

Assessment of emotional state and mental activity of 15-16 year-old boys and girls who had a low level of physical activity

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Abstract. The paper presents the results of assessing the emotional state, mental activity, and the level of physical activity in 15-16 year-old boys and girls. The validity and significance of the obtained results and conclusions were ensured by the choice of the research methods as follows: theoretical analysis and generalization of the data of scientific and methodological literature, psychological methods, methods for assessing physical activity (Framingham Physical Activity Index), and methods of mathematical statistics. The study involved 99 students, of which 50 students were 15 year-old and 49 students were 16 year-old. The obtained results indicate the relevance of the chosen area of research. Among the 15-16 year-old boys and girls, no persons were found with a high level of emotional state. For boys aged 15 to 16 years, the total score for emotional state was equal to 6.5-6.7 points, thus indicating a good state. For girls aged 15 to 16 years, the total score for emotional state was 5.8 points, thus indicating a worsened state. According to the results of the analysis of mental activity indicators, it was found that 15.6% (n = 5) of boys and 11.8% (n = 2) girls aged 15 years could not retain in memory any pair of digits and had the short-term memory span of 0.0%. In boys aged 15 to 16 years, short-term memory span was higher than in girls by 7.0% -7.4%, although there was no statistically significant difference ($p>0.05$) between them. The average values of attention span and switching of attentional focus of 15-16 year-old boys and girls indicate a low level of attention and a large number of mistakes made by them. The students aged 15-16 years spent 93.0% - 94.0% of time at a basal, a sedentary, and a slight levels of activity. They spent about 6.0-7.0% of time engaging in moderate and heavy physical activity. There was no statistically significant difference ($p>0.05$) between boys and girls in the distribution by physical activity levels. The results obtained should be taken into account when developing programs of health-enhancing and recreation classes for high school students.

Key words: emotional state, mental activity, physical activity, boys and girls.

Introduction

An intensive educational process, on the one hand, and a significant reduction in physical activity, cannot but affect the emotional state and mental activity of students (Perekopskyi, 2016; Kashuba et al, 2017). Emotional state is an important factor affecting the daily life of an individual; it can increase the tone and general health status or conversely can lower it. Emotional state can influence the success of educational activity. The human body, where all the elements are interrelated and interact with each other, are largely under the control of the nervous system (Moseychuk et al, 2018). Therefore, the emotional state affects the functioning of the cardiovascular, respiratory, and immune systems (Korobeynikov et al, 2018). One of the main indicators of the functional state of the mental sphere is the mental activity. Its high level is one of the main indicators of mental health and functional state of the body as a whole (Kokun et al, 2018).

In a modern educational environment, the students' preparedness for mental activity is of great importance. For the purpose of studying the mental activity with the involvement of psychical functions is divided as follows: intellectual, emotional, personal, and motivational activities (Korobeynikov, 2008). The actual development of all cognitive functions of an individual, in particular thinking, memory, attention, and perception, ends in adolescence. However, throughout the life of a person they continue to improve, or conversely, there may be a negative dynamics (Bezrukykh, 2005; Andrieieva et al, 2017; Andrieieva et al, 2018). The relevance of our study is due to the fact that the issues related to studying of the emotional state and mental activity of 15-16 year-old boys and girls who had a low level of physical activity still remain insufficiently investigated at the present stage.

Materials and Methods

The study was conducted at the Lviv regional center of local lore, excursions, and tourism for students. The study involved 50 students aged 15 years (33 boys and 17 girls) and 49 students aged 16 years (34 boys and

15 girls). To assess the daily volume of physical activity of boys and girls aged 15-16 years, we used the Framingham Physical Activity Index (Davidenko, 1999). To assess the information processing abilities, we used the ESAP test (The European Survey on Aging protocol). The used test was recommended by the European Federation of Psychologists' Associations after the evaluation of a pilot study "EXCELSA-Pilot" performed in the EU countries and Ukraine during 1998-2001 (Korobeynikov, 2001). This test is based on a modified version of Wexler scale (Galan, 2009). To measure self-efficacy, we used the General Self-Efficacy (GSE) scale of R. Schwarzer and M. Jerusalem. To assess the emotional state the test of American psychologists A. Wessman and D. Ricks was used. When studying attention span, we used the number ordering test designed for assessing the function of attention distribution and switching.

