



# Features of the influence of physical loads of different directions on the performance indicators of female students of different somatotypes

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## Abstract

**Objective of the study** was to identify the features of the influence of physical loads of various directions on the physical fitness of female students of different somatotypes.

**Results and conclusions.** Within the framework of this work, the features of the influence of loads of various sports orientations on the physical fitness of female students of different somatotypes are determined.

The pilot study involved female students involved in volleyball, basketball, swimming and fitness as part of elective physical education courses. All participants in the experiment were identified body type: asthenic, thoracic, muscular and digestive. For a comparative assessment of physical performance under the influence of loads of different sports directions, the following methods were used: functional test PWC<sub>170</sub> and determination of the magnitude of the intensity of accumulation of pulse debt (IAPD).

**Keywords:** *body types, types of physical activity, working capacity, physical education of students.*

**Introduction.** Physical performance is a part of general physical fitness, therefore specialists and researchers in the field of university sports pay special attention to its assessment. Currently, studies devoted to the study of the influence of various sports on the performance of female students, in particular fitness aerobics, Pilates, cheerleading and other popular types of physical activity, are in great demand in science and practice. In this regard, the search for effective methods for assessing the physical condition of students under the influence of loads of various sports orientations becomes an important direction in solving the problems of increasing physical and mental performance, acquiring by students the necessary theoretical knowledge and skills in their future professional activities.

**Objective of the study** was to identify the features of the influence of physical loads of various directions

on the physical fitness of female students of different somatotypes.

**Methods and structure of the study.** The experimental work involved female students involved in volleyball, basketball, swimming and fitness as part of elective physical education courses. All participants in the experiment were identified body type: asthenic, thoracic, muscular and digestive. For a comparative assessment of physical performance under the influence of physical loads of different directions, the following methods were used: functional test PWC<sub>170</sub> and determination of the magnitude of the intensity of accumulation of pulse debt (IAPD).

**Results of the study and their discussion.** Table 1 shows the dynamics of indicators of physical performance of female students of different somatotypes under the influence of basketball lessons. As can be seen from the table, basketball lessons



had the most favorable effect on the physical performance of girls with asthenic and thoracic body types. This is evidenced by a significant increase in the absolute and relative values of  $PWC_{170}$  by 12.14% and 10.54% in representatives of the asthenic body type, which indicates an increase in the aerobic performance of female students in this category. However, in this case, an increase in the intensity of accumulation of pulse debt was revealed, which indicates a high physiological cost that the body spent when performing stepergometric loads. When using *basketball lessons* during the semester, an increase in muscle performance was also found in female students of the thoracic body type. This is indicated by an increase in the absolute and relative values of  $PWC_{170}$  by 8.09% and 10.54%, respectively. The magnitude of the IAPD in this case remained unchanged.

The female students of muscular and digestive body types showed a tendency to decrease in aerobic performance. This, in particular, is evidenced by an unreliable decrease in the absolute and relative values of  $PWC_{170}$  by 7.16% and 3.01%, respectively, in girls of the muscular somatotype. A similar picture was also found in female students of the digestive body type - the decrease in  $PWC_{170}$  was 3.13% and 6.86%, respectively. At the same time, it should be noted that when performing stress testing, its physiological cost

decreased in girls of the muscular somatotype by 8.7%, and the digestive one - by 18.18%.

In table 2 shows the dynamics of indicators of physical performance of girl students of different somatotypes under the influence of *volleyball lessons*.

As can be seen from table 2, a significant increase in absolute and relative values was found in representatives of the muscular body type. It amounted to 15.41% and 17.24%. This indicates a favorable effect of volleyball lessons on the aerobic performance of female students. However, the increase in the intensity of accumulation of pulse debt in this case indicates a high physiological cost of the performed standard physical activity, which turned out to be 12.5% higher than it was in the previous semester.

In girls of other body types, volleyball lessons mainly had a negative impact on their functional capabilities. This is evidenced by a decrease in the relative value of  $PWC_{170}$  in female students of asthenic, thoracic and digestive body types. At the same time, the decrease in the indicator under consideration amounted to: 3.3%, 5.52% and 5.93%, respectively. Which indicates the presence of a negative trend in the influence of volleyball classes on the aerobic performance of girls with asthenic, thoracic and digestive somatotypes.

Table 3 shows the dynamics of physical performance indicators of girl students of different somatotypes under the influence of *swimming lessons*.

