

Analysis of the parameter changes of students' physical development (at the age of 18–20) to identify the threat of increased body weight and obesity

ALEKSANDER OSIPOV^{1,2,4}, SERGII IERMAKOV⁶, VIKTOR GRUZINKY¹, MIKHAIL KUDRYAVTSEV^{1,3,4,5}, ALEXANDER BLIZNEVSKY¹, VALENTINA BLIZNEVSKAYA¹, ZHANNA SERZHANOVA³, VLADIMIR KUZMIN¹, TATYANA ZHAVNER¹, ANNA VAPAEVA¹, KONSTANTIN MARKOV⁷, ELENA KONDRASHOVA³

¹Siberian Federal University, Krasnoyarsk, RUSSIA

²Professor V. F. Voino-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, RUSSIA

³Reshetnev Siberian State University of Science and Technology, Krasnoyarsk, RUSSIA

⁴Siberian Law Institute of the Ministry of Internal Affairs of the Russian Federation, Krasnoyarsk, RUSSIA

⁵Krasnoyarsk State Pedagogical University named after V.P. Astafyev, Krasnoyarsk, RUSSIA

⁶National Research University Belgorod State University, RUSSIA

⁷Irkutsk National Research Technical University, RUSSIA

Published online: June 30, 2018

(Accepted for publication May 21, 2018)

DOI:10.7752/jpes.2018.02118

Abstract:

Recently, there has been an increase in the number of young people who are overweight and obese reaching the scale of a global epidemic. Besides, the scientists have recorded a significant increase in the body weights of the students during their study years. One of the reasons for this phenomenon may be a lack of knowledge by innovative students about the risks of developing obesity and related chronic diseases. There is a need for comprehensive and long-term research to increase students' knowledge of the problems associated with developing obesity. In any case it is necessary to make an objective assessment of the physical development level of students, their physical activity level, their everyday lifestyle and food quality. Therefore in this study, we analyzed and evaluated the changes of the physical development and health parameters of the students from the Siberian federal university (SFU) over a long time period (2002–2014). **Material & methods:** Meanwhile, annually 800 students of the 1-3 courses of the SFU selected at random and took part in the study. Half of the examined students were the boys (n=400) and the other half were the girls (n=400). Moreover, both the boys and girls were allocated into two equal groups. It is important to note that there were the groups: male-1 (n=200) and female-1 (n=200) who were relatively healthy students. There were the groups: male-2 (n=200) and female-2 (n=200) where the students were with various diseases. An important point is that the age of the researched students is between 18-20 years. The main parameters of the study included the body weighing of the young people indicating their growth and the restoration time of the functional systems of the body after the load test (A. Martinet test). All in all the authors' opinion is that the values of these parameters will allow giving an objective assessment of the presence or absence of a threat of developing obesity and overweight among the students. **Results:** The obtained data allow to come to a conclusion about the significant increase ($P < 0.01$) in the average body weight of the students in the groups male-1 and male-2 for the period from 2002 to 2014. On average, the body weight of the students increased by 6 ± 0.4 kg. It makes sense that in the groups of girls there were female-1 and female-2 and minor fluctuations of body weight were discovered during quite a long period from 2006 to 2014. In addition, the evolution of the growth values of the students was mixed among the boys - male-1 in different periods of the research. Besides, the boys who are the male-2 revealed a significant increase ($P < 0.01$) in the average growth of young people from 177 ± 0.5 cm in 2002 to 180 ± 0.2 cm in 2014. In fact, the dynamics of growth in the groups of girls who were female-1 and female-2 was mixed in different periods of the research. The average growth rates among the girls of both groups were found within the range of 2 ± 0.3 cm. In a word, the indices of the recovery interval of the students' body after the test load allowed us to distinguish 2 main periods. It is known that there were the groups of boys who were male-1 and male-2 showed a reduction in the parameters of recovery time during the time period from 2002 to 2004. Further there was found significant dynamics ($P < 0.01$) of the gradual increase in the recovery period after the load. Concerning the groups of girls there were female-1 and female-2 showed a reduction in time values of recovery in the period from 2002 to 2006. Further there is significant dynamics ($P < 0.01$) of the particular increase in time parameters. **Conclusions:** Actually, the results of the research indicate the significant risk of increase of overweight and obesity among the male students. It turned out that the negative dynamics of a significant increase of the average body weight among young men during the period of research was revealed. In a word, the young women students have not identified the threats to a significant increase of the body weight. At the same time in all the studied groups the

negative dynamics of increase in the recovery time of the functional systems of the organism after the load test was fulfilled and it was found in the period from 2006 to 2014. It is not surprising that the data let us suggest that there is the decrease in the level of physical preparedness of the students (boys and girls) within the specified time period.

Key words: health of students; problems of excess body weight; obesity; physical development; data collection and analysis; changes in body weight; health protection of students.

Introduction

As a matter of fact, the specialists know about the significant correlations between the parameters of physical health of the students and their level of academic achievement (Xiang Gu, Jackson, et al., 2017; Ansari, & Stock, 2010). But other than that, it is proven that the physical activity is a necessary condition to increase the level of educational achievements of young people (Santana, Azevedo, Cattuzzo, et al., 2017). It has also been found that a healthy lifestyle for the students which primarily implies a healthy diet and regular physical activity is a protective factor that counteracts the emergence and development of many diseases (Korn, Gonen, Shaked, et al., 2013). It may seem that the experts include such diseases as various types of cancer, cardiometabolic diseases, obesity, hypertension and a number of other diseases (Mokdad, Marks, Stroup, et al., 2005). Unfortunately, the modern accents in the physical education of youth and education in general have shifted significantly from the tasks associated with raising the level of health of the students to the tasks of ensuring the daily functioning of the organism in a normal state (Bebcakova, Vadasova, Kacur, et al., 2015). It turned out that a negative impact on the physical health of young people provides the level of urbanization (Ujević, Sporis, Milanović, et al., 2013). According to the experts, in recent years there is a certain human environment with an excessive amount of factors that negatively affect young people's health (Bocarro, Kanters, Cerin, et al., 2012). In addition, a significant decrease in the level of physical activity, and as a result, the spread of overweight and obesity among the adolescents and young people living in the cities of India as notes M. Hoque (Hoque, Doi, Mannan, et al., 2014).