Results

The volume of physical activity of school students depends on many physiological, socio-economic, domestic, psychological, and other factors, such as age, gender, body type, physical fitness, motivation for physical activity, lifestyle, geographical and climatic conditions, the amount of free time and the way a person spend it, accessibility of sports facilities, etc. (Andrieieva, 2015)

The data of the assessment of daily volume of physical activity are presented in tables 1 and 2.

Table 1. Indicators of physical activity of boys and girls aged 15 years (n = 50)

Level of physical activity	Boys (n=33)		Girls (n=17)	
	Duration, min	Proportion in %	Duration, min	Proportion in %
Basal level of activity	549.6	38.2	551.4	38.3
Sedentary level of activity	509.0	35.3	528.6	36.7
Slight level of activity	279.6	19.4	270.0	18.8
Moderate level of activity	70.8	4.9	62.2	4.3
Heavy level of activity	31.0	2.2	27.8	1.9

The data of the assessment of physical activity of boys and girls aged 15 years showed the prevalence of physical activity at a basal and a sedentary levels. The basal level of activity includes the sleep and rest in a lying position. The boys spent an average of 549.6 minutes at a basal level of physical activity that is 38.2% of the total day time, while the 15 year-old girls spent an average of 551.4 minutes at this level of activity that is 38.3% of the total day time. The sedentary level includes the following activities: traveling on public transport, reading, watching TV, playing tabletop and computer games, eating, and making homework. The 15 year-old boys spent an average of 509.0 minutes at a sedentary level of physical activity and the girls spent 528.6 minutes that amounts to 35.3% and 36.7% of the total day time for boys and girls, respectively. The results of our study of physical activity of 15-16 year-old boys and girls confirmed the published data on a low level of physical activity of adolescents at this age.

The slight level of physical activity includes personal hygiene, active standing, walking, and attendance of school classes, except physical education classes. The 15 year-old students spent at this level of activity an average of 279.6 minutes for boys and 270.0 minutes for girls. The boys and girls spent at a slight level activity 19.4% and 18.8% of the total day time, respectively. The reported data indicate a large amount of the educational load.

The moderate level of physical activity includes household chores, walking, and doing morning gymnastics. The 15 year-old boys spent an average of 70.8 minutes at a sedentary level of physical activity and the girls spent 62.2 minutes that amounts to 4.9% and 4.3% of the total day time for boys and girls, respectively.

The heavy level of physical activity includes participation in organized sports activities, organized classes of physical exercises, sports, and active games. The 15 year-old boys and girls spent an average of 31.0 and 27.8 minutes at this level of activity, respectively. This amounts 2.2% and 1.9% of the total day time for boys and girls, respectively.

Table 2. Indicators of physical activity of boys and girls aged 16 years (n = 50)

Level of physical activity	Boys (n=34)		Girls (n=15)	
	Duration, min	Proportion in %	Duration, min	Proportion in %
Basal level of activity	558.0	38.8	556.8	38.7
Sedentary level of activity	546.6	38.0	549.6	38.2
Slight level of activity	244.8	17.0	251.2	17.4
Moderate level of activity	58.7	4.1	56.4	3.9
Heavy level of activity	31.9	2.2	26.0	1.8

When assessing the physical activity of boys and girls aged 16 years, the predominance of activity at the baseline and sedentary levels was found compared to activity at other levels. The boys spent an average of 558.0 min (38.8%) and 546.6 min (38.0%), and girls spent 556.8 min (37.8%) and 549.6 min (38.2%) at these levels of physical activity, respectively. The boys spent an average of 244.8 and 58.7 minutes at the slight and moderate

levels of physical activity and the girls spent 251.2 and 56.4 minutes that amounts to 17.0% and 4.1% of the total day time for boys and 17.4% and 3.9% for girls, respectively.

The least time 16 year-old boys and girls devote to the heavy level physical activity. The boys and the girls spent at the heavy level of activity only 31.9 and 26.0 minutes, respectively. This amounts for 2.2% and 1.8% of the total day time for boys and girls, respectively. It was found that the students under study had a low level of physical activity. The next stage of the study was the assessment of mental activity of boys and girls aged 15-16 years who had a low level of physical activity. The results are presented in tables 3 and 4.