**Table 1.** Dynamics of indicators of physical performance of female students of different body types under the influence of basketball lessons

| Body type | Indicators                           | Beginning of experiment | End of experiment | Changes, % |
|-----------|--------------------------------------|-------------------------|-------------------|------------|
| Asthenic  | $PWC_{170\text{ abs}}$ , kg/m/min    | 537,36±36,1             | 602,59±18,17      | 12,14 *    |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 10,82±0,55              | 11,96±0,47        | 10,54 *    |
|           | IAPD, c.u.                           | 0,46±0,01               | 0,53±0,03         | 15,22      |
| Thoracic  | $PWC_{170\text{ abs}}$ , kg/m/min    | 657,28±48,59            | 693,27±63,01      | 8,09       |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 11,81±0,84              | 12,44±1,43        | 8,46       |
|           | IAPD, c.u.                           | 0,53±0,03               | 0,53±0,05         | -1,85      |
| Muscular  | $PWC_{170\text{ abs}}$ , kg/m/min    | 726,31±15,98            | 674,34±43,72      | -7,16      |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 11,96±0,32              | 11,6±0,71         | -3,01      |
|           | IAPD, c.u.                           | 0,69±0,05               | 0,63±0,03         | -8,70      |
| Digestive | $PWC_{170\text{ abs}}$ , kg/m/min    | 734,93±36,18            | 711,89±4,11       | -3,13      |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 11,52±0,53              | 10,73±0,31        | -6,86      |
|           | IAPD, c.u.                           | 0,55±0,05               | 0,45±0,03         | -18,18 *   |

**Table 2.** Dynamics of indicators of physical performance of female students of different body types under the influence of volleyball lessons

| Body type | Indicators                            | Beginning of experiment | End of experiment | Changes, % |
|-----------|---------------------------------------|-------------------------|-------------------|------------|
| Asthenic  | PWC <sub>170 abs.</sub> , kg/m/min    | 609,48±42,11            | 587,78±24,09      | -3,56      |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 12,11±0,75              | 11,71±0,4         | -3,30      |
|           | IAPD, c.u.                            | 0,51±0,04               | 0,51±0,02         | 0,00       |
| Thoracic  | PWC <sub>170 abs.</sub> , kg/m/min    | 724,42±36,41            | 690,38±25,13      | -4,70      |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 13,04±0,67              | 12,32±0,57        | -5,52      |
|           | IAPD, c.u.                            | 0,57±0,04               | 0,6±0,03          | 5,26       |
| Muscular  | PWC <sub>170 abs.</sub> , kg/m/min    | 676,58±57,0             | 780,85±35,65      | 15,41 *    |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 10,67±0,86              | 12,51±0,66        | 17,24 *    |
|           | IAPD, c.u.                            | 0,48±0,04               | 0,54±0,04         | 12,5       |
| Digestive | PWC <sub>170 abs.</sub> , kg/m/min    | 783,66±43,95            | 814,33±88,84      | 3,91       |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 10,28±1,01              | 9,67±0,87         | -5,93      |
|           | IAPD, c.u.                            | 0,5±0,06                | 0,54±0,04         | 8,00       |

**Table 3.** Dynamics of indicators of physical performance of female students of different body types under the influence of swimming lessons

| Body type | Indicators                            | Beginning of experiment | End of experiment | Changes, % |
|-----------|---------------------------------------|-------------------------|-------------------|------------|
| Asthenic  | PWC <sub>170 abs.</sub> , kg/m/min    | 627,93±41,36            | 646,03±19,92      | 2,88       |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 12,24±0,69              | 13,35±0,49        | 9,07       |
|           | IAPD, c.u.                            | 0,55±0,03               | 0,53±0,07         | -3,64      |
| Thoracic  | PWC <sub>170 abs.</sub> , kg/m/min    | 625,81±21,26            | 679,67±21,64      | 8,61 *     |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 11,44±0,21              | 12,28±0,34        | 7,34 *     |
|           | IAPD, c.u.                            | 0,57±0,02               | 0,52±0,03         | -8,77      |
| Muscular  | PWC <sub>170 abs.</sub> , kg/m/min    | 727,58±21,18            | 706,6±32,44       | -2,88      |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 12,16±0,51              | 11,19±0,58        | -7,98      |
|           | IAPD, c.u.                            | 0,65±0,05               | 0,56±0,04         | -13,85 *   |
| Digestive | PWC <sub>170 abs.</sub> , kg/m/min    | 832,7±17,49             | 838,33±39,0       | 0,68       |
|           | PWC <sub>170 rel.</sub> , kg/m/min/kg | 10,37±0,45              | 11,2±0,65         | 8,00       |
|           | IAPD, c.u.                            | 0,57±0,02               | 0,5±0,09          | -12,28     |

As can be seen from table 3, a significant increase in absolute and relative values was found in female students of the thoracic body type. It amounted to 8.61% and 7.34%. This indicates a positive impact of

swimming lessons on the aerobic performance of female students of this body type.