In recent years, the scientists have noted a significant increase in the number of young people including the students who are overweight or obese (Osipov, Kudryavtsev, Gruzinky, et al., 2017; Gaetano, 2016; Peshkov, & Sharaykina, 2014). Meanwhile, the research data show that the development of obesity among the young people affected almost all countries in the world in recent years. Frankly speaking, one third of the children and adolescents in Cyprus are overweight and has various stages of obesity (Grammatikopoulou, Kotanidou, Markaki, et al., 2014). The development of obesity in young people today is the main threat to public health in the Republic of Bangladesh (Biswas, Islam, Islam, et al., 2017). The prevalence of overweight and various stages of obesity among young people in the Balearic Islands reaches 20% (Muntaner-Mas, Vidal-Conti, Cantallops, et al., 2017). It was revealed that during the training many students of universities and colleges receive a serious increase in weight, which can lead to significant problems in their health (Gowin, Cheney, Gwin, et al., 2015). There is also a series of studies showing the relationship between the development of obesity and the decline in academic achievement in students (Santana, Hill, Azevedo, et al., 2017). By the way, it was revealed that with increasing body weight students begin to suffer from lack of physical activity and mental well-being (de Vos, Hanck, Neisingh, et al., 2015). The reasons for the obesity development of the young people are different, but one of the main reasons is the lack of daily physical activity of the modern schoolchildren and students (Lazareva, Aravitska, Andrieieva, et al., 2017). We must admit that there is a significant risk that young people with excessive body mass will have the development of obesity in the future. In addition, the experts recommend involving the young people in physical activity as a key behavioral goal of the successful prevention of obesity (Stankov, Olds, & Cargo, 2012).

Firstly, the development of obesity has a significant negative impact on the likelihood of developing cardiovascular diseases and adversely affects the quality of people's life his or her physical and social well-being. In recent years the development of obesity among the youth has reached the epidemic proportions. Next 10 years according to forecasts of the specialists the number of people diagnosed with obesity will increase by 40% unless effective measures are taken in the field of health (Kovesdy, Furth, & Zoccali, 2017). In other words, the strategies are needed to improve the quality of healthy eating and physical activity of young people to prevent the spread of obesity (Kumanyika, Obarzanek, Stettler, et al., 2008). Moreover, it has been revealed that the majority of student youth do not receive crucial for the daily level of physical activity to enhance their physical health: 60 minutes a day or more. At the same time, it is estimated that the adolescents and young people spend on average 7 hours or more per day at screens of smart-phones and computer devices (Kudryavtsev, Kramida, & Osipov, 2016; Martin, Ameluxen-Coleman, & Heinrichs, 2015). The scientists believe that there are two main objectives which health professionals have to solve today: a significant increase in the level of daily physical activity and a significant reduction of time that young people spend at screens of computer monitors (D Abundo, M., Sidman, C., Fiala, K., et al., 2015). The health of today's youth including University students is an urgent task of the modern society. The students represent themselves the intellectual and economic development potential of any state (Artyukhov, & Kaskaeva, 2014). It is important to note that the

special research is required on the dynamics of changes in body weight of the students during their educational period for effective actions on the health care of young people and the prevention of obesity development (Wang & Fu, 2017).

In order to improve the effectiveness of youth health measures it is necessary to collect and analyze objective data on the state of physical development and health of young people at certain time periods (Fernandez Alonso, Gutierrez Sanchez, & Pino Juste, 2012). Actually, there should be studied a sufficient amount of sample of the studied young people over sufficiently long time periods to improve the quality of data reliability. From time to time, the major educational institutions such as federal universities are suitable to organize and conduct the research of such kind. As a result these universities are characterized by a significant base for the research and data collection: laboratories, qualified medical personnel and a large number of the students. In such conditions it is possible to gather objective data about the physical condition and physical potential of the students. R. Plotnikoff argues that the student body is an ideal object for conducting activities aimed at improving health. In the environment of universities and campus the students are among the modern scientific research, qualified pedagogical and medical workers who creates the perfect environment to raise the level of students' health (Plotnikoff, Costigan, Williams, et al., 2015). The experts say that universities can be the bases for the successful resolution of problems associated with incorrect perceptions of the students about physical health and ideal body weight (Mikolajczyk, Maxwell, Ansari, et al., 2010). According to J. Jakicic there is a need to study the required amount of daily physical activity which prevents the development of obesity. In addition, the impact of physical activity should be considered on long-term regulation of the body weight (Jakicic, 2009).

All in all, the conduct of such studies with a large number of the students of different gender and level of physical development and health will allow obtaining objective data of the physical health of students. Therefore, the data analysis allows identifying the positive or negative growth dynamics of objective indicators of young people physical development, to see the threat to the health of students in time and to take the necessary measures to eliminate them. Moreover, it should be noted that in most universities of the Russian Federation research to identify the threats to the development of obesity of the students either is not conducted at all or is inadequate. Furthermore, there is no system of dissemination of such research among the students themselves with the goal of preventing the threat of developing obesity and related diseases. Besides, in most universities the mandatory annual medical examinations of the students are abolished that does not allow the experts to draw objective conclusions about the health of young people. Most of all, the modern students do not have complete knowledge about the state of their physical health and do not consider the threat of weight gain as a threat to their health. As a result of the above indicates the need for comprehensive scientific research in universities. The research should be devoted to identifying the level of physical development and health of students during their education period. Indeed, various changes in the indicators of physical development of the students will be as objective criteria for the presence or absence of various threats to the health of young people.