An analysis of the individual measures of the short-memory span showed that 15.6% (n = 5) of boys could not retain in memory any pair of digits and had the short-term memory span of 0.0%. 11.8% (n=2) of 15 year-old girls could not retain in memory any pair of digits. The maximum values of short-term memory span were 41.7% in boys and 50.0% in girls aged 15 years. The average short-term memory span was 23.6% and 18.6% for 16 year-old boys and girls, respectively. This indicator showed a high variation among students. The coefficients of variation ranged from 44.1% to 66.4%. This feature indicates the heterogeneity of the sample. An analysis of the results of information processing assessment indicates that 15 year-old girls have statistically significant higher (p <0.05) averages than the boys of the same age. There was a high variation of this indicator among boys and girls aged 15 years. The coefficients of variation were higher than 14.6% that indicates the heterogeneity of the sample.

Girls aged 16 years also had statistically significant higher (p <0.05) averages of information processing measures than the 16 year-old boys. The variation was high only in boys (coefficient of variation was 22.8%) that indicates the heterogeneity of the sample.

Table 3. Averages of the indicators of cognitive functions for boys and girls aged 15 years (n = 50)

Indicator	\bar{x}	S	Me	25 %	75 %	V, %
Boys (n=33)						
Short-term memory span, %	24.4	11.82	25.5	17.9	34.5	48.4
Amount of information processed, bit	235.8	68.42	224.9	184.3	288.0	29.0
Self-efficacy, points	25.9	3.38	25.0	24.0	27.0	13.1
Attention span, points	3.4	2.51	3.0	1.0	5.0	73.8
Number of mistakes made	13.9	6.84	13.0	8.0	19.0	49.2
Tranquility-anxiety, points	7.0	1.42	7.0	6.0	8.0	20.3
Energy-fatigue, points	6.5	1.50	6.0	5.0	8.0	23.1
Elation-depression, points	6.7	1.57	7.0	5.0	8.0	23.4
Self-confidence-inadequacy, points	5.7	1.33	5.0	5.0	7.0	23.3
Girls (n=17)						
Short-term memory span, %	17.7	12.94	16.7	8.3	25.0	73.1
Amount of information processed, bit	318.6	88.15	321.3	312.7	330.0	27.7
Self-efficacy, points	24.8	5.16	24.0	20.5	27.0	20.8
Attention span, points	4.0	1.30	3.9	2.8	5.0	32.5
Number of mistakes made	12.9	4.22	12.9	9.0	15.4	32.7
Tranquility-anxiety, points	6.3	1.65	6.0	5.0	7.0	26.2
Energy-fatigue, points	5.3	1.65	5.0	5.0	6.0	31.1
Elation-depression, points	6.0	1.27	6.0	6.0	6.0	21.2
Self-confidence-inadequacy, points	5.8	2.27	6.0	4.0	7.0	39.1

To measure self-efficacy, we used the GSE scale of R. Schwarzer and M. Jerusalem, which enables assessing the potential ability of a person to organize and carry out the activity necessary to achieve a certain goal.

To the item "I can always manage to solve difficult problems if I try hard enough", 42.4% (n = 14) of boys and 47.1% (n = 8) of girls aged 15 years made the "not at all true" response. The "hardly true" response was given by 21.2% (n = 7) of boys and 17.6% (n = 3) of girls aged 15 years. To this statement, the "hardly true" answer was given by 38.2 % (n=13) of boys and 46.7% (n=7) of girls aged 16 years. Moreover, 17.6% (n=6) of boys and 13.3% (n=2) of girls aged 16 years made the "not at all true" response. Only 18.2% (n=6) of boys and 23.5% (n=4) of girls aged 15 years, and 26.5% (n=9) of boys and 20.0% (n=3) of girls age 16 years made the "moderately true" response. The "exactly true" response was made by 18.2% (n=6) of boys and 13.3% (n=2) of girls aged 15 years, and 17.6% (n=6) of boys and 20.0% (n=3) of girls aged 16 years.

Therefore, the vast majority of boys and girls aged 15-16 years do not always find solutions to complex problems. In our opinion, this is due to lack of self-confidence as well as insufficient knowledge and skills.

