Physical activity of the university’s senior students

Mikhail M. Kolokoltsev1ABCDE, Wladyslaw Jagiello2ABCDE

1Irkutsk National Research Technical University, Russia
2Gdansk University of Physical Education and Sport, Gdansk, Poland

Abstract

Purpose: To prevent hypodynamics, to evaluate the volume and level of weekly physical activity of the university’s senior students.

Material: The study involved students (n = 244) aged 19-20 years (n = 157 - boys, n = 87 - girls). The students studied in the 4th year of the Technical University (Russia). The following parameters were investigated: physical activity (PA), the intensity of metabolic processes and motor skills. The volume of weekly physical activity was determined by a short form of the IPAQ-SF physical activity questionnaire. The level of physical activity intensity was determined by the formula of a metabolic equivalent of task (MET) (min/week). According to MET, students are divided into three groups: 1st group with a high level; 2nd group with average level; 3rd group with low level. The battery of motor tests used to evaluate students’ physical preparedness.

Results: The total intensive and non-intensive weekly motor activity of boys was 6.2 hours (372 min). This confirms with the standard volume (6 hours) recommended by WHO. The total motor activity of the girls (intense and non-intense) was 4.5 hours (271.6 min) per week. More than a quarter of the surveyed boys had a high level of physical activity. About 62% of students had an average level and 12.7% had a low level. Among all surveyed girls 16.1% have a high level of physical activity, 41.4% had an average level and 42.5% had a low level. The results of boys with a low level of physical activity in all motor tests were lower than the results of boys with high and average levels of physical activity. The exception was the results of the Seated Forward Bend test (p <0.05). In 6 motor tests, the results of girls with a low level of physical activity were worse than the results of female students with a high level of weekly physical activity (p <0.05). There are no significant differences between the test results in girls with low and average levels of weekly physical activity.

Conclusions: After completing the course on the subject “Elective Courses in Physical Culture and Sports”, the physical activity of students remains high enough. 12.7% of boys and 42.5% of girls with low levels of physical activity and MET were identified among the surveyed student population. This allows aligning them into a group at risk of developing non-communicable diseases. To reduce the hypodynamics of junior courses students at risk, it should use individually directed pedagogical technologies of physical education. In presenting the theoretical section of the subject “Physical Culture” to the senior courses students it is necessary to strengthen their motivation for independent motor activity.

Keywords: physical culture, physical activity, metabolic equivalent, physical preparedness.

Introduction

Physical activity is the body motor actions of a person with the help of muscle force, accompanied by a level of energy consumption higher than metabolism at rest [1]. Physical activity means the usual types of daily motor activity of the person.

According to some authors, hypodynamia is one of the reasons for ischemic heart disease, diabetes [2], obesity [3], cancer and other non-communicable diseases [4]. One of the reasons for the health deterioration of modern youth is the global tendency for hypodynamia and hypokinesia [5-7]. According to the documents of the World Health Organization (WHO), more than 1/3 of the world’s population does not reach the required level of physical activity [8].

The decrease in the quality of students’ health begins before their admission to a higher education institution [9-11]. Insufficient physical activity of schoolchildren leads to a violation of the adaptation mechanisms of the body and reduces the indicators of their physical development and physical preparedness [12, 13]. However, children who exercise for at least 60 min per day have a high level of health [14].

Further education at the university is associated with an intensive learning process [15]. Changes in the students’ quality of life occur as a result of an increase in the volume of neuropsychiatric factors in the educational environment and their impact on the adaptive potential of the organism [16-18]; ignoring the basics of healthy lifestyles against the hypodynamia background [19, 20]. Physical activity is an effective drug-free means of preserving and enhancing the reserve capacity of the human body [21-23]. Physical activity is a complex biosocial phenomenon [24]. There are reports in the literature on the study of motor activity of junior courses students of higher education institutions [25, 26]. The study of the structure and gender features of the physical activity of senior students seems to be relevant. These students have a reduced volume of controlled physical activity. This is due to the completion of academic training courses on the subject “Elective courses in physical culture and sports”. There is an increase in the number of students
at the potential risk of developing the non-communicable diseases of hypodynamic genesis.

A person’s physical activity is measured by three methods: time spent per day or week (timekeeping); energy costs (indirect calorimetry); the number of daily locomotions (pedometry) [27, 28]. The questionnaire for assessing the level of physical activity allows assessing the objective questionnaire for a person’s weekly motor activity [International Questionnaire on Physical Activity, IPAQ-Short Form (IPAQ-SF)] [29]. This questionnaire is acceptable according to the validity and reproducibility [30], and it was tested in several regions of Russia [31] and in other countries [32].