Material & methods

In the first place, the main area of the research is the Siberian Federal University which is one of the largest universities of Siberia and the Russian Federation. Besides, the research period was approximately 13 years (from 2002 to 2014). In addition, the students (boys and girls) of the 1, 2 and 3 courses from various faculties and specialties of training had participated in the research. Besides, every year 800 people are surveyed (young men are $n=400$; girls are $n=400$). In fact, the boys and girls were allocated into 2 subgroups: the students who do not have deviations in health and students with various diseases or diagnoses that limit their physical activity. As a matter of fact, there were 200 students in each subgroup. It goes without saying that the examination included measurement of growth and body mass as well as the study of the reaction of the organism after the load test by A. Martinet. The weight and body height are required parameters for assessing the distribution of obesity in accordance with the guidelines of the IOTF – International Obesity Task Force. It should be noted that the research analyzed the indicators of changes in the average values of body mass of students as well as the recovery time of the body of young people after a standard physical load (A Martinet test). Unfortunately, the authors did not take into account the ratio of Body Mass Index (BMI) when collecting the data since the use of BMI does not take into account the differences between components of body compositions: ratio of muscle and fat in the body. Also, the experts note a lack of consensus about the universality of various anthropometric indicators for effective determination of obesity (Sperrin, Marshall, Higgins, et al., 2016; Chan & Woo, 2010).

Nevertheless, the purpose of the research is to collect the objective information and analysis of the data on dynamics of changes of indicators of the physical development and health of the young people (boys and girls) – students of 1-3 years courses of the SFU over a longer period of time. Indeed, the collection and analysis of data will allow the experts to provide more complete and accurate information about significant changes in the status of the health of students in the Russian Federation over a long time interval. Besides, the availability of all necessary information and objective assessment of the obtained data will allow drawing conclusions about the presence or absence of the threat of the spread of obesity and the growth of overweight among students.

As a result, the statistical analysis of the obtained results was carried out using automated programs to identify the validity and statistical significance of research results. Therefore, in these studies we used the SPSS20 program. Also, the reliability and significance of the results was determined using Student's t-test as the most suitable tool to determine the differences of averages in a fairly large number of students studied samples according to the authors.

Results

Concerning the analysis of changes in body mass of the studied young people have shown that in groups of young men there is the dynamics of increase of mean values of body mass of the students. Meanwhile, in the group of relatively healthy students (male-1) the average body weight over the study period significantly ($P<0.01$) increased from 65 ± 0.2 kg to 71 ± 0.3 kg. Indeed, it should be noted that in this group (male-1) were identified periods of decline of average body mass in 2005, 2009 and 2012. Moreover, in 2005 it was found a significant ($P<0.01$) decrease in body weight of students from 65 ± 0.4 kg and 63 ± 0.5 kg. It is important to note that in 2009 the indicators of body weight of the investigated young people have declined from 69 ± 0.8 kg to 66 ± 0.9 kg. In 2012, revealed a decline in the body weight of students (male-1) 73 ± 0.8 kg and 70 ± 0.3 kg. Therefore, the differences of the obtained values are statistically significant ($P<0.01$). Finally, in the group of students with various deviations in health over the entire study period mean values of body weight significantly ($P<0.01$) was increased from 67 ± 0.7 kg to 74 ± 0.4 kg.

It is important to note that in groups of the girls significant fluctuations in body weight were detected in the period from 2002 to 2005. It should be also mentioned that the relatively healthy students (female-1) was recorded significant ($P<0.01$) reduction of mean values of body mass 59 ± 0.3 kg in 2002 to 56 ± 0.9 kg in 2003 and 55 ± 0.2 kg in 2005. Further, the indicators of body weight of students in this group do not contain significant differences. As for the female students with various diseases (female-2) revealed only one period ($P<0.01$) of the exact higher body weight from 60 ± 0.2 kg to 62 ± 0.5 kg in 2005. In other periods the dynamics of changes in indicators of body weight of the girls did not contain significant differences.

General dynamics of changes of average values of body weight of the studied students during period of studies (2002 – 2013) is shown in Fig.1.

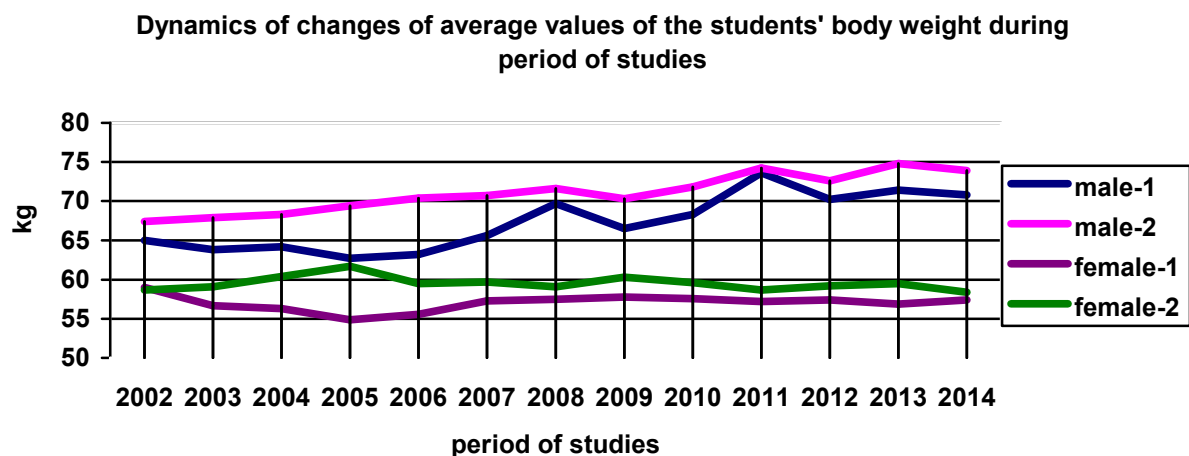


Fig. 1. Dynamics of changes of average values of the students' body weight during period of studies