To the item "If someone opposes me, I can find the means and ways to get what I want", the "not at all true" response was given by 12.1% (n=4) of boys and 11.8% (n=2) of girls aged 15 years, and 8.8% (n=3) of boys and 13.3% (n=2) of girls aged 16 years. The "hardly true" response was made by 27.3% (n=9) of boys and 23.5% (n=4) of girls aged 15 years, and 29.4% (n=10) of boys and 26.7% (n=4) of girls aged 16 years. The

“moderately true” response was given by 30.3% (n=10) of boys and 29.4% (n=5) of girls aged 15 years, and 32.4% (n=11) of boys and 26.7% (n=4) of girls aged 16 years. The “exactly true” response was made by 30.3% (n=10) of boys and 35.3% (n=6) of girls aged 15 years, and 29.4% (n=10) of boys and 33.3% (n=5) of girls aged 16 years.

The results show that most 15-16 year-old boys and girls have a good potential for gaining new knowledge, skills, and abilities, which will contribute to the achievement of a goal.

To the item “It is easy for me to stick to my aims and accomplish my goals”, the “not at all true” response was given by 36.4% (n=12) of boys and 29.4% (n=5) of girls aged 15 years, and by 32.4% (n=11) of boys and 33.3% (n=5) of girls aged 16 years. The “hardly true” response was done by 24.2% (n=8) of boys and 29.4% (n=5) of girls aged 15 years, and 23.5% (n=8) of boys and 26.7% (n=4) of girls aged 16 years. The “moderately true” response was done by 27.3% (n=9) of boys and 23.5% (n=4) of girls aged 15 years, and 26.5% (n=9) of boys and 26.7% (n=4) of girls aged 16 years. The “exactly true” response was given by 12.1% (n=4) of boys and 17.6% (n=3) of girls aged 15 years, and 17.6% (n=6) of boys and 13.3% (n=2) of girls aged 16 years.

Thus, the results indicate that the majority of 15-16 year-old boys and girls cannot easily achieve their goals. This again indicates the lack of necessary experience, knowledge, and skills. Furthermore, this can testify to the inability to properly plan the day and to rationally use time.

To the item “I am confident that I could deal efficiently with unexpected events”, the “not at all true” response was given by 9.1% (n=3) of boys and 11.8% (n=2) of girls aged 15 years, and 5.9% (n=2) of boys and 20.0% (n=3) of girls aged 16 years. The “hardly true” response was made by 18.2% (n=6) of boys and 17.6% (n=3) of girls aged 15 years, and 20.6% (n=7) of boys and 20.0% (n=6) of girls aged 16 years. The “moderately true” response was given by 60.6% (n=20) of boys and 41.2% (n=7) of girls aged 15 years, and 61.8% (n=21) of boys and 46.7% (n=7) of girls aged 16 years. The other 15-16 year-old boys and girls made the “exactly true” response.

Therefore, the scores of most boys and girls aged 15-16 years indicate that they have the necessary theoretical background for proper handling in a difficult situation.

To the statements “I am confident that I could deal efficiently with unexpected events” and “I can solve most problems if I invest the necessary effort”, the “moderately true” response was given by: 69.7% (n=23) of boys and 64.7% (n=11) of girls aged 15 years, and 73.5% (n=25) of boys and 73.3% (n=11) of girls aged 16 years. The other 15-16 year-old boys and girls made the “exactly true” response.

The results indicate that the boys and girls aged 15-16 years were confident in their abilities. They have a complete understanding of the need to make efforts to solve any problem.

To the other of the items, which pose the questions of solving difficulties and problems as well as the ability to manage a situation, the vast majority of the boys and girls aged 15-16 years made negative responses. This may indicate a lack of life experience; the boys and girls lacked confidence in their abilities and the in the ability to make decisions on their own.

The average results obtained during the study indicate that boys and girls aged 15-16 years show an average level of self-efficacy.

The average values of attention span and switching of attentional focus of 15 year-old boys and girls indicate a low level of attention and a large number of mistakes made by them. For 15 year-old girls, the average value of attention distribution and switching was low; almost all girls made a large number of errors in the tests. The coefficients of variation of the attention span and the number of mistakes made by 15 year-old boys and girls ranged from 32.5% to 73.8% that indicates the heterogeneity of the samples.

