

Physical activity amount influence over suboptimal health status

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Abstract:

Research aim – to study female students' suboptimal health status relationship with their level of physical activity and quality of life to reduce the risk of developing non-communicable diseases. *Research material and methods.* The work was carried out in 2019 at the Irkutsk National Research Technical University (Russia). The study involved 96 female students aged 18-19. To assess the girls' suboptimal health status, the SHSQ-25 questionnaire was used. According to the results of the survey, all the surveyed girls were divided into two groups: the girls of the first group had a total value of SHS-total <14 points, in the second group SHS total ≥ 14 points. All girls' weekly physical activity was determined by the IPAQ-SF questionnaire; the students' quality of life was evaluated by the SF-36 questionnaire. Seven motor tests were used to assess the girls' motor qualities. The girls' body mass index (BMI) was also calculated. *Research results.* The quality of life indicators values, calculated using the scales of physical activity, general health, vitality and mental health were higher in the girls of the first group (SHS-total <14 points) than in the girls of the second group (SHS total ≥ 14 points), p<0.05. The results of the survey by the IPAQ-SF questionnaire showed that girls with a weekly physical activity volume of less than 150 minutes increased the risk of suboptimal health status. Girls of the second group (SHS total ≥ 14 points) are more likely to be overweight and obese, which is a predictor of chronic non-communicable diseases occurrence. The girls' from the second group motor tests values are significantly lower than those of girls from the first group, p<0.05. *Conclusions.* Low indicators of life quality and motor qualities, excessive body weight increase the girls' suboptimal health status level, which are the grounds for placing such girls in the risk group for chronic non-communicable diseases. To identify the risk of chronic non-communicable diseases in female students, a comprehensive assessment of the girls' suboptimal health status, quality of life and physical activity, body mass index and motor qualities was carried out. This comprehensive approach has proven to be effective for non-invasive screening. Low physical activity is a marker of the risk of developing body diseases and reducing the labor potential level in future specialists. Increasing physical activity, observing healthy lifestyle basics will reduce the level of students' hypodynamia.

Key Words: suboptimal status, quality of life, physical activity

Introduction

Suboptimal health status» term refers to the physical state of a person between health and illness. Individuals with suboptimal status may report minor health complaints, general malaise, weakness, and fatigue over the past three months (Yan Y. X., et. al., 2009; Wei Wang, Yu-Xiang Yan, 2012). These symptoms may be manifest for a chronic non-communicable disease development.

Currently, a number of authors have established that in many regions of the world, the most important cause of high mortality is chronic non-communicable diseases [WHO Global action plan for the prevention and

control of noncommunicable diseases 2013-2020; Danilova, et. al., 2015] among which, the leading role is occupied by the cardiovascular system pathology (Townsend et. al., 2016).

Most people with suboptimal health status have one or more risk factors for chronic non-communicable diseases (Krylova et. al., 2018). These are overweight (Goldaeva, Pavlenko, 2016), high blood pressure (Dolgalev, et. al., 2019), spinal problems (Metalnikov et al., 2020), environmental factors (Lastkov, & Dubovaya, 2020), bad habits and psycho-emotional factors (Tabacco, 2018; Pats, & Yunevich, 2020).

The scientific literature presents materials related to the study of the relationship between risk factors and suboptimal health status for certain population groups (Krylova, et. al., 2018; Jieyu Chen, et. al., 2017; Yu-Xiang, et. al., 2018). It is established that a person's insufficient physical activity (Chekhovska et. al., 2020; Bakiko et. al., 2020) is one of the leading causes of severe non-communicable diseases.

The World Health Organization notes that more than one third of the world's population does not achieve the required level of physical activity (WHO. Physical activity Fact sheet, 2018). Insufficient physical activity is also recorded among students (Moy, et. al., 2016; Yatsun, et. al., 2017; Gryaznykh, 2010), it leads to hypodynamia development (Olafsdottir et. al., 2016) and can cause them various non-communicable diseases (Yang, Dong, 2017). Therefore, a comprehensive study of students' physical activity issues is relevant and appropriate.