An important point is that the dynamics of changes in growth indicators were relatively healthy students (male-1) consisted of several periods. Also, in the period from 2002 to 2006 there were no significant differences in these growth indicators. In the period from 2006 to 2007 a significant increase ($P<0.01$) growth rates of the students (male-1) from 177 ± 0.4 cm to 179 ± 0.7 cm was revealed. It should be noted that in the period from 2007 to 2010 a significant ($P<0.01$) decrease in the growth of young men from 179 ± 0.7 cm to 176 ± 0.4 cm was observed. Also, in the subsequent period from 2010 to 2013 there was a significant increase in growth with values from 176 ± 0.4 cm to 180 ± 0.2 cm. Besides, in 2014 the growth of students from 180 ± 0.2 cm to 178 ± 0.6 cm was reduced. In the group of students with various deviations in health (male-2) throughout the study period, a gradual increase in the growth of young men was revealed. From 2002 to 2014 a significant ($P<0.01$) increase in the values of growth of students (male-2) from 177 ± 0.5 cm in 2002 to 180 ± 0.2 cm in 2014 was revealed.

All in all, the analysis of changes in growth rates were relatively healthy students (female-1) shows that between 2002 and 2003 was recorded a significant ($P<0.01$) growth of the girls. The values of the growth data increased from 164 ± 0.9 cm to 166 ± 0.3 cm. After all from 2003 to 2005 the growth rates decreased from 166 ± 0.3 cm to 165 ± 0.2 cm. Furthermore in the period from 2005 to 2006 the average growth of girls decreased from 165 ± 0.2 cm to 164 ± 0.5 cm. Moreover, the decrease in values in this period was significant ($P<0.05$). From 2006

to 2008 the average values of the growth data of the girls (female-1) increased ($P < 0.05$) from 164 ± 0.5 cm to 165 ± 0.2 cm. From 2008 to 2010, the values of the growth indicators revealed a significant ($P < 0.01$) increase in growth from 165 ± 0.2 cm to 167 ± 0.2 cm. From 2010 to 2011 there was recorded a decrease ($P < 0.01$) growth from 167 ± 0.2 cm to 164 ± 0.9 cm. In the further average values of the growth data of the girls (female-1) did not show significant differences. It is important to remember that the changes in the growth indicators of students with different abnormalities in their health (female-2) were represented by several periods. From 2002 to 2003 a decrease ($P < 0.01$) growth from 164 ± 0.6 cm to 166 ± 0.8 cm was recorded. We must admit that from 2003 to 2006 the growth rates of students did not demonstrate significant differences. From 2006 to 2008 there was found a significant ($P < 0.01$) decrease of average values of growth parameters of this group from 166 ± 0.3 cm to 164 ± 0.8 cm. Actually, in the period from 2009 to 2014 there was a gradual increase in growth rates of girls. From 2009 to 2013 the difference between the values of the growth indices was not significant. Finally, in 2014 the value of the growth rate of girls was 166 ± 0.1 cm and significantly ($P < 0.01$) higher than the average growth of the students was 165 ± 0.1 cm in 2009.

Indicators of the changes in average values of growth of the studied students are presented in Fig. 2.

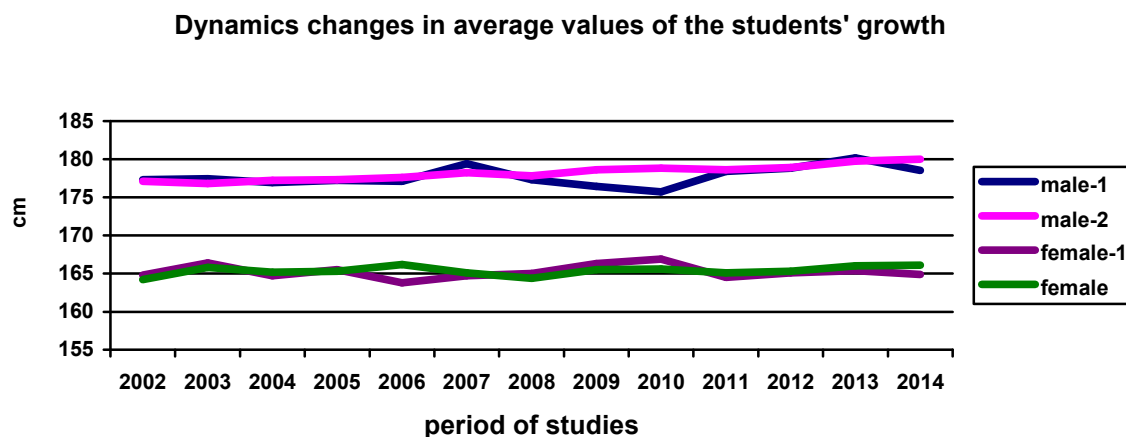


Fig. 2. Dynamics changes in average values of the students'

It is important to note that the analysis of the average values of the recovery period of the body of students after the load test allowed determining 2 major periods in the research. In any case, the first period (2002-2004) for male students was characterized by a decrease in the average recovery period of young people. Actually, the significant ($P < 0.01$) lower values were detected in relatively healthy students from 112 ± 2 to 102 seconds ± 2 seconds. Also, there was also found a significant ($P < 0.01$) difference between the results of the restoration of the students who had deviations in their health. In 2002, the average recovery period of students (male-2) amounted to 117 ± 2 seconds, and in 2004 it was 110 ± 2 seconds. Further, both groups of male students demonstrated the dynamics of gradual and significant increase in recovery period of the body after having the load test. From 2005 to 2014 average recovery period significantly ($P < 0.01$) increased from 106 ± 2 seconds to 119 ± 2 seconds in the group (male-1) and from 117 ± 2 seconds to 122 ± 2 seconds in the group (male-2). It should be noted that in the group of male-2 in some years there were periods of lower average recovery period from 124 ± 2 seconds to 119 ± 2 seconds in 2009 and 125 ± 2 seconds to 118 ± 2 seconds in 2012. However, the overall dynamics of recovery rates indicates a significant increase in the average recovery period after the load test of the students of this group.