The average values of attention span and switching of attentional focus of 16 year-old boys and girls indicate a low level of attention. The 16 year-old boys were less attentive than girls and made a large number of mistakes during testing. The coefficients of variation of the attention span and the number of mistakes for 16 year-old boys and girls ranged from 31.5% to 59.5% that indicates the heterogeneity of the samples.

The next stage of our study was the assessment of the students’ emotional state, which consists of many components, including energy and fatigue, tranquility and anxiety, elation and depression, self-confidence and feeling of inadequacy.

An analysis of the results of testing the emotional state of boys aged 15 years revealed that the overwhelming majority of the boys, 27.3% (n = 9), made response “Nothing particularly troubling me. More or less at ease” during testing with “tranquility-anxiety” scale. The other 24.2% (n=8) of the boys claim that they are “Pretty generally secure and free from care”, while 21.2% of the boys (n=7) responded that they are “Exceptional calm, wonderfully secure and care”, and 15.2 % (n=5) of the boys said that they feel “Perfect and complete tranquility. Unshakably secure”. In the 15-year-old group, 12.1% (n=4) of boys made response “Somewhat concerned with minor worries or problems. Slightly ill at ease, a bit troubled”.

During the testing on the “tranquility-anxiety” scale, 35.3% (n=6) of 15-year-old girls responded that they are “Somewhat concerned with minor worries or problems. Slightly ill at ease, a bit troubled”, and 23.5% (n=4) of the girls responded “Nothing particularly troubling me. More or less at ease”. The other 11.8% (n=2) claimed that they are “Exceptional calm, wonderfully secure and care”, and 11.8% (n=2) of girls made response

“Perfect and complete tranquility. Unshakably secure”. There were also negative responses, 5.9% (n=1) of girls said that they are “Experiencing some worry, fear, trouble, or uncertainty. Nervous, jittery, on edge”.

On the scale of “energy-fatigue”, most of 15 year-old boys, 33.3% (n=11), stated that they felt “Fairly fresh. Adequate energy”, while other 21.2% (n=7) claimed that they are “Slightly tired, indolent. Somewhat lacking in energy”. The remaining 15.2% (n=5) of the boys chose response “Great energy and drive”. The most positive responses were in 15.2% (n=5) of the boys who pointed to “Exuberant vitality, tremendous energy, great zest for activity”. 29.4% (n=5) of girls aged 15 years chose response “Slightly tired, indolent. Somewhat lacking in energy”, while the other 29.4% (n=5) claimed that they are “Fairly fresh. Adequate energy”. 11.8% (n=2) of the girls made response “Great energy and drive”. There were also negative responses, 11.8% (n=2) of the girls chose “Great fatigue. Sluggish. Can hardly keep going. Meager resources”, 5.9% (n=1) of the girls said that they are “Tremendously weary. Nearly worn out and practically at a standstill. Almost no resources”, and 5.9% (n=1) of them claimed that they are “Rather tired. Lethargic. Not much energy”.

On the “elation-depression” scale, most of 15 year-old boys, 36.4% (n=12), said they are “Elated and in high spirits”, the remaining 21.2% (n=7) were “Feeling pretty good, ‘O.K.’”, and the other 21.2% (n=7) of the boys made response “Feeling a little bit low. Just so-so”. 9.1% (n=3) of the boys said they felt “Feeling pretty good, ‘O.K.’”, and 6.1% (n=2) of them made response “Spirits low and somewhat ‘blue’”.

64.7% (n=11) of 15-year girls made response “Feeling pretty good, ‘O.K.’”, and 17.6% (n=3) of them chose response “Spirits low and somewhat ‘blue’”. On the “self-confidence vs. feeling of inadequacy” scale, most of 15 year-old boys, 54.5% (n=18) made response “Feel my performance and capabilities somewhat limited”, 21.2% (n=7) chose response “Feel my abilities sufficient and my prospects good”, 15.2% (n=5) of the boys made response “Highly confident of my capabilities”, and 9.1% (n=3) of the boys were “Distressed by weakness and lack of ability”. 23.5% (n=4) of 15 year-old girls chose response “Highly confident of my capabilities”, 17.6% (n = 3) of the girls made response “Feel my performance and capabilities somewhat limited”, the other 17.6% (n=3) of them chose the “Feel fairly adequate” response, and 11.8% (n=2) chose the “Feel my abilities sufficient and my prospects good”, while 11.8% (n=2) of the girls made response “Feel rather inadequate”, the other 11.8% (n=2) of them were “Distressed by weakness and lack of ability”, and 5.9% (n=1) of girls were “Wretched and miserable. Sick of my own incompetence”.