To maintain people's aged 18 to 64 health level, the World Health Organization (WHO. Global recommendations on physical activity for health, 2010) proposed a minimum rate of weekly motor activity in the amount of 2.5 hours (at least 30 minutes per day x 5 days per week) with moderate aerobic exercises or at least 1 hour 15 minutes (25 minutes x 3 days) with high-intensity loads. There are recommendations for performing at least 10 thousand steps per day to prevent hypokinesia development (Eakin, et. al., 2007).

The process of higher education is very intensive (Hortigüela et. al., 2015). Students ignore healthy lifestyle basics against the background of hypodynamia (Moi et. al., 2016; Pengpid et. al., 2019). It can lead to a suboptimal health status in students and a decrease in their quality of life (Kolokoltsev et al., 2020) (Kolokol'tsev et al., 2020). There are quite a lot of methods for assessing the quality of human life (Ustselemba et al., 2019). The most popular in different countries of the world (Bull et. al., 2009) and in Russia (Safonova, Shalamova, 2015) is the international questionnaire SF-36 (Short Form Health Survey) for assessing the quality of life and the characteristics of the physical and psychological components of health (Ware et. al., 1993).

It is of scientific and practical interest to study the relationship between students' level of physical activity and quality of life with their suboptimal health status. In our opinion, the results of such studies will increase the health – improving measures effectiveness in educational institutions and reduce non-communicable diseases development of hypodynamic genesis in students.

Research aim – to study female students' suboptimal health status relationship with their level of physical activity and quality of life to reduce the risk of developing non-communicable diseases.

Material & methods

The work was carried out in 2019 at the Irkutsk National Research Technical University (Russia). The study involved 96 female students aged 18-19 who did not make any health complaints in the last 3 months.

The girls' suboptimal health status assessment was carried out using the SHSQ-25 questionnaire («Suboptimal Health Status» Questionnaire 25 Items), which contains 25 questions and 5 options for grading the answer (in points) to each question on five separate scales: fatigue, cardiovascular system, immune system, digestive tract, psychological status (Wei Wang, Yu-Xiang Yan, 2012).

The questionnaire was validated in Russia (Martina E. Ju., 2014), where the value of suboptimal health status total indicator (SHS-total) < 14 points corresponds to good health and the person is considered healthy. The value of SHS-total \geq 14 indicates that the subject is in a state of pre-illness, which implies his further treatment in a medical institution. According to the results of the SHSQ-25 survey, all the girls we examined were divided into two groups: the first group had a total value of the SHS-total indicator <14 points and the second, where the total value of the SHS-total indicator \geq 14 points.

To characterize the female students' quality of life, the Russian version of the SF-36 (Short Form Health Survey) questionnaire was used to assess the physical and psychological components of health (Ware et. al., 1993). The methodology includes 36 questions, which are grouped into 8 scales of health characteristics physical and mental component. The physical component allows determining a person's physical activity (the degree of daily physical activity); role functioning (the ability to perform professional activities); the intensity of physical pain and general health. The mental component characterizes: vitality, social activity, role-playing emotional functioning, mental health of a person. Answers are evaluated in points from 0 to 100. The higher the value of the indicator, the higher the respondents assess their health state and quality of life.

To study the relationship between the girls' suboptimal health status and weekly physical activity, we conducted an additional survey using the IPAQ-SF Physical Activity Questionnaire (International physical activity questionnaire), according to which it is possible to determine the respondent's number of minutes for daily moderate physical activity during the last week (Craib Cora L et. al., 2003). Moderate physical activity

(except walking) includes motor actions of a person that significantly increase breathing compared to the usual state, increase the heart rate by no more than 20% of the initial one, and last at least 10 minutes per approach.

To determine the girls' body weight characteristics, the body mass index was calculated using the formula: $BMI = \text{body weight/body length}^2$, kg/m^2 (WHO Global Database on Body Mass Index (BMI), 2012). A BMI value of $<18.5 \text{ kg/m}^2$ indicates a body weight deficit; a BMI within $18.5\text{-}24.99 \text{ kg/m}^2$ indicates a normal weight; if $BMI = 25.0\text{-}29.9 \text{ kg/m}^2$, body weight is considered excessive; if BMI is higher than 30 kg/m^2 , there are signs of obesity of various degrees (WHO: Memorial of the meeting arranged by USAID, WHO, PAHO and Mother Care Organization «Mother Care», 1991).