An important point is that the students (female-1) have the lower value of the recovery period which was from 2002 to 2006. Furthermore, during this period the recovery rates significantly ($P < 0.01$) decreased from 124 ± 2 seconds in 2002 to 112 ± 2 seconds in 2006. Besides, since 2007 a consistent trend of increasing values of the recovery time of the body of girls was revealed. Only in 2010 there was a decrease in the recovery period of students (female-1). Actually, from 2011 to 2014 a significant increase in the values of the time recovery options for students in this group was found. In 2011, the figures were an average of 122 ± 2 seconds and in 2014 is 125 ± 2 seconds. Girls group (female-2) decrease recovery period discovered in the period from 2002 to 2005. In 2002, the recovery rates averaged 128 ± 2 seconds, and in 2005 – 114 ± 2 seconds. After 2005, there revealed a consistent increase in the recovery period of students (female-2). In 2006, the recovery options was 116 ± 2 seconds, and in 2014 it was 134 ± 2 seconds, which was significantly ($P < 0.01$) more.

Dynamics of changes of indicators of body recovery of the students after the load test are given in Fig. 3.

Dynamics of changes of indicators of body recovery of the students after the load test

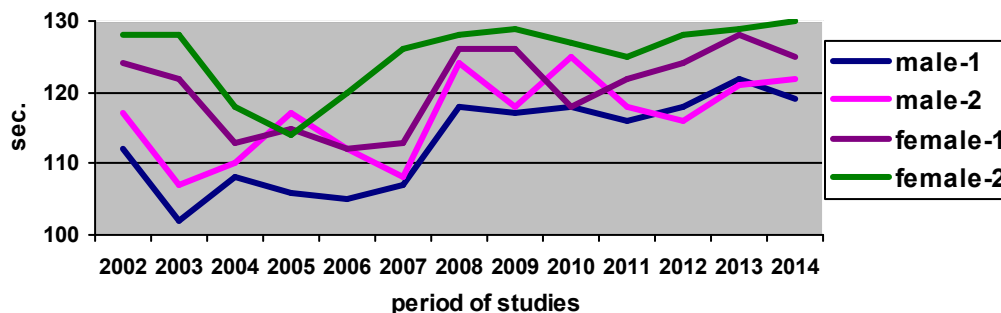


Fig. 3. Dynamics of changes of indicators of body recovery of the students after the load test

Discussion

As a result of analysis of these studies showed that the dynamics of changes of indicators of physical development and health were sufficiently different among the boys and girls. It makes sense to some coincidences which were revealed only in the results of the evaluation of changes to the data recovery after the load test. We must admit that in the groups of boys (male-1 and male-2) and the group of girls (female-1 and female-2) there was found the decrease of the parameters of recovery period during the years from 2002 to 2005. Further there was a gradual increase in the average values of the recovery time of the body of students after the load test. Moreover, such dynamics allowed making a conclusion about the gradual deterioration of level of functional preparedness of the students of the SFU for the last 8 years. Besides, the dynamics of change growth of the students was rather long time periods of slight increase or decrease in the measurement data. However, the difference between the average values of growth was significant ($P < 0.01$), boys (male-1 and male-2) and girls (female-2) at the beginning and end of studies. Indeed, the students (female-1) at the beginning and end of the studies there were no significant differences in values of the body growth. In general, the results of the research allowed claiming about a significant increase in male students and of the female students, on average 2 ± 0.3 cm in boys and 1 ± 0.4 cm in girls during the entire study period. Analysis of the data characterizing the average values of body weight of the studied students allowed coming to an interesting conclusion about difference obtained by the authors' data with the latest scientific data, most experts in the field of health. The authors did not reveal any significant differences in the dynamics of variations in body mass of female students—the girls (female-1 and female-2) in the total study period. In our opinion, only in 2005 there were recorded significant ($P < 0.01$) changes in average values of the body mass of students in the future offset. Thus, these data enter into some contradiction with the claims about the global epidemic of obesity among today's young people. At the same time, the dynamics of changes of indicators of body weight in male students (male-1 and male-2) is in full agreement with these statements. On average, indicators of body weight of the students for the entire study period increased by 6 ± 0.4 kg. However, it should be noted a significant decrease in body weight in boys (male-1) over the past few years of research. From 2011 to 2014 the average body mass of boys decreased from 73 ± 0.8 kg to 70 ± 0.3 kg. According to the authors of the article, this dynamics could be explained by active work of the SFU teachers in creating sports and physical environment at the university. Thus, this environment through the changes in the forms and structure of physical education classes should increase the physical activity level of students (Osipov, Kudryavtsev, Fedorova, et al., 2017). In general it should be noted that the male gender and the beginning of training at the university are factors contributing to the increase in excess body weight (Deliens, Clarys, Van Hecke, et al., 2013). Modern programs of physical training of students should consider these factors.

After all the specialists pay attention to quite a significant weakening of the level of physical preparedness of the students during their study in post-Soviet countries (Druz, Iermakov, Nosko, et al., 2017; Lebedinskiy, Koipysheva, Rybina, et al., 2017). As a result a significant heterogeneity of the main indicators of students' physical conditioning have already revealed at the stage of admission of young people to universities (Gainullin, Isaev, Zalyapin et al., 2017). By the end of education the physical development of the majority of Russian students are significantly reduced. At the same time in some European countries the level of physical development of the student youth is much higher. For example, the research of level of physical activity of Polish students shows that the level of physical activity is a significant part of students sufficient for successful prevention of various chronic diseases (Zuzda, Latosiewicz, & Augustyńska, 2017). However, the problem of weakening the physical health of students is the characteristic not only for countries of the former USSR. By the way the experts say that one-third of all students in the United States have various deviations in physical health, primarily the problem of overweight and development of obesity (Wojcicki, 2012; Perez, Hoelscher, Springer, et al., 2011).