The total score for emotional state amounted to 6.5 points in 15 year-old boys indicating a good state and to 5.8 points in girls aged 15 years indicating a worsened state.

An analysis of the results of testing the emotional state of boys aged 16 years on the “tranquility-anxiety” scale revealed that most of the boys, 29.4% (n=10), felt “Perfect and complete tranquility. Unshakably secure”, 26.5% (n=9) made response “Pretty generally secure and free from care”, and 23.5 (n=8) of the boys chose the “Exceptional calm, wonderfully secure and carefree” response. 20.6% (n=7) of the boys gave response “Somewhat concerned with minor worries or problems. Slightly ill at ease, a bit troubled”.

On the “tranquility-anxiety” scale, 33.3% (n=5) of girls aged 16 years chose the “Nothing particularly troubling me. More or less at ease” response, 26.7% (n=4) of the girls were “Somewhat concerned with minor worries or problems. Slightly ill at ease, a bit troubled”, and the rest of the girls, 20.0% (n=3), made the “Pretty generally secure and free from care” response.

Table 4. Averages of the indicators of cognitive functions for boys and girls aged 16 years (n = 49)

Indicator	\bar{X}	S	Me	25 %	75 %	V, %
Boys (n=34)						
Short-term memory span, %	23.5	10.41	25.0	16.7	33.3	44.1
Amount of information processed, bit	240.6	54.82	234.1	184.3	296.1	22.8
Self-efficacy, points	26.4	3.68	26.2	24.1	27.8	13.9
Attention span, points	4.1	2.44	3.6	2.4	5.9	59.5
Number of mistakes made	14.5	6.76	14.7	9.0	20.0	46.6
Tranquility-anxiety, points	7.2	1.49	7.5	6.5	8.0	20.7
Energy-fatigue, points	6.7	1.60	7.0	5.0	8.0	23.9
Elation-depression, points	7.1	1.47	7.0	6.0	8.0	20.7
Self-confidence-inadequacy, points	5.9	2.43	5.5	4.0	7.0	41.2
Girls (n=15)						
Short-term memory span, %	18.6	12.35	16.7	8.3	25.0	66.4
Amount of information processed, bit	353.8	47.88	330.1	321.5	404.6	13.5
Self-efficacy, points	23.5	1.61	24.0	22.0	25.0	6.9
Attention span, points	4.2	1.57	4.0	3.0	5.0	37.4
Number of mistakes made	9.9	3.12	11.0	8.0	12.0	31.5
Tranquility-anxiety, points	6.1	1.30	6.0	5.0	7.0	21.3
Energy-fatigue, points	5.3	1.23	5.0	5.0	6.0	23.2
Elation-depression, points	6.1	1.87	6.0	5.0	7.0	30.7
Self-confidence-inadequacy, points	5.6	1.59	5.0	5.0	7.0	28.4

On the “energy-fatigue” scale, most of 16 year-old boys, 32.4% (n=11), chose the response “Very fresh, considerable energy”, while the other 26.5% (n=9) of the boys conversely were “Rather tired. Lethargic. Not much energy”, and the rest of the boys, 23.5% (n=8), felt “Great energy and drive”.

Most of 16 year-old girls, 40.0% (n=6), chose response “Slightly tired, indolent. Somewhat lacking in energy”. In contrast, the other 26.7% (n=4) of the girls made the “Fairly fresh. Adequate energy” response. 13.3% (n=3) of the girls chose response “Rather tired. Lethargic. Not much energy”.

On the “elation-depression” scale, most of 16 year-old boys, 32.4% (n=11), said they are “Feeling very good and cheerful”, 23.5% (n=8) were “Elated and in high spirits”, and the remaining 23.5% (n=8) of the boys made response “Feeling pretty good, ‘O.K.’”. 8.8% (n=3) of the boys gave response “Spirits low and somewhat ‘blue’”.