To identify the relationship between suboptimal health status and physical fitness, a study of the girls' motor qualities was conducted using motor tests: 30 m run from the standing start (sec); 1000 m run (min, sec); Cadence Push-Up Test, number of times; Bent suspension (two hands), (sec); Eurofit Sit Up Test (for 30 sec.), number of times; Standing Forward Bend from a sitting position, (cm) and Standing long jump (cm).

Statistical processing of the material was performed by conventional research methods using Microsoft Excel 2010 and Statistica 10.0 programs. The reliability of the differences was determined by calculating the Student's t-test of reliability. Differences were considered significant at $p < 0.05$. The work carried out does not infringe on the rights and does not endanger the well-being of girls in accordance with the ethical standards of the Human Rights Committee of the Helsinki Declaration of 2008 (WMA Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects, 2013).

Results

The survey on the SHSQ-25 questionnaire results analysis showed suboptimal health status symptoms presence. The most frequent complaints among female students are drowsiness (67.7%), headache (64.5%), fatigue (37.5%) and back discomfort (20.8%). Signs of nervousness are experienced by 54.2% of girls, 31.2% of students report restless sleep and 41.6% of impaired attention. 27.1% of female students reported abdominal pain and decreased appetite. 37.5% of the surveyed girls often suffer from acute respiratory diseases.

Of the 96 students surveyed, 62 girls (64.6%) had a total SHS score of <14 points and 34 (35.4%) had a SHS - total score of ≥ 14 points. According to these data, all the girls were divided into two groups of suboptimal health status for the study.

Table 1. Quality of life indicators values for girls with different suboptimal health status (SHS) (in points)

SF-36 questionnaire scales	1 st group SHS- total <14 (n=62)	2 nd group SHS- total ≥ 14 (n=34)	Difference between indicators values (%)
Physical health component			
Physical Functioning	74,45±23,87	19,49±11,34 *	73,8
Role-Physical	68,49±25,12	38,22±25,34	44,2
Bodily Pain	61,17±32,47	33,67±26,18	44,9
General Health	68,43±31,89	17,33±12,23 *	74,7
Mental health component			
Vitality	58,22±30,76	15,53±10,23 *	73,3
Social Functioning	59,46±32,82	21,07±18,19	64,5
Role-Emotional	61,32±32,8	32,4±15,19	47,2
Mental Health	64,42±26,71	13,27±15,65 *	79,4

Note. * - significant difference between the first and the second groups indices ($p < 0,05$)

As can be seen from Table 1, the quality of life indicator value on the physical activity scale was 3.8 times higher in girls of the first group than in girls of the second one ($p < 0.05$). The indicator of the girls' in the second group general state of health was 3.9 times lower than in the first group ($p < 0.05$). Significantly lower were the values of indicators on the scale of health psychological component by the SF-36 questionnaire (vitality and mental health) in girls of the second group than in the first group ($p < 0.05$).

An analysis of the weekly physical activity survey results using the IPAQ-SF questionnaire showed (Table 2) that among all girls, having a weekly physical activity of more than 150 minutes, the value of girls' from group 1 suboptimal health status (SHS-total) total indicator was 32.6% less than that of girls from the second group ($p < 0.05$).

Table 2. Total SHS index value of the in girls having a different amount of weekly physical activity according to the IPAQ-SF questionnaire (in points)

Group	Weekly physical activity	
	< 150 minutes	> 150 minutes
1 st group SHS-total <14 , (n=62)	13,78±2,26	11,43±1,34
2 nd group SHS-total ≥ 14 , (n=34)	20,85±2,19*	15,16±2,39*

Note. * - significant difference between the total SHS index value for girls from the 1st and the 2nd groups ($p < 0,05$)

The girls of the 1st group, having physical activity less than 150 minutes per week, the value of the suboptimal health status overall rate (SHS-total) was 51.3% less than that of the girls from the second group with the same volume of weekly physical activity ($p < 0.05$).

Girls with different weekly physical activity volume there were significant differences between the values of some scales from SHSQ - 25 questionnaire (Fig.1).