In a word, a high level of physical activity is one of the main success factors in solving the spread of obesity (Wiklund, 2016). The experts draw attention to the fact that the existing programs of obesity prevention which require daily physical exercises of moderate intensity during 30 minutes cannot guarantee effective control of body weight. Meanwhile, there are proposals to increase the physical activity of average intensity for up to 60 minutes every day (Jakicic, & Otto, 2005). Unfortunately, the regulatory framework of programs in physical education existing in the Russian universities does not provide a significant increase in time for physical activities and sports (Osipov, Starova, Malakhova, et al., 2016). It should be noted that China also faced the problem of the development of obesity in students (pupils and students). But other than that the last educational programs in China contain a significant academic intervention to promote healthy eating, maintaining a healthy lifestyle and increase physical activity of youth (Wang & Zhai, 2013). In a word, the promotion of knowledge about the risks of obesity development is a very important factor of success in the obesity control among young people. Thus, it was revealed that the level of students' knowledge about the risks associated with obesity and development of concomitant diseases is limited (Alasmari, Al-Shehri, Aljuaid, et al., 2017).

At the same time there are studies claiming that success in the fight against obesity does not depend on the government programs but on individuals and their actions to strengthen their health (Chan & Woo, 2010). The fight with overweight and obesity development in these circumstances will depend on the individual changes of everyday lifestyle of the young people. A persistent theme in the study of the physical activity level of the SFU students shows that young people are particularly interested in mini-training and home training, because they do not have free time for practice in a fitness club (Martinez, Harmon, Nigg, et al., 2016). In these circumstances the fight with overweight and obesity will depend on the individual changes of everyday lifestyle of young people. Therefore, there are studies that the overall level of physical activity is higher for male students, but female students receive higher grades for doing exercises in physical education classes (Karaca, Çağlar, Deliceoglu, et al., 2016). By the way the experts and teachers should consider these features of young people and should choose programmes of physical activity based on these circumstances. It was revealed that the combination of aerobic and strength exercise for 45 minutes three times a week is an effective form of prophylaxis of the obesity development (Chen, Ismail, & Al-Safi, 2016). It is proved that an increase in the motor regimen even in the declared weekly volume allows significantly increasing the performance of the heart of young people at rest and load (Mikhaylova, & Kimyaeva, 2013). It is necessary motivate today's students to individual fitness and sports. Meanwhile, the existing universities physical education programs are not able to provide the necessary level of physical activity to maintain body weight at the appropriate level (Meckel, Galily, Nemet, et al., 2011). Thus, there is a need to increase interventions aimed at preventing and combating the spread of obesity among the modern schoolchildren and students. Finally, this need in addition to preserving the health of young people due to the significant correlation between the body mass of the students and their level of academic achievement (Anderson, & Good, 2017; Franz, & Feresu, 2013).

Conclusions

It is generally agreed today that the need for annual comprehensive research in order to obtain reliable information on the state of physical health of the students is evident to all health professionals. According to the authors of more recent studies have proposed that an objective assessment and analysis of the results will enable scientists to identify the presence of those or other threats to health of young people in particular the development of obesity among the students. Our purpose is to obtain reliable data which is necessary to conduct studies with a large number of subjects in a fairly long period of time.

The research conducted by the authors of the article allows us to state that there is a significant risk of an increase in the excess body weight of young students at the beginning and the middle of their studies. At the same time the female students had no significant dynamics of increase in body weight values during the study period. It is important to emphasize the dynamics of growth indicators of the students in the period of research varied within 1-2 cm and did not significantly affect the indicators of the average body weight of the young people. Our focus is on that in all the studied groups the negative dynamics of increasing the time parameters of the body recovery after the load test was revealed (A.Martinet test). Besides, this allows the authors to assert that the level of physical preparedness of the young people (male and female) has declined during most of the research period (2006 to 2014). In conclusion, these studies will continue as the threat of the spread of obesity and related diseases is real for a large number of the modern students. In addition to collecting data on the current level of the physical health of students it is required significant efforts to increase physical activity of young people and the dissemination of information about the presence of a clear threat of obesity among the future-proof youth.

Conflicts of interest - If the authors have any conflicts of interest to declare.

References

- Alasmari, H., Al-Shehri, A., Aljuaid, T., et al. (2017). Relationship between body mass index and obesity awareness in school students. *Journal of Clinical Medicine Research*, 9(6). 520-524. DOI:10.14740/jocmr2987w