For 16 year-old girls, 26.7% (n=4) of responses were “Feeling pretty good, ‘O.K.’”, 20.0% (n=3) of responses were “Feeling very good and cheerful”, 13.3% (n=2) of the girls chose the response “Feeling a little bit low. Just so-so”, and 13.3% (n=2) of the girls answered “Depressed and feeling very low. Definitely ‘blue’”.

On the scale “self-confidence vs. feeling of inadequacy”, 26.5% (n=9) of 16 year old boys chose the response “Feel my abilities sufficient and my prospects good”, in contrast 17.6% (n=6) of the boys answered “Feel my performance and capabilities somewhat limited”, and the remaining 17.6% (n=6) gave response “Feel rather inadequate”. Some of the boys gave the negative responses: 8.8% (n=3) of them chose response “Distressed by my weakness and lack of ability”, and the remaining 8.8% (n=3) answered “Wretched and miserable. Sick of my own incompetence”. 8.8% (n=3) of the boys answered “Nothing is impossible to me. Can do anything I want”. Girls aged 15 years gave on the scale “self-confidence vs. feeling of inadequacy” the following responses: 40.0% (n=6) chose response “Feel my performance and capabilities somewhat limited”, 13.3% (n=2) answered “Feel my abilities sufficient and my prospects good”, 13.3% (n=2) gave response “Feel fairly adequate” response, the other 13.3% (n=2) made response “Feel rather inadequate”, and the remaining 6.7% (n=1) were “Highly confident of their capabilities”.

The total score for emotional state amounted to 6.7 points for 16 year-old boys indicating a good state and to 5.8 points for 16 year-old girls indicating a worsened state. In our opinion, the negative responses, which are often found in 15-16 year-old boys and girls when evaluating the emotional state, may indicate a chronic mental overstrain due to mental and daily activities. The analysis of the results showed a high variability of the studied parameters in all gender and age groups. The coefficients of variation were higher than 14.6%, thus indicating the heterogeneity of the samples.

Discussion

The study of the influence of physical activity on the emotional and cognitive status is very relevant at the moment. An important feature of emotions is their direct connection with the increase or decrease in the functional activity of the body. According to Reva (2002), the emotional state of boys and girls aged 15-16 years is negatively affected by the following factors: an increase in the intensity of the information flow, a growth in the number of activities, the actualization of the need for professional self-identification, an increase in personal responsibility for the success of the learning activity, an increase in intellectual load, and aggravation of hypokinesia. According to researchers, girls aged 15-16 years are in a worse emotional state than boys of the same age. This is an important cause for concern of teachers and parents, because the emotional state is one of the determining elements of motivation in life. It is commonly believed that proper physical activity positively affects the emotional state of school students, giving emotional comfort, emotions of pleasure, and emotional well-being. Scientists have identified the negative impact of the educational load and hypokinesia on the psycho-emotional state of students, such as general well-being, activity, and mood that is particularly notable at the end of the school year.

Scientific researches show that there is a significant decrease in physical activity observed in adolescence on the background of a decrease in interest in physical education classes at school, an increase in class time, and a negative attitude to physical exercise in general. Our findings are consistent with those of other authors and show that the level of physical activity of most students is below the physiological norm. The results extend the previous knowledge about the structure and volume of physical activity of current school students (Blahii et al, 2018). The study confirms the earlier observations, which showed the low level of physical activity of school students, especially of senior school students (Yarmak et al, 2018). A low level of physical activity negatively affects mental activity of a person, in particular, short-term memory (Erickson, 2011), speed and amount of information processing (Korobeynikov, 2017; Blahii et al, 2018), and the emotional state (Andrieieva, 2015). Kuzminsky (2005) believed that a low level of physical activity causes a decrease in the functioning of motion analyzers that impacts overall mental activity. This influence is manifested in the following symptoms: drowsiness, slackness, irritability, insomnia, lack of appetite, deterioration of mood, a decrease in emotional stability, mental and physical performance, fatigue, and sometimes thought disorder. Modern research data on physical activity at different emotional states demonstrate the high level of research on psychological reliability of athletes (Korobeynikov, 2018), anxiety in schoolchildren (Galan et al, 2018; Kashuba et al, 2018), and assessment of social and psychological adaptation of students (Boichuk, 2008; Slobozhaninov, 2018). The

analysis of the studies in this area revealed the effectiveness of the influence of physical activity on the cognitive functions of school students, in particular on their mental performance. Scientists associate the problem of acquisition of new knowledge by high school students with a decrease in adaptive capacities, which takes place against the background of increased emotional stresses and the need to acquire a large amount of new information in conditions of hypokinesia.

