           | 480  | 650  | 700  | 800       |

### c) Vertical jump

It was found that leg load is the most effective in terms of growth hormone production and that is why the measurement of the explosive power of the legs was included in the battery of the tests. This is usually measured with the distance jump from the spot or with the high jump. The high jump measurement is easier. The difference between the touch of the wall with the arm stretched while standing and jumping is measured with these tests.

In the whole group of subjects, men had relatively better results than women, but in overall evaluation according to the scale, the average result of men (38 cm) was insufficient while in women it was good (30 cm). It can be deduced that in female students this motor ability improved on a higher level compared to men, even if their output was not excellent. The difference between men and women was statistically significant at  $p < 0.01$ . Similar results were found in trained students for both genders. Men had relatively better results (39cm) than women (28cm), although according to the evaluation scale, their output was insufficient. Similar situation was

in women whose average output was good but close to insufficient result. Untrained male students reached better results (36cm) than untrained female students (30cm), although their output in evaluation scale was insufficient while in women it was good. Women were better in overall results (Figure 3).

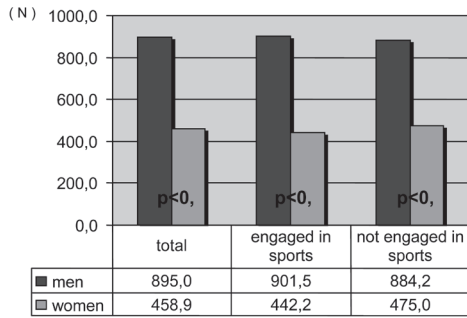


Figure 2.

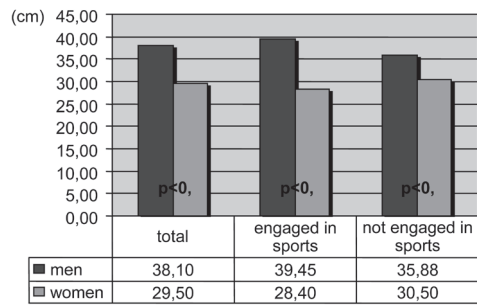


Figure 3.

#### d) Trunk-bending sideways (difference)

The trunk flexibility measured with bend aside: the evaluation of the trunk-bending sideways to the left in the whole group of the IFBLR students showed no difference between men and women. Similarly, there were no major differences between the values of the bend aside of the trunk to the left in trained men and trained women, and the same holds for untrained men and women (Figure 4). There were no major differences in the results of the bend aside of the trunk–bending sideways to the right in the whole group and among men and women as well as in trained men and women, and untrained men and women (Table 3a, 3b). The results were not statistically significant. In theory, based on the equality of the achieved results, it can be presumed that the results of the bend aside of the trunk to the left would be similar in men and women. In comparison of the results of the bend aside to the left and to the right in the whole group and separately in trained and untrained men, no major differences were observed. The same results were achieved in the whole group of women and trained and untrained women.

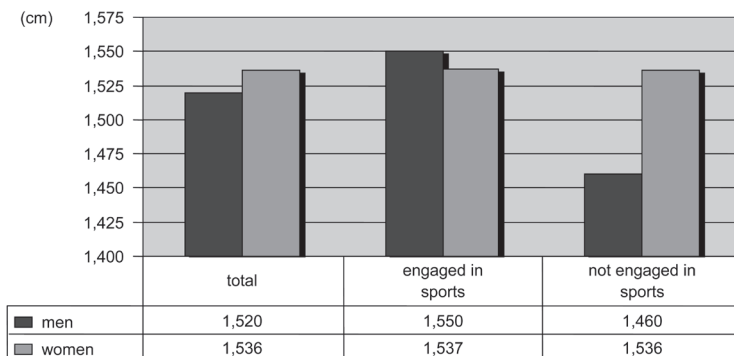
**Table 3a.** Normative values for men

| Evaluation          | 20 – 30 – 39 years | 40 – 49 years  | 50 – 59 years  |
|---------------------|--------------------|----------------|----------------|
| Above average       | 27,2 cm            | 25,9 cm        | 23,5 cm        |
| Better than average | 23,3 – 27,1 cm     | 22,0 – 25,8 cm | 19,6 – 23,4 cm |
| Average             | 19,5 – 23,2 cm     | 18,1 – 21,9 cm | 15,7 – 19,5 cm |
| Lower than average  | 15,6 – 19,4 cm     | 14,3 – 18 cm   | 12,0 – 15,6 cm |
| Insufficient        | 15,5 cm            | 14,2 cm        | 11,8 cm        |

**Table 3b.** Normative values for women

| Evaluation          | 20 – 30 – 39 years | 40 – 49 years  | 50 – 59 years  |
|---------------------|--------------------|----------------|----------------|
| Above average       | 26,2 cm            | 24,7 cm        | 23,0 cm        |
| Better than average | 22,6 – 26,1 cm     | 21,0 – 24,6 cm | 19,3 – 22,9 cm |
| Average             | 18,9 – 22,5 cm     | 17,4 – 20,9 cm | 15,7 – 19,2 cm |
| Lower than average  | 15,2 – 18,8 cm     | 13,7 – 17,3 cm | 12,0 – 15,6 cm |
| Insufficient        | 15,1 cm            | 13,6 cm        | 11,9 cm        |

The disadvantage of the table is that the same category of the bend aside of the trunk is applied for 20, 30 and 39-year-olds. There can be huge differences in this range and that is why the evaluation is only informative. According to the above table, the outputs of our students are evaluated as better than average.