Physical activity of university students in the Russian Federation is determined in the volume of 6-8 hours per week [33]. In the recommendations of various authors on the volume of activity of students’ motor activity (measured by time spent), the standards differ significantly: from 7-14 hours per week [34] and up to 16-18 hours per week [35]. To maintain the health of people aged 18-64, it is proposed the following: a minimum rate of weekly motor activity of 2 hours 30 minutes (not less than 30 minutes per day for 5 days a week) with the exercise of moderate aerobic orientation; or at least 1 hour 15 minutes (25 minutes for 3 days) with high-intensity loads [36, 37].

The analysis of modern literature indicates the tendency of student youth to hypodynamia and reduction of energy costs. Therefore, a comprehensive study of the issues of the physical activity of university students is relevant and appropriate.

The purpose of the study. To prevent hypodynamics, evaluate the volume and level of weekly physical activity of university students.

Material and Methods.

Participants.

Students (n = 244) aged 19-20 years (n = 157 – boys, n = 87 – girls) participated in the study. The students studied in the 4th year of the Technical University (Russia). All students completed the course on the subject “Elective Course in Physical Culture and Sports”.

Design of the study

The volume of motor loads and the evaluation of the weekly physical activity level of students were determined by the short form of the IPAQ-SF physical activity questionnaire [28]. The metabolic equivalent of task (MET) was calculated [38] to determine the intensity of metabolic processes in the body of boys and girls. According to the IPAQ-SF questionnaire, the level of physical activity intensity of a person is determined by the formula of the metabolic equivalent of task (MET) calculation (Table 1).

The total weekly volume of human energy costs is determined by the sum of the metabolic equivalents of low, average and high levels of physical activity intensity: $\text{MET}_{\text{total}} = \text{MET}_{\text{h}} + \text{MET}_{\text{a}} + \text{MET}_{\text{l}} \ (\text{min} / \text{week})$.

where, $\text{MET}_{\text{h}}$ is a high level of physical activity intensity, $\text{MET}_{\text{a}}$ is an average level of physical activity intensity, $\text{MET}_{\text{l}}$ is a low level of physical activity intensity.

According to MET, the students were divided into three groups:

1st group with a high level of physical activity intensity.

- 3 or more days of high-intensity PA with a metabolic cost of at least 1500 MET;
- or a daily load of any intensity with a metabolic cost of at least 3000 MET.

2nd group with an average level of physical activity intensity. These are students who have a week:

- 3 or more days of high physical activity, lasting at least 20 min;
- at least 5 days of average physical activity intensity or walking, with a duration of at least 30 minutes;
- or at least 5 days of loads of any intensity with a metabolic cost of 600 MET.

3rd group with low intensity of physical activity. Students whose physical activity does not meet the above-mentioned criteria are included.

The evaluation of physical preparedness of senior students was performed applying a battery of motor tests [39]:

- 5x10 m shuttle test, sec.;
- 100 m run, sec;
- 1000 m run, min, sec;
- Pull-Up Bars (boys), quantity of times;
- Cadence Push-Up Test, (girls), quantity of times;
- Eurofit Sit Up Test (for 30 sec), quantity of times;
- Seated Forward Bend, cm;
- Standing Long Jump Test (Broad Jump), cm;

Statistical analysis. The sample volume (n), mean value (M), minimum, maximum, standard deviation (σ), standard error (m) were calculated applying the software “Microsoft Excel”, “StatSoft Statistica 6.1”. The reliability was determined by parametric methods [40].

Table 1. The method of determining the level of physical activity intensity by MET (min / week)

<table>
<thead>
<tr>
<th>Level of physical activity intensity (min / week)</th>
<th>The formula for calculating MET min / week by the IPAQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (h)</td>
<td>$8.0 \times [\text{duration of high intensity PA (min)}] \times [\text{number of days per week in which high intensity physical activity occurred}]$</td>
</tr>
<tr>
<td>Average (a)</td>
<td>$4.0 \times [\text{duration of moderate intensity PA (min)}] \times [\text{number of days per week}]$</td>
</tr>
<tr>
<td>Low (l)</td>
<td>$3.3 \times [\text{walking time (min)}] \times [\text{number of days per week}]$</td>
</tr>
</tbody>
</table>

Note. * - the conversion coefficients for the corresponding PA intensity level.
Results

Table 2 presents the results of a study of weekly physical activity of senior students.

Table 2 is shown that the physical activity of boys is significantly higher physical activity of girls (p <0.05). We did not find gender differences in the duration of daily walking and their weekly number (p > 0.05).

The figure illustrates the students’ division by levels of the metabolic equivalent of task (MET) of weekly physical activity.

The 1st group included 54 students (high MET level). Among them, there were 57.7% more boys than girls.

The 2nd group included 133 students (average MET level). At the same time, there were 49.2% more boys than girls.

The 3rd group (low MET level) included 57 students. It is 23.4% of the total number of students. There were 3.5 times fewer boys than girls. We suppose that students of this group are at high risk of developing non-communicable diseases and therefore require special attention from the physical education teachers and medical service of the university.