Our research expands the data on the lack of cognitive development in high school students with a low level of physical activity (Galan, 2018; Moseychuk et al, 2018). Positive emotional environment determines psychophysiological capabilities of a person, therefore an increase in physical activity of school students will favor the formation of positive emotions and increase of mental performance of school students. One of the conditions for the development and improvement of the mechanisms of adaptation to mental loads is physical activity, which can act as an optimizing factor, and, in case of its inappropriate use, as a maladaptive factor (Kokun et al, 2018). Physical loads cause changes in various functions of the body, affect mental performance, attention, operative thinking, and the amount of processed information (Bezrukikh et al, 2005; Korobeynikov et al, 2013). The properly selected regimen of physical activity positively affects the mental processes and the development of mental resistance to intense intellectual activity. It is established that the short-term effect of physical exercises is caused by an increase in the flow of proprioceptive impulses from contracting muscles into the brain that leads to its activation and manifests itself in maintaining of the mental working capacity of high school students for a long period of time. On the other hand, the long-term effect of physical activity on mental performance is due to the increased coordination of function of the body's physiological systems (Bezrukikh et al, 2005; Korobeynikov et al, 2013). The studies also show that moderate physical activity contributes to improving the effectiveness of solving cognitive tasks of a low complexity level; furthermore, the moderate-intensity exercise provides a greater effect than the low-intensity ones. The effectiveness of the solution of the tasks of high level of complexity, on the contrary, decreases after physical activity, and the degree of the decrease is also proportional to the level of the exercise intensity (Boichuk, 2008; Perekopsky, 2016). All this suggests that the effect of physical activity on cognitive ability depends equally on the intensity of the exercise and the nature of the tasks to be solved. The directed influence of physical exercises of proper duration and intensity, taking into account the individual characteristics of the physical and emotional state of senior school students, contributes to increasing of their mental working capacity.

Conclusions

Despite the considerable interest of scientists in the problem of improving the health of school-age children and adolescents, most studies are concerned with improving physical fitness, while the approaches to improving the psycho-emotional state and mental performance of pupils with a low level of physical activity have been insufficiently studied. Taking into account the significant increase in the duration of static and informational forms of educational load during the school year, it was important to determine the volume of physical activity of high school students. The data of the assessment of physical activity of boys and girls aged 15-16 years show the prevalence of physical activity at a basal and a sedentary levels. The duration of heavy and moderate physical activity of 15-16 year-old girls is shorter compared to the boys, but no significant difference was found in the distribution by physical activity levels between boys and girls ($p > 0.05$). The deficit of organized physical activity of high school students is on average 35-40% of the physiological norm.

It was found that improper physical activity negatively affects the psycho-emotional state and mental performance of high school students. The data of the assessment of intellectual activity, in particular, short-term memory, attention, and the amount of information processing in boys and girls aged 15-16 years lead to the conclusion that the overwhelming majority of students showed low performance, although there was a positive dynamics of the assessment results, which have improved with age. Girls aged 15-16 years had statistically significant higher ($p < 0.05$) averages of information processing measures than the 15-16 year-old boys. The analysis of the emotional state of boys and girls aged 15-16 years indicates a chronic mental overstrain due to neuro-emotional overload resulted from intellectual activity, deviation from a daily routine of work and rest, and insufficient physical activity. Thus, the assessment of the indicators of the emotional state and mental activity of students with a low level of physical activity indicates a significant decrease of these indicators compared with their peers without a deficit of physical activity. The above-mentioned highlights the necessity and utility of developing available and attractive health-enhancing programs aimed at increasing physical activity level of school students.

Conflict of interests

The authors declare that there is no conflict of interests.

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