

Physical fitness and life quality of female students with different classes of diseases

MIKHAIL KOLOKOLTSEV¹, ELENA ROMANOVA², TATIANA MARTIROSOVA³, OLGA LIMARENKO⁴, ANTON VOROZHEIKIN⁵, TOKHTAR KISPAYEV⁶

¹Department of Physical Culture, Irkutsk National Research Technical University, Irkutsk, RUSSIA

²Department of Physical Education, Altai State University, Barnaul, RUSSIA

³Department of Physical Culture and Health, Reshetnev Siberian State University of Science and Technology, Krasnoyarsk, RUSSIA,

⁴Department of Physical Culture, Siberian Federal University, Krasnoyarsk, RUSSIA

⁵Department of Information Technologies, Kaliningrad Institute of Management, RUSSIA

⁶Department of Theory and Methodology of Physical Culture and Sports Training, Karaganda Buketov University, KAZAKHSTAN

Published online: January 31, 2023

(Accepted for publication January 15, 2023)

DOI:10.7752/jpes.2023.01016

Abstract:

An important indicator of students' health status is the characteristic of their quality of life and physical fitness. The study of these issues in relation to the classes of diseases seems relevant and timely. *Research aim:* to study the female students' quality of life and physical fitness in relation to various somatic diseases. *Materials and methods.* The research involved 133 girls aged 17-19, who, due to their somatic health, were assigned to the 3rd functional group (special medical health group) for physical education. The female students with various classes of diseases quality of life was determined using the SF-36 questionnaire. Motor qualities were determined by testing the basic motor qualities. *Results.* Girls with diseases of the cardiovascular system and respiratory organs have the lowest ability to perform daily physical activity, which is associated with physical pain, low level of role functioning and general health. Girls with these diseases have the lowest characteristics of psychological health, emotional and behavioral control with the phenomena of anxiety and depression, compared with girls with other classes of diseases. Students with pathology of the cardiorespiratory system in 5 out of 7 motor tests registered the lowest indicators of testing the motor qualities of "speed", "strength", "speed-strength abilities" and "general endurance". *Conclusions.* Diseases of the cardiovascular and respiratory systems limit the girls' physical activity, worsen their psychological health and significantly reduce their quality of life. The results obtained should be taken into account when planning the educational process of female students' assigned to a special medical health group physical education.

Key Words: physical fitness, diseases, quality of life, motor qualities, physical education

Introduction

The leading activity of professional educational institutions is the training of qualified specialists and students' health and quality of life preservation and improvement (Abileira-Gonzalez et al., 2019). The quality of life is understood as a subjective assessment of a person's activity in society results, his/her satisfaction with the physical and mental components of health, which are the subject matter by researchers (Santini et al., 2020; Park et al., 2020). In the student environment, the analysis of the quality of life state makes it possible to assess the young people's potential in performing physical activity (Lojdová et al., 2021), their resistance to the effects of negative environmental factors and difficulties in adapting to learning conditions.

An analysis of students' health status indicates that it begins to deteriorate even while they are studying at school (Krasnozhan, 2017). With further study at the university, there is deterioration in physical, somatic and mental health indicators (Katzmarzyk et al., 2018). According to the researchers, this is due to the negative impact of a significant academic load on the health, intensive use of digital educational technologies (Hakman et al., 2020), the impact on the body of high neuro-psyche factors (McManus & Gunnell, 2020) against the background of low physical activity (Chen et al., 2020; Dominski, & Brandt, 2020; Setiakarnawijaya et al., 2021). During the study period, students develop bad habits and often do not observe the basics of a healthy lifestyle (Pengpid et al., 2019). The influence of these negative factors on students' health has especially increased in recent decades. The number of students with deviations in their somatic and mental health state and assigned to a special group for PE classes can reach 50% of the total number of students (Gerber et al., 2017; Hollis et al., 2017). About 20% of students are exempt from PE classes for health reasons, many have disabilities and limited health opportunities (Glazkova et al., 2020). Physical education of students with physical activity limitations due to non-communicable somatic diseases occupies a special place in the health-saving system in