**Figure 4.** (difference in cm)

### e) Blood pressure

Surprisingly high levels of the systolic blood pressure were found in the male group (137 mmHg) compared with women, whose values were almost ideal (119 mmHg) ( $p < 0.01$ ). Similar results were obtained for trained male subjects: men – 138 mmHg, women 117 mmHg and untrained too: men 135 mmHg, women 121 mmHg. In both groups the differences were statistically significant (evaluated with t-test) with  $p < 0.01$ . In the evaluation of the diastolic blood pressure, the ideal values were found in men in the whole group (82 mmHg) in comparison with women (77 mmHg). Both values can be marked as very good (with statistical significance of  $p < 0.05$ ).

The values of the diastolic blood pressure in the group of the trained men (82 mmHg) in comparison to the trained women (76 mmHg) reached the highest difference between genders and were statistically significant. The differences in the values of the diastolic blood pressure in the group of untrained men and women were not significant and they reached ideal level (Figure 5 and 6).

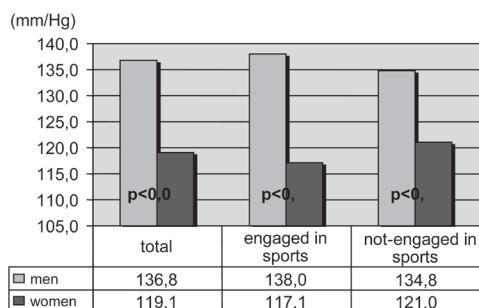


Figure 5. Systolic BP

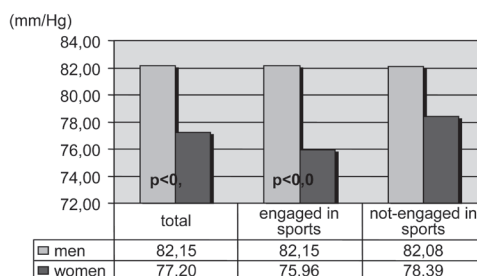


Figure 6. Diastolic BP

### f) Orthostatic test

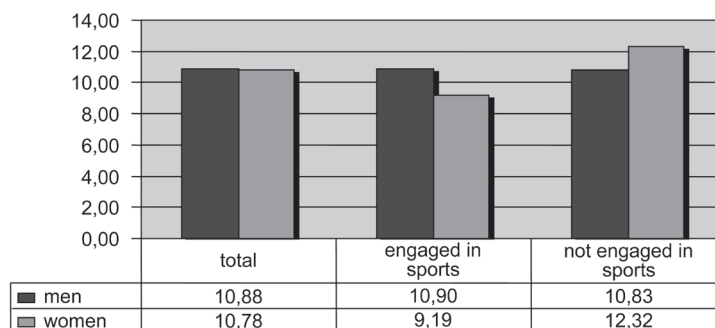
In the evaluation of the orthostatic test the following limits were used:

6-12 beats/min – good heart reaction for the load

13-19 beats/min – satisfactory reaction

20 and more – unsatisfactory reaction – lowered heart efficiency

In the whole group the heart reaction for the changed posture was good. It was closely over 10 strokes /min, the difference between trained and untrained men was minimal (trained 10.9 strokes/min, untrained 10.8 strokes/min). The heart reaction of the untrained women can be evaluated only as satisfactory. Although these results were not statistically significant, they were remarkable (Figure 7).



*Figure 7.*

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## ABSTRACT

**Objective:** In this paper the authors collected information about the level of motor efficiency and functional ability indicators in students of the Institute of Physiotherapy, Balneology and Medical Rehabilitation (IFBLR) IFBLR UCM in Trnava. The level of the indicators was measured in 87 students, 32 male and 55 female, and 47 of them were doing some sport and 40 were not. Their average age was 21 years. In the paper the authors are evaluating the results of the whole group, the results of the group involved in training (trained) and the one not involved in training

(untrained), and men and women individually as well. **Methods:** The standardised tests for power measurement and joint mobility were used. For the measurement of the functional values, the orthostatic exam and blood pressure levels were collected. **Results:** In the **sit-up test** surprisingly no difference between men and women was found, neither in the trained nor untrained group. There were significant differences between men (895 N) and women (459 N) in **hand grip test** using dynamometer. The higher values were found both in trained and untrained men compared to women. The values of **vertical jump** in men are marked as „insufficient” and in women as „good”. It can be deduced that women have more lower hand power than men. There were no significant differences in the **trunk-bending sideways** to the left and to the right between men and women, similarly between trained and untrained men and women. The **systolic blood levels** in men were much higher (137 mmHg) while in women the levels were normal (119 mmHg). The values of the diastolic pressure were almost ideal in men and women. The results of **orthostatic exam** were found to be as good in men and women without any significant differences between trained and untrained men. There was more significant difference between trained and untrained women. The heart reaction of the untrained women was unsatisfactory.

***Key words:** motor efficiency, functional efficiency, sit-up, hand grip power, vertical jump, trunk bending sideways, blood pressure, orthostatic test, undergraduates, students of physiotherapy*