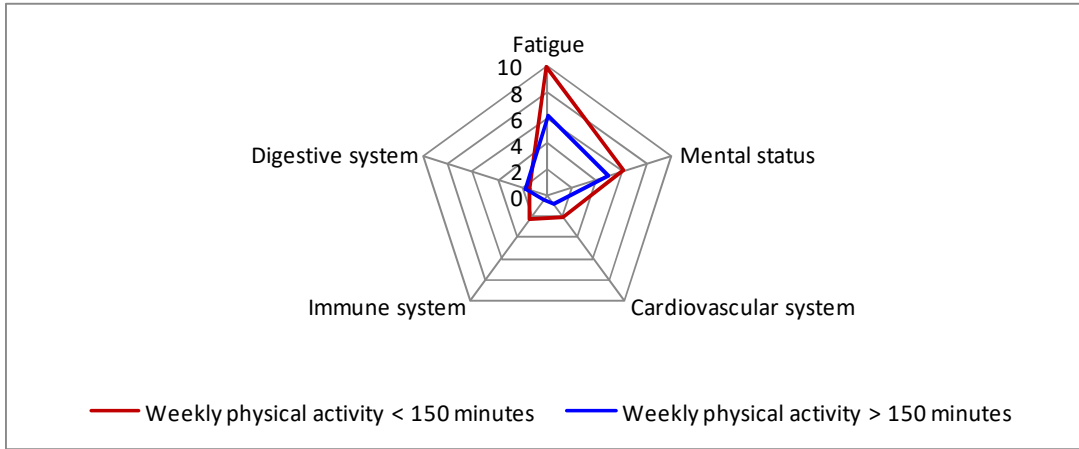


Fig. 1. The girls' with different amounts of weekly physical activity indicators values on the SHSQ-25 questionnaire scales (in points)

The girls, having physical activity more than 150 minutes per week, the values of fatigue, cardiovascular and immune systems indicators scales were less than in girls with weekly physical activity less than 150 minutes ($p < 0.05$).

This fact indicates that the volume of weekly physical activity of the girls, surveyed by us, affects the questionnaire SHSQ-25 indicators values scales, characterized by the presence or absence of suboptimal health status.

One of the risk factors for non-communicable diseases development in humans is overweight and obesity. We determined the body mass index in girls with different indicator values of suboptimal health status (SHS-total).

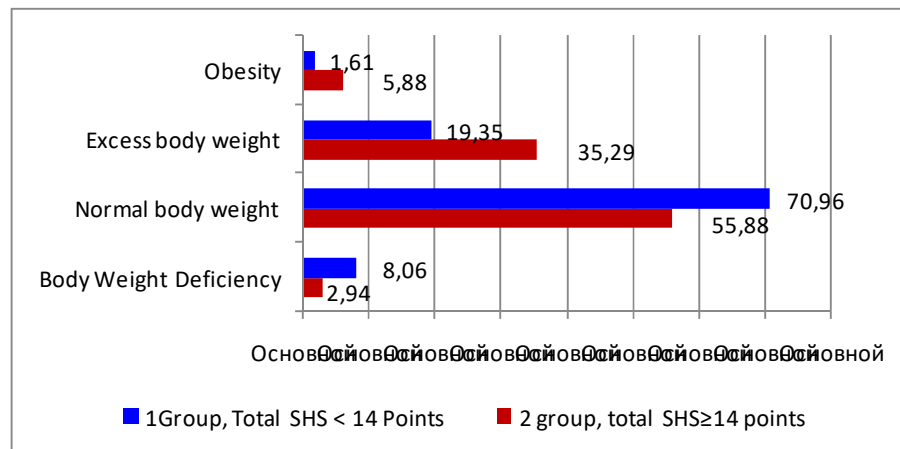


Fig. 2. The number of girls with different BMI indices and SHS-total values (%)

According to Figure 2, girls with normal body weight turned out to be 26.9% more, and with a weight deficit of 63.5% more in the first group (SHS-total < 14 points) than girls in the second group (SHS-total ≥ 14 points), $p < 0.05$. Girls with overweight and obesity in the second group were 1.8 and 3.6 times more, respectively, than in the first group, $p < 0.05$. These data indicate that girls of the second group (SHS-total ≥ 14 points) with overweight and obesity have a higher suboptimal health status and a higher risk of non-communicable diseases. The girls of the second group had low indicators of physical fitness, which is confirmed by the results of motor qualities testing (Table 3).