educational institutions (Momot et al., 2020). The study of various factors that can influence the students' health state and the subsequent assessment of the satisfaction level of young people with physical and psychological aspects of their life activity becomes important. In recent decades, the study of health from the standpoint of assessing the quality of life (Rezaei) has become widely used in world practice (Rezaei & Khosroshahi, 2018; Zuffiano et al., 2018; Lojdova et al., 2021). Such research works are relevant and timely in studying the state of students' satisfaction with the quality of life, which allows outlining ways to improve their physical, mental and somatic health. Several methods are used to diagnose the state of quality of life. The most common method of diagnosing the quality of life using the SF-36 questionnaire (Short Form Health Survey); it was proposed by Ware (1993). According to many researchers, the use of this questionnaire is approved by the simplicity of the quality of life diagnosis, high sensitivity, validity and reliability of the results obtained. The scientific literature presents a sufficient number of scientific research works devoted to assessing certain population groups' quality of life in various countries of the world using a questionnaire of 36 questions (Trabal et al., 2015; Santin-Medeiros et al., 2017; Kolokoltsev et al., 2020). The unsatisfactory state of students' health in many countries focuses the researchers' attention on the study of possible links between somatic diseases with the students' quality of life and their physical fitness, which largely characterizes the physical component of the respondent. Identification of diseases of various genesis patterns interrelation with the quality of life and motor abilities makes it possible to more effectively implement physical culture and wellness technologies among students.

Research aim: to study the female students' quality of life and physical fitness in relation to various somatic diseases.

Material & methods

133 girls aged 17-19 took part in the research project, which was conducted in the 2021-2022 academic year at the Department of Physical Culture and Sports of the Irkutsk National Research Technical University. According to the medical examination, due to the state of somatic health for physical education, the girls were sent to the IIIrd functional group (special medical group) with limited volume and intensity of physical activity.

According to the revealed pathology, the students were grouped into 7 classes of diseases: A - diseases of the visual organs (n=24); B - genitourinary system (n=10); C - musculoskeletal system (n=40); D - cardiovascular system (n= 21); E - nervous system (n=11); F - blood diseases (n= 8); G - respiratory system (n= 19). To assess the female students' quality of life, the SF-36 (Short Form Health Survey) questionnaire was used, which was proposed by Ware et al. (1993). The SF-36 questionnaire subjectively characterizes the surveyed girls' quality of life by the number of points according to two components - physical and psychological. According to the methodology for assessing the quality of life using SF-36, the respondent needs to answer 36 questions, which are grouped into 8 scales: characteristics of physical and psychological components of health. The physical component of the quality of life has 4 scales, which are presented in Table 1. The psychological component also has 4 scales and evaluates mental health, role-based emotional functioning, and social and vital activity, Table 2. Using the methodology recommended by the authors, the girls assessed their quality of life in scores from 0 to 100. The maximum score evaluates the state of their health and quality of life as the best.

The state of the girls' physical fitness was assessed using generally accepted tests for assessing motor qualities: "speed", "general endurance", "speed-strength endurance of the back and abdominal muscles", "speed-strength endurance of the upper extremities muscles", "flexibility", "dynamic strength of the lower extremities muscles", Table 3. The materials obtained during the study were processed by statistical methods using licensed programs STATISTICA 10.0, MS Excel 2010. The reliability of the differences was determined by the value of the Student's t criterion. The difference in indicators was considered reliable at $p < 0.05$.

Results

The results of girls' with different classes of diseases quality of life assessing on the scales of the physical component are presented in Table 1.

Table 1. Physical component of quality of life (points, M±m)

Class of diseases	Scales of the physical component			
	Physical activity	Role functioning	Pain intensity	General state of health
A - Diseases of the visual organs (n=24)	93.0±2.0	64.58±6.88	63.88±4.03	65.08±4.32
B - Diseases of the genitourinary system n=10)	89.28±3.35	83.33±8.66	65.66±6.16	60.67±3.83
C - Diseases of the musculoskeletal system n=40)	80.87±2.32	63.75±5.65	71.33±4.11	56.71±3.29
D - Diseases of the cardiovascular system (n=21)	74.52±1.48	46.42±6.96	77.4±4.91	52.85±8.51
E - Diseases of the nervous system (n=11)	81.66±7.92	57.14±8.98	75.0±5.91	69.66±7.61
F - blood diseases (n=8)	85.0±2.64	70.0±3.24	65.38±4.44	79.2±3.37
G - Diseases of the respiratory system (n=19)	77.77±3.51	44.44±2.84	75.7±4.91	53.88±4.48

It was found that the girls' physical activity has a significant difference depending on the class of somatic disease. The most physically active were girls with visual organs (93.0±2.0 points) and the genitourinary system (89.28±3.35 points) diseases. In girls with cardiovascular system pathology, physical activity was 19.8 and 16.5% less than in students with visual organs and genitourinary system diseases ($p < 0.05$). Low physical activity rates were registered in girls with respiratory system diseases, which was 16.3 and 13.2% less than in students with visual organs and genitourinary system diseases ($p < 0.05$).