- Alonso Fernandez, D., Gutierrez, Sanchez, A., & Pino Juste, M. (2012). Health-related physical condition variables in university students. *Journal of Human Sport & Exercise*, 7(1). 331-340. DOI:10.4100/jhse.2012.71.11
- Anderson, A., & Good, D. (2017). Increased body weight affects academic performance in university students. *Preventive Medicine Reports*, 5. 220-223. <https://doi.org/10.1016/j.pmedr.2016.12.020>
- Ansari, W., & Stock, C. (2010). Is the Health and Wellbeing of University Students Associated with their Academic Performance? Cross Sectional Findings from the United Kingdom. *International Journal of Environmental Research and Public Health*, 7(2). 509-527. DOI:10.3390/ijerph7020509
- Artyukhov, I., & Kaskaeva, D. (2014). Health status assessment of the higher educational institutions students in Krasnoyarsk. *Siberian Medical Review*, 6(90). 61-64. [In Russian]
- Bebcakova, V., Vadasova, B., Kacur, P., et al. (2015). Distribution of health-related physical fitness in Slovak population. *SpringerPlus*, 4. 691. <https://doi.org/10.1186/s40064-015-1479-4>
- Biswas, T., Islam, A., Islam, M., et al. (2017). Overweight and obesity among children and adolescents in Bangladesh: a systematic review and meta-analysis. *Public Health*, 142. 94-101. DOI:10.1016/j.puhe.2016.10.010
- Bocarro, J., Kanters, M., Cerin, E., et al. (2012). School sport policy and school-based physical activity environments and their association with observed physical activity in middle school children. *Health & Place*, 18(1). 31-38. DOI:10.1016/j.healthplace.2011.08.007
- Chan, R., & Woo, J. (2010). Prevention of overweight and obesity: how effective is the current public health approach. *International Journal of Environmental Research and Public Health*, 7(3). 765-783. DOI:10.3390/ijerph7030765
- Chen, C., Ismail, N., & Al-Safi, A. (2016). Effects of brisk walking and resistance training on cardiorespiratory fitness, body composition, and lipid profiles among overweight and obese individuals. *Journal of Physical Education and Sport*, 3. 957-963. DOI:10.7752/jpes.2016.03151
- D Abundo, M., Sidman, C., Fiala, K., et al. (2015). Sitting behavior and physical activity of college students: Implications for health education and promotion. *International Journal of Adult Vocational Education and Technology*, 6(3). DOI:10.4018/IJAVET.2015070105
- Deliens, T., Clarys, P., Van Hecke, L., et al. (2013). Changes in weight and body composition during the first semester at university. A prospective explanatory study. *Appetite*, 65. 111-116. <https://doi.org/10.1016/j.appet.2013.01.024>
- de Vos, P., Hanck, C. Neisingh, M., et al. (2015). Weight gain in freshman college students and perceived health. *Preventive Medicine Reports*, 2. 229-234. <https://doi.org/10.1016/j.pmedr.2015.03.008>
- Druz, V., Iermakov S., Nosko, M., et al. (2017). The problems of students' physical training individualization. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 21(2). 51-59. DOI:10.15561/18189172.2017.0201
- Franz, D., & Feresu, S. (2013) The relationship between physical activity, body mass index, and academic performance and college-age students. *Open Journal of Epidemiology*, 3. 4-11. DOI:10.4236/ojepi.2013.31002
- Gaetano, A. (2016). Relationship between physical inactivity and effects on individual health status. *Journal of Physical Education and Sport, Supplement issue* (2). 1069-1074. DOI:10.7752/jpes.2016.s2170
- Gainullin, R., Isaev, A., Zalyapin, V., et al. (2017). Statistical analysis of morphometric indicators and physical readiness variability of students. *Physical education of students*, 21(5). 205-212. DOI:10.15561/20755279.2017.0502
- Gowin, M., Cheney, M., Gwin, S., et al. (2015). Health and fitness app use in college students: A qualitative study. *American Journal of Health Education*, 46(4). 223-230. DOI:10.1080/19325037.2015.1044140
- Grammatikopoulou, M., Kotanidou, E., Markaki, A., et al. (2014). A systematic review and meta-analysis of weight status among adolescents in Cyprus: scrutinizing the data for the years 2000-2010. *Hormones (Athens)*, 13(4). 543-551. DOI:10.14310/horm.2002.1511
- Hoque, M., Doi, S., Mannan, M., et al. (2014). Prevalence of overweight and obesity among children and adolescents of the Indian subcontinent: a meta-analysis. *Nutrition Reviews*, 72(8). 541-550. DOI:10.1111/nure.12130
- Jakicic, J. (2009). The effect of physical activity on body weight. *Obesity*, 17(supplement 3). S34-S38. DOI:10.1038/oby.2009.386
- Jakicic, J., & Otto, A. (2005). Physical activity considerations for the treatment and prevention of obesity 1- 4. *The American Journal of Clinical Nutrition*, 82(1). 2265-2295.
- Karaca, A., Çağlar, E., Deliceoglu, G., et al. (2016). Physical activity with regard to socio-demographic variables and decisional balance perceptions for exercise among university students. *Journal of Physical Education and Sport*, 3. 932-939. DOI:10.7752/jpes.2016.03147
- Korn, L., Gonen, E., Shaked, Y., et al. (2013). Health Perceptions, Self and Body Image, Physical Activity and Nutrition among Undergraduate Students in Israel. *PLoS One*, 8(3). e58543. DOI:10.1371/journal.pone.0058543