Among all surveyed boys, 25.5% have a high level of physical activity. 61.8% of students have an average level and 12.7% have a low level. Among all girls, 16.1% of female students have a high level, 41.4% have an average level and 42.5% have a low level. Thus, the quantitative ratio of boys with different levels of PA is expressed by the ratio: 2h: 4.8a: 1l (conventional signs: h – high, a – average, 1 – low).

The energy costs of boys with high and average weekly physical activity were 34.6% and 38.7% higher (respectively) than the energy costs of girls (Table 3). The energy costs of boys and girls at walking are approximately equal.

The evaluation of the motor tests results of senior students with different levels of weekly physical activity are presented in tables 4 and 5.

It was found that the results of all motor tests in boys with low levels of physical activity were worse than in boys with high and average levels of motor activity (p <0.05). The exceptions are the results of the Seated Forward Bend test. The significant differences between the results of boys with average and high levels of physical activity (p <0.05) were recorded in two strength tests (“Pull-Up Bars” and “Eurofit Sit Up Test (for 30 sec)”).

Table 2. Student questionnaire results by the IPAQ-SF questionnaire (M ± m)

<table>
<thead>
<tr>
<th>Questioned</th>
<th>The number of days with intensive* physical activity per week</th>
<th>Duration of intensive * physical activity per day (min)</th>
<th>The number of days of non-intensive ** physical activity per week</th>
<th>Duration of non-intensive physical activity per day (min)</th>
<th>How many days a week do you walk? (min)</th>
<th>How long do you walk per day? (hour)</th>
<th>How many hours a day do you spend sitting or lying down? (hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys (n=157)</td>
<td>2.83±0.11</td>
<td>52.26±1.6</td>
<td>3.42±0.16</td>
<td>65.6±2.7</td>
<td>6.46±0.10</td>
<td>71.9±2.4</td>
<td>7.1±0.18</td>
</tr>
<tr>
<td>Girls (n=78)</td>
<td>2.42±0.17</td>
<td>45.39±2.45</td>
<td>3.08±0.24</td>
<td>52.5±3.8</td>
<td>6.39±0.15</td>
<td>65.3±3.18</td>
<td>8.2±0.29</td>
</tr>
<tr>
<td>reliability (p)</td>
<td>p &lt; 0.05</td>
<td>p &lt; 0.05</td>
<td>p &gt; 0.05</td>
<td>p &lt; 0.05</td>
<td>p &gt; 0.05</td>
<td>p &gt; 0.05</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

Note. * - intensive physical activity includes motor actions that lead to increased respiratory rate; heart rate increase by more than 20% and continue for at least 10 min at one time (swimming, running, shaping, hard physical work, etc.).

** - Non-intense physical activity includes motor actions that increase the breathing rate compared to the normal condition and continue for at least 10 min at one time (walking is not included).

Table 3. The energy costs of students for physical activity (MET min / week)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Level of weekly physical activity intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Boys</td>
<td>1183.2±155.3</td>
</tr>
<tr>
<td>Girls</td>
<td>878.7±67.2</td>
</tr>
<tr>
<td>Reliability (p)</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>
The evaluation of the motor tests results in girls with different levels of weekly motor activity is presented in Table 5. There are no significant differences between the results of all tests in girls with low and average levels of weekly physical activity (p> 0.05). Girls with low levels of physical activity showed the worst results in 6 motor tests, compared to other female students (p <0.05). In girls with high levels of physical activity, the results of motor tests (coordination abilities, the strength of the muscles of the upper limbs and abdominal muscles) were higher, compared with the results of girls with average level (p <0.05).

**Discussion**

It was found that the number of days of intensive physical activity exercises in boys was 16.9% more per week than in girls (p <0.05, Table 2). In this case, all students spent daily less than 1 hour on intensive physical activity. The daily intense physical activity in boys was 15.1% longer than in girls (p <0.05). The total intensive weekly physical activity of boys and girls was 2.46 and 1.83 hours, respectively. The indicators of weekly intensive physical activity of students are much higher.
in comparison with the results of students from another region of Russia (Surgut) with daily physical activity of 63 min per week [24]; in Swedish youths with daily physical activity of 23 min [41].

In boys, the number of training days per week with non-intensive physical activity increased by 9.9% than in girls (p>0.05). Daily non-intense physical activity of boys was 19.9% higher than that in girls. Weekly non-intense physical activity was 3.73 hours in boys and 2.69 hours in girls (p<0.05). The results of our data do not differ from the indicators of the weekly volume of non-intensive physical activity of students in Surgut, Russia [24].