The "role functioning" scale shows the students' daily activities. According to this scale, the highest role functioning was observed in girls with genitourinary system (83.33 ±8.66 points) and blood diseases (70.0±3.24 points). In female students with cardiovascular disease, the scale value was 44.3 and 33.6% less, respectively ($p < 0.05$). In girls with respiratory pathology, the value of the scale indicator «role functioning» was 46.6 and 36.5% less than in girls with genitourinary system and blood diseases, respectively ($p < 0.05$).

The indicators of the "pain intensity" scale in girls with diseases of the cardiovascular system (77.4±4.91 points), respiratory diseases (75.7±4.91 points) and the nervous system (75.0±5.91 points) were significantly higher compared to other classes of diseases.

The worst general state of physical health was observed in girls with cardiovascular disease (52.85±8.51 points), respiratory system (53.88±4.48 points) and musculoskeletal system disease (56.71±3.29 points), compared with other classes of diseases.

The results of the assessment of the psychological component of the girls' with different classes of diseases quality of life are presented in Table 2.

Table 2. Psychological component of quality of life (points, M±m)

Class of diseases	Scales of the psychological component			
	Mental health	Role emotional functioning	Social activity	Vital activity
A - Diseases of the visual organs (n=24)	61.5±4.89	44.44±9.12	67.12±5.29	50.0±3.84
B - Diseases of the genitourinary system (n=10)	63.85±6.63	48.61±4.28	69.64±5.98	52.85±4.51
C - Diseases of the musculoskeletal system (n=40)	64.4±2.79	46.66±6.06	74.5±3.13	51.5±2.75
D - Diseases of the cardiovascular system (n=21)	60.76±4.09	34.91±6.69	61.5±5.1	43.33±5.66
E - Diseases of the nervous system (n=11)	64.0±7.04	44.44±5.39	66.66±5.16	47.38±2.59
F - blood diseases (n=8)	64.6±5.54	46.66±5.99	73.5±6.74	61.0±4.1
G - Diseases of the respiratory system (n=19)	60.44±5.14	40.74±4.79	59.72±4.27	44.44±4.14

According to the "mental health" scale, which assesses the degree of mental well-being, the presence or absence of anxiety or depression, we have identified relatively low values of indicators that do not exceed 65 points in girls with different classes of diseases, $p > 0.05$. The «role emotional functioning» scale describes the quantitative characteristics of the students' emotional status influence on implementation of educational or social activities. According to our data, the values of the indicators of this scale were low in all groups of diseases and did not exceed 50 points. It indicates a decrease in the volume and speed of performing various types of work and an increase in the cost of physical and mental activity. The highest number of points in this scale was noted in girls with genitourinary system pathology – 48.61 ± 4.28 points. The lowest values of the «role emotional functioning» scale indicator were recorded in girls with cardiovascular disease (34.91±6.69 points), which is 28.2% less than in girls with genitourinary system disease, $p < 0.05$.

The «social activity» scale describes the characteristics of communication, dialogue with other people. The analysis of our survey results of girls showed a fairly high level of social activity in the group of girls with diseases of the musculoskeletal and blood systems - 74.5± 3.13 and 73.5±6.74 points, respectively. These values exceed by 24.7 and 23.1%, respectively, the indicator of social activity in girls with respiratory system disease 59.72 ±4.27, $p < 0.05$. Relatively low values (61.5±5.1 points) of the indicator of social activity were registered in girls with pathology of the cardiovascular system. These results indicate low social activity of girls with these diseases in communication and dialogue with other people.

The «vital activity» scale level indicates that the highest value of the indicator was registered in female students with blood disease 61.0±4.1 points, which is 40.1 and 37.3% more than in girls with cardiovascular disease (43.33±5.66 points) and respiratory systems (44.44±4.14 points), respectively, $p < 0.05$. Low values of indicators of social and vital activity confirm our assumption about the development of the fatigue process in the observed female students associated with an increase in academic and psycho-emotional load at the end of the academic semester.

Determination of the female students' of a special medical group physical fitness allows identifying possible relationships of the girls' different levels of physical activity from the type of their somatic disease, Table 3.