- Kovesdy, C., Furth, S., & Zoccali, C. (2017). Obesity and kidney disease: hidden consequences of the epidemic. *Journal of Physical Education and Sport*, 1. 156-165. DOI:10.7752/jpes.2017.01024
- Kudryavtsev, M., Kramida, I., & Osipov, A. (2016). Influence of monitor bad habits on healthy lifestyle of students. *Teoriya i Praktika Fizicheskoy Kultury*, 6. 24-26. [In Russian]
- Kumanyika, S., Obarzanek, E., Stettler, N., et al. (2008). Population-based prevention of obesity. The need for comprehensive promotion of healthful eating, physical activity, and energy balance. A scientific statement from American heart association council on epidemiology and prevention, interdisciplinary committee for prevention (formerly the expert panel on population and prevention science). *Circulation*, 118. 428-464. <https://doi.org/10.1161/CIRCULATIONAHA.108.189702>
- Lazareva, O., Aravitska, M., Andrieieva, O., et al. (2017). Dynamics of physical activity status in patients with grade I-III obesity in response to a physical rehabilitation program. *Journal of Physical Education and Sport*, 3. 1960-1965. DOI:10.7752/jpes.2017.03193
- Lebedinskiy, V., Koipysheva, E., Rybina, L., et al. (2017). Age dynamic of physical condition changes in pre-school age girls, schoolgirls and students, living in conditions of Eastern Siberia. *Physical education of students*, 21(6). 280-286. DOI:10.15561/20755279.2017.0604
- Martin, N., Ameluxen-Coleman, E., & Heinrichs, D. (2015). Innovative ways to use modern technology to enhance, rather than hinder, physical activity among youth. *Journal of Physical Education, Recreation & Dance*, 86(4). 46-53. <https://doi.org/10.1080/07303084.2015.1009205>
- Martinez, Ya., Harmon, B., Nigg, C., et al. (2016). Diet and physical activity intervention strategies for college students. *Health Behavior and Policy Review*, 3(4). 336-347. DOI:10.14485/HBPR.3.4.5
- Meckel, Y., Galily, Y., Nemet, D., et al. (2011). Changes in weight indexes and aerobic fitness of physical education students over three years of college. *Journal of Human Sport & Exercise*, 6(1). 112-121. DOI:10.4100/jhse.2011.61.13
- Mikhaylova, L., & Kimyaeva, S. (2013). Central hemodynamics indices in senior pupils with increased educational and motive loadings. *Siberian Medical Review*, 3(81). 55. [In Russian]
- Mikolajczyk, R., Maxwell, A., Ansari, W., et al. (2010). Relationship between perceived body weight and body mass index based on self-reported height and weight among university students: a cross-sectional study in seven European countries. *BMC Public Health*, 10. 40. DOI:10.1186/1471-2458-10-40
- Mokdad, A., Marks, J., Stroup, D., et al. (2005). Actual causes of death in the United States, 2000. *The Journal of the American Medical Association*, 291(10). 1238-1245.
- Muntaner-Mas, A., Vidal-Conti, J., Cantallops, J., et al. (2017). Obesity and physical activity patterns among Balearic Islands children and adolescents: a cross-sectional study. *Journal of Human Sport & Exercise*, 12(2). 333-348. DOI:10.14198/jhse.2017.122.10
- Osipov, A., Kudryavtsev, M., Gruzinky, V., et al. (2017). Means of optimal body mass control and obesity prophylaxis among students. *Physical education of students*, 21(1). 40-45. DOI:10.15561/20755279.2017.0107
- Osipov, A., Kudryavtsev, M., Fedorova, P., et al. (2017). Components of positive impact of exposure on university physical culture and sports on students' physical activity. *Journal of Physical Education and Sport*, 2. 871-878. DOI:10.7752/jpes.2017.02133
- Osipov, A., Starova, O., Malakhova, A., et al. (2016). Modernization process of physical education of students in the framework of implementation of the state strategy for the development of physical culture, sport and tourism in the Russian Federation. *Journal of Physical Education and Sport*, 4. 1236-1241. DOI:10.7752/jpes.2016.04196
- Perez, A., Hoelscher, D., Springer, A., et al. (2011). Physical activity, watching television, and the risk of obesity in students, Texas, 2004-2005. *Preventing Chronic Disease*, 8(3). http://www.cdc.gov/pcd/issues/2011/may/10_0007.htm [Accessed 10.12.2017].
- Peshkov, M., & Sharaykina, E. (2014). Body mass index in students: the present state of the problem. *Siberian Medical Review*, 4(88). 49-56. [In Russian]
- Plotnikoff, R., Costigan, S., Williams, R., et al. (2015). Effectiveness of interventions targeting physical activity, nutrition and healthy weight for university and college students: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 12. 45. <https://doi.org/10.1186/s12966-015-0203-7>
- Santana, C., Hill, J., Azevedo, L., et al. (2017). The association between obesity and academic performance in youth: a systematic review. *Scandinavian Journal of Medicine & Science in Sports*, 18(10). 1191-1199. DOI:10.1111/obr.12582
- Santana, C., Azevedo, L., Cattuzzo, M., et al. (2017). Physical fitness and academic performance in youth: A systematic review. *Scandinavian Journal of Medicine & Science in Sports*, 27(6). 579-603. DOI:10.1111/sms.12773
- Sperrin, M., Marshall, A., Higgins, V., et al. (2016). Body mass index relates weight to height differently in women and older adults: serial cross-sectional surveys in England (1992–2011). *Journal of Public Health*, 38(3). 607-613. <https://doi.org/10.1093/pubmed/fdv067>

- Stankov, I., Olds, T., & Cargo, M. (2012). Overweight and obese adolescents: what turns them off physical activity? *International Journal of Behavioral Nutrition and Physical Activity*, 9. 53. <https://doi.org/10.1186/1479-5868-9-53>
- Ujević, T., Sporis, G., Milanović, Z., et al. (2013). Differences between health-related physical fitness profiles of Croatian children in urban and rural areas. *Collegium Antropologicum*, 37(1). 75-80.
- Wang, F., & Fu, H. (2017). Physical fitness assessment using supervised SOM classification based on BMI of college students, northern China. *Journal of Physical Education and Sport*, 4. 2622-2631. DOI:10.7752/jpes.2017.04300
- Wang, H., & Zhai, F. (2013). Program and policy options for preventing obesity in China. *Obesity Reviews*, 14(supplement 2). 134-140. DOI:10.1111/obr.12106
- Wiklund, P. (2016). The role of physical activity and exercise in obesity and weight management: Time for critical appraisal. *Journal of Sport and Health Science*, 5(2). 151-154. <https://doi.org/10.1016/j.jshs.2016.04.001>
- Wojcicki, M. (2012). The effects of physical activity education on exercise self-efficacy and physical activity: A comparison study between exercise science and physical education teacher education. *Health, Human Performance and Recreation Undergraduate Honors Theses*. 28 p. <http://scholarworks.uark.edu/hhpruht/28/>
- Xiang, M., Gu, X., Jackson, A., et al. (2017). Understanding adolescents' mental health and academic achievement: Does physical fitness matter? *School Psychology International*, 38(6). 647-663. <https://doi.org/10.1177/01430343177117582>
- Zuzda, J., Latosiewicz, R., & Augustyńska, B. (2017). Risk assessment and level of physical activity of students in Poland. *Physical education of students*, 21(4). 193-199. DOI:10.15561/20755279.2017.0408