Table 3. Motor tests results of girls with different SHS-total indices values (M±m)

Tests	1st group SHS-total <14 (n=62)	2nd group SHS-total ≥14 (n=34)
30 m run from the standing start (sec)	6,08±0,06	9,67±0,34*
1000 m run (min/s)	7,12±0,35	11,72±0,46*
Cadence Push-Up Test, (number of times)	17,7±0,45	13,3±0,32*
Bent suspension (two hands), (sec)	6,13±0,23	3,02±0,04*
Eurofit Sit Up Test (for 30 sec.), number of times	16,55±0,39	11,6±0,27*
Standing Forward Bend from a sitting position, (cm)	14,3±0,34	13,9±0,30
Standing long jump (cm)	152,5±2,11	147,5±2,02*

Note - *significant differences between the 1st and the 2nd groups girls' indices values (P<0,05)

It was found that the values of all motor tests of the girls from the second group were significantly lower than these indicators values in the girls from the first one (with the exception of the «Standing Forward Bend from a sitting position» test), p<0.05. This indicates a weak physical fitness of the girls from the second group, having SHS-total ≥14.

Discussion

The current scientific literature analysis indicates an increasing interest of researchers in studying various population groups' suboptimal health status (Marutina E. Ju., 2014; Yu-Xiang et. al., 2018; Krylova et. al., 2018). There are reports on risk factors influence over cardiovascular system pathology formation (Goldaeva, Pavlenko, 2016; Jieyu Chen, et. al., 2017) and other non-communicable human diseases development (Wei Wang, Yu-Xiang Yan, 2012; Kupaev, et. al., 2019). However, the influence of different amounts of students' physical activity and their body weight state over their suboptimal health status and quality of life remains insufficiently studied. It is found that more than 60% of examined students at Irkutsk State Technical University (first group) have the suboptimal health status level (SHS-total) less than 14 and more than 30% of the students (second group) have a level (SHS-total) more than 14 points on the questionnaire SHSQ-25. The study of the female students' quality of life was carried out using the SF-36 questionnaire. The responses analysis showed that the physical activity of the girls from the second group was limited by their state of health, they are more likely to experience depression and anxiety, compared to the girls from the first group. Our findings are consistent with those of other authors (Yu-Xiang Yan, et. al., 2018).

According to the recommendations of the World Health Organization, adult population physical activity should be at least 150 minutes per week (WHO Global recommendations on physical activity for health, 2010). Our data suggest that girls with a weekly physical activity volume of more than 150 minutes reduce the risk of suboptimal health status, which is consistent with the results of a study by other authors (Moy, et. al., 2016; Yatsun, et. al., 2017). One of the factors in severe non-communicable human diseases development is overweight and obesity (Goldaeva, Pavlenko, 2016). According to our data, girls in the second group with a total suboptimal status of more than 14 points are more likely to be overweight and obese. Therefore, they are at high risk of developing chronic non-communicable diseases, which is consistent with the statements of other authors (Krylova, et. al., 2018). Low quality of life, having suboptimal health status high level, overweight and hypodynamia (Olafsdottir et. al., 2016) can reduce a person's motor qualities. We found significantly low values of motor qualities (except flexibility) in girls with high indicators of suboptimal health status (SHS-total ≥14). They are at high risk of developing chronic non-communicable diseases and need to be monitored by the health service.

Conclusions

The examined girls with a high suboptimal health status indicator showed a decrease in the physical and mental components of their quality of life and physical fitness. Girls - students with a weekly physical activity of more than 150 minutes have an overall suboptimal status indicator significantly lower than those with physical activity of less than 150 minutes per week.

Low quality of life and motor qualities indicators, excessive body weight increase the level of girls' suboptimal health status, these are the grounds for placing such girls in the risk group for chronic non-communicable diseases.

The comprehensive method use for assessing the suboptimal health status, quality of life and physical activity, body mass index and motor qualities proved to be an effective, non-invasive screening method for identifying the risk of chronic non-communicable diseases in girls.

Low physical activity is a marker of the risk for developing body diseases and reducing the labor potential level in future specialists. Increasing physical activity, observing healthy lifestyle basics can reduce the level of students' hypodynamia.

Knowledge of the relationship between suboptimal health status and physical activity is an important aspect for young people's physical education and health care.

Conflicts of interest. The authors declare no conflict of interest.

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