The total intensive and non-intensive weekly motor activity in boys was 6.2 hours (372 min). This corresponds to the standard volume (6 hours) of performing weekly motor activity [33] and WHO recommendation [36]. The total motor activity of female students (intensive and non-intensive) was 4.5 hours (271.6 min per week), which is confirmed in researches in Russia [24] and foreign countries [41, 53-55]. Analysis of the results of our studies showed that the number of boys involved in sports is more than girls.

The students’ division by physical activity levels, considering the values of MET, allows identifying students with hypodynamia and to carry out purposeful work among them to increase motivation to motor activity.

Conducted pedagogical research shows that the physical activity of boys is higher than girls. Gender differences in physical activity have been noted by researchers in Russia [24] and foreign countries [41, 53-55]. Analysis of the results of our studies showed that the daily and weekly total physical activity of boys is significantly higher than in girls. This is explained by girls sitting upright for a long period (Table 2). The survey showed that the number of boys involved in sports is more than girls.

Students respond positively to the importance of physical activity in the daily activities of youth. More than 30% of students regularly take part in sports groups, 24% do morning exercises, 22% do skiing, 36% cycle, 18% attend fitness clubs. The results of our research indicate a high physical activity of senior students after completion of training in the program of physical education at the university. The result of increasing students’ motivation to motor activity is the purposeful work of the pedagogical staff of the Physical Education Department. This

<table>
<thead>
<tr>
<th>Motor tests</th>
<th>Level of weekly physical activity intensity</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (n=37)</td>
<td>Average (n=36)</td>
</tr>
<tr>
<td>5×10 m shuttle test, sec;</td>
<td>21.8±0.3</td>
<td>21.7±0.2</td>
</tr>
<tr>
<td>100 m, sec</td>
<td>17.6±0.2</td>
<td>17.69±0.6</td>
</tr>
<tr>
<td>1000 m, min, sec</td>
<td>5.55±0.07</td>
<td>5.53±0.05</td>
</tr>
<tr>
<td>Cadence Push-Up Test, quantity of times;</td>
<td>37.9±0.26</td>
<td>38.5±0.25</td>
</tr>
<tr>
<td>Eurofit Sit Up Test (for 30 sec.), quantity of times;</td>
<td>21.5±0.17</td>
<td>21.8±0.19</td>
</tr>
<tr>
<td>Seated Forward Bend, cm;</td>
<td>15.9±0.16</td>
<td>15.8±0.15</td>
</tr>
<tr>
<td>Standing Long Jump Test (Broad Jump), cm;</td>
<td>168.8±21</td>
<td>169.2±2.2</td>
</tr>
</tbody>
</table>

Table 5. The results of girls’ motor tests (M ± m)
contributes to the development of students’ research competence to carry out practical projects of sports competitions, festivals, and olympiads. Authors from Altai University (Russia) [56], Grodno (Belarus) [57], China [58, 59], Romania and Spain [60-62] report an increase in students’ interest in physical education in the last 10 years.

The evaluation of the tests’ results of the physical preparedness of the senior students indicates that motor skills are most developed in students with high levels of weekly physical activity. There are reports in the literature on the mutual influence of the volume of motor activity of students, their level of physical preparedness [63, 64] and the body mass index [65-68].

The screening study showed that using the IPAQ-SF questionnaire allowed determining the volume and intensity of weekly physical activity and the time of inactivity in senior students. The obtained results can be used in the theoretical training of senior courses students to correct their independent physical activity.

Conclusions

After completing the course on the subject “Elective Courses in Physical Culture and Sports”, the physical activity of the university’s senior students continues to be quite high.

The intensive and non-intensive weekly motor activity is following the WHO recommendation for the optimal level of motor activity in senior courses students at the technical university. In this case, the boys’ total weekly intensive and non-intensive physical activity is more than in girls. Among the surveyed population, 23.4% of students have low levels of physical activity, MET, motor skills. It is a marker of the risk of developing non-communicable diseases of the body.

Teachers of the Physical Education Department in junior courses should divide students into groups according to MET with one risk group for the development of non-communicable diseases; use innovative methods to increase students’ motivation for the self-motor activity.

We suppose that further study of the features of the range of physical activity of students is a promising direction in the prevention of hypodynamia and health-promoting future specialists.

Confict of interest

The authors declare no conflict of interest.

References


12. Sukharev AG. The concept of strengthening the health of children and adolescents in Russia. Healthy children of Russia in the XXI century. Moscow: Russia; 2009. (In Russian)


15. Gorelov AA, Tretiakov AA. Nervous-emotional tension and methods to increase students’ resilience to its effects. Belgorod, Russia: CPI “Politica,” 2012. (In Russian)


18. Di Battista R, Robazza C, Ruiz MC, Bertollo M, Vitali F, Bortoli...


47. Interdepartmental strategy for the formation of a healthy lifestyle, prevention and control of noncommunicable diseases for the period up to 2025. Moscow; 2016. (In Russian)