The female students of asthenic and digestive body types showed a tendency to increase physical



performance in absolute and relative values of  $PWC_{170}$ . The increase in the above indicators, respectively, was 2.88% and 9.07% in representatives of the asthenic somatotype and 0.68% and 8.0% in the digestive body type.

When studying the effect of swimming on the aerobic performance of students of the muscular type, an unreliable decrease by 2.88% and 7.98% (in absolute and relative values of  $PWC_{170}$ ) was revealed. However, there is a noticeable significant decrease in the physiological cost of the tested physical activity.

Table 4 shows the dynamics of indicators of physical performance of girl students of different somatotypes under the influence of *fitness classes*.

As can be seen from table 4, a significant increase in the absolute and relative values of  $PWC_{170}$  was found in representatives of the digestive body type - it amounted to 21.8% and 24.89%, respectively.

Fitness classes have a positive effect on aerobic performance and the physiological cost of standard steppergometric loads in female students of thoracic and muscular somatotypes.

The only body type that reacted negatively to fitness classes is the asthenic body type, which showed a decrease in aerobic performance according to the absolute and relative values of  $PWC_{170}$ . In this case, these values decreased by 7.9% and 9.27%, respectively. But at the same time, the physiological cost of

standard physical activity, which was used during testing, decreased by 5.36, which is a positive fact of the influence of fitness on the functional capabilities of female students in this category.

**Conclusions.** Basketball classes had the most favorable effect on the physical performance of girls with asthenic and thoracic body types. The female students of muscular and digestive body types showed a tendency to decrease in aerobic performance.

Volleyball classes have a positive effect on the aerobic performance of female students of a muscular body type. In girls of other body types, volleyball lessons mainly had a negative impact on their functional capabilities.

The positive impact of swimming lessons on the aerobic performance of female students of the thoracic body type was revealed. The female students of asthenic and digestive body types showed a tendency to increase physical performance in absolute and relative values of  $PWC_{170}$ . When studying the effect of swimming on the aerobic performance of students of the muscular type, an unreliable decrease by 2.88% and 7.98% (in absolute and relative values of  $PWC_{170}$ ) was revealed. However, there is a noticeable significant decrease in the physiological cost of the tested physical activity.

As a result of fitness classes, a significant increase in the absolute and relative values of  $PWC_{170}$  was found

**Table 4.** Dynamics of indicators of physical performance of female students of different body types under the influence of fitness classes

| Body type | Indicators                           | Beginning of experiment | End of experiment | Changes, % |
|-----------|--------------------------------------|-------------------------|-------------------|------------|
| Asthenic  | $PWC_{170\text{ abs}}$ , kg/m/min    | 664,3±42,19             | 611,83±20,76      | -7,90      |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 13,49±0,92              | 12,24±0,51        | -9,27      |
|           | IAPD, c.u.                           | 0,56±0,03               | 0,53±0,03         | -5,36      |
| Thoracic  | $PWC_{170\text{ abs}}$ , kg/m/min    | 624,05±40,87            | 664,54±19,13      | 6,49       |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 11,24±0,85              | 11,93±0,31        | 6,14       |
|           | IAPD, c.u.                           | 0,6±0,04                | 0,57±0,04         | -5,00      |
| Muscular  | $PWC_{170\text{ abs}}$ , kg/m/min    | 749,6±63,47             | 772,68±49,25      | 3,08       |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 11,26±0,7               | 12,34±0,82        | 9,59       |
|           | IAPD, c.u.                           | 0,62±0,07               | 0,58±0,04         | -6,45      |
| Digestive | $PWC_{170\text{ abs}}$ , kg/m/min    | 726,76±39,81            | 885,01±62,47      | 21,77 *    |
|           | $PWC_{170\text{ rel}}$ , kg/m/min/kg | 9,12±0,91               | 11,39±0,52        | 24,89 *    |
|           | IAPD, c.u.                           | 0,63±0,04               | 0,55±0,09         | -12,70     |



in representatives of the digestive body type. Fitness classes have a positive effect on aerobic performance and the physiological cost of standard steppergeometric loads in female students of thoracic and muscular somatotypes. The only body type that reacted negatively to fitness classes is the asthenic body type, which has a decrease in aerobic performance according to the absolute and relative values of  $PWC_{170}$ .

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