Table 3. Girls' with different types of somatic diseases motor qualities indicators values, M ± m

Test	Disease class*						
	A	B	C	D	E	F	G
30 m running from a high start, s	5.07 ±0.2	5.25 ±0.17	5.19 ±0.08	6.73 ±0.25	5.16 ±0.16	5.2 ±0.07	6.44 ±0.13
1000 m running, m/s	6.47 ±0.19	6.02 ±0.13	6.60 ±0.17	8.60 ±0.50	5.65 ±0.2	6.47 ±0.17	8.44 ±0.24
Abdominal crunch in 30 seconds, the number of times	19.09 ±1.52	21.83 ±2.4	20.51 ±1.15	16.0 ±1.32	19.05 ±5.0	22.8 ±2.16	15.75 ±1.48
Push-ups, number of times	20.52 ±2.0	25.57 ±3.13	21.52 ±1.6	18.66 ±1.6	32.2 ±2.0	23.85 ±3.41	17.0 ±2.12
Standing long jump, cm	151.4 ±4.39	163.5 ±2.88	160.18 ±3.52	165.27 ±4.91	163.5 ±11.4	168.6 ±8.98	154.42 ±8.32
Bend forward from a sitting position, cm	9.95 ±1.29	11.85 ±4.47	16.17 ±1.21	8.54 ±2.59	11.5 ±3.5	18.4 ±2.51	11.12 ±2.39

Note. * - A - Diseases of the visual organs; B - Diseases of the genitourinary system; C - Diseases of the musculoskeletal system; D - Diseases of the cardiovascular system; E - Diseases of the nervous system; F - blood diseases; G - Diseases of the respiratory system

The results of the analysis of the speed qualities state («30 m running» test) indicate that the best value of the indicator (5.07 ± 0.2 s) was observed in girls with visual organ disease (group A). In girls with diseases of the cardiovascular (group D) and respiratory systems (group G), the lowest values of indicators are recorded - 6.73 ± 0.25 s and 6.44 ± 0.13 s, $p < 0.05$. The girls with diseases of the nervous system (5.65 ± 0.2 m/s) and with genitourinary system pathology (6.02 ± 0.13 m/s) turned out to be the most resilient (test «1000 m running»). Girls with diseases of the cardiovascular and respiratory systems (groups D and G) showed the worst result – 8.6 ± 0.50 and 8.44 ± 0.24 m/s, respectively, $p < 0.05$.

The greatest development of the trunk muscles strength («Abdominal crunch» test) was noted in girls with blood disease (group F) - 22.8 ± 2.16 times. The weakest were girls with respiratory diseases (group G) – 15.75 ± 1.48 times, which is 30.9% less than in girls of group F, $p < 0.05$. The results of testing the strength abilities of the upper extremities muscles ("Push-up" test) showed the advantage of girls with a nervous system disease (32.2 ± 2.0 times). The result of testing the arm muscles strength in girls with respiratory pathology was 17.0 ± 2.12 times) and turned out to be 47.2% less than in girls of group D, $p < 0.05$. Low indicators in speed-strength abilities in girls with diseases of the cardiovascular and respiratory systems may also indicate a significant dependence of the results of testing these qualities from the state of the reserve capabilities of the cardiorespiratory system.

Girls with blood disease (group F) - 168.6 ± 8.98 cm have the greatest development of the lower extremities muscles dynamic strength («Standing long jump» test). In female students with visual organ disease (group A), the index value was 151.4 ± 4.39 cm and was 10.2% less than in girls of group F, $p < 0.05$. Girls with blood diseases were the most flexible (the «Bend forward» test), their result was 18.4 ± 2.51 cm. The lowest test result was found in girls with cardiovascular disease – 8.54 ± 2.59 cm, which is 53.6% less than in students of group F, $p < 0.05$.

Dicussion

A significant proportion of students with identified diseases and assigned to a special medical group for physical education may account for 50% of the total number of students (Gerber et al., 2017; Hollis et al., 2017). It indicates the urgent need for research devoted to the study of issues related to the students' of a special medical group health. In recent decades, the method of determining the quality of life of the surveyed (Rezaei) has been used to characterize the state of health (Rezaei & Khosroshahi, 2018; Zuffianò et al., 2018; Lojdová et al., 2021). It allows implementing the obtained research data to improve the level of a person's physical, mental and somatic health, therefore we believe that the project we have carried out is important and timely.

The research project results obtained by us indicate the lowest values of indicators of all physical health scales in girls with diseases of the cardiovascular and respiratory systems, compared with the values of indicators of scales in girls with other classes of diseases. In our opinion, diseases of the cardiovascular and respiratory systems limit the motor potential of girls with this pathology, which is confirmed by a high level of pain on the « pain intensity» scale and low results of testing of motor qualities. Heart and lung diseases worsen the tolerance

of the girls' body to physical exertion and reduce their reserve capabilities. Our data are consistent with the research materials of other authors, which indicate the leading role of the cardiorespiratory system in the performance of physical activity (Mozolev et al., 2020; Bellenger & Buckley, 2021). We believe that when performing physical activities in the classroom by students with cardiorespiratory system diseases, it is necessary to take into account the adaptive capabilities peculiarities to prevent overstrain and disadaptation of their body.

Along with a significant deterioration in the physical component of the quality of life, especially in girls with cardiovascular and respiratory systems pathology, we found significantly low values of the mental health scale in all students, which do not exceed 65 points in all classes of diseases. This indicates a close relationship between the physical and psychological components of the examined female students. Our data indicate a decrease in the level of emotional and behavioral control of the examined girls, the appearance of feelings of anxiety and depression, a decrease in social and life activity. Diseases of various classes in girls indicate a decrease in the volume and speed of performing various types of work and an increase in the cost of physical work and mental activity. These data confirm the results we obtained when comparing the quality of life of girls of different generations (Kolokoltsev et al., 2020). Especially low scores in the "role emotional functioning" scale were found in girls with cardiovascular disease. Relatively low values of indicators on the scales of "social activity" and "vital activity" were also registered in girls with cardiovascular system pathology. The low values of the indicators of the psychological component of the quality of life confirm our assumption about the development of the fatigue process in the observed female students associated with an increase in educational and psycho-emotional load at the end of the academic semester. A particularly pronounced deterioration in the quality of life was found in girls with pathology of the cardiovascular and respiratory systems.

The research results analysis of the girls of the special medical group physical fitness indicates a significant difference in the results of testing motor qualities depending on the class of the disease. We found that girls with diseases of the cardiovascular and respiratory systems have the lowest result in the tests, which confirms the important role of the cardiorespiratory system in performing physical loadings, especially high-speed, high-speed power direction and general endurance.

Conclusions

As a result of the research project, it was found that the characteristics of the physical component of the quality of life in girls with various diseases have significant differences. The lowest ability to perform daily physical activity associated with physical pain, low level of role functioning and general health were found in girls with diseases of the cardiovascular system and respiratory organs. Girls with these diseases have the lowest characteristics of psychological quality of life, emotional and behavioral control with the phenomena of anxiety and depression, low social and vital activity than students with other diseases.

The lowest values of physical fitness indicators are recorded in most motor tests in girls with diseases of the cardiovascular system and respiratory organs. Analysis of the results of motor testing shows that diseases of the cardiorespiratory system significantly limit the motor potential of girls, which can further aggravate the course of the disease and cause disadaptation of the body. During PE classes at an educational institution, the teacher should pay the greatest attention to students with heart and lung diseases.

The obtained research results should be taken into account when planning the educational process of physical education of female students assigned to a special medical group.

Conflicts of interest. The authors declare no conflict of interest regarding the publication of this study.

References

- Abilleira-González, M., Fernández-Villarino, M.A., Varela-Casal, C., Arufe-Giráldez, V., Silva-Piñeiro, R., & Gonzalez-Gonzalez, S.G. (2019). Physical activity intervention program through walking routes in sedentary university students. *Journal of Human Sport and Exercise*, 14(2), 411-425. DOI: 10.14198/jhse.2019.142.13
- Bellenger, C., Thomso, R., Davison, K., Robertson, E., & Buckley, J. (2021). The Impact of Functional Overreaching on Post-exercise Parasympathetic Reactivation in Runners. *Front Physiol*, 11. DOI: 10.3389/fphys.2020.614765
- Chen, P., Mao, L., Nassis, G. P., Harmer, P., Ainsworth B. E., & Li, F. (2020). Coronavirus disease (COVID19): The need to maintain regular physical activity while taking precautions. *Journal of Sport and Health Science*, 9(2), 103-104. DOI: 10.1016/j.jshs.2020.02.001
- Dominski, F. H., & Brandt, R. (2020). Do the benefits of exercise in indoor and outdoor environments during the COVID-19 pandemic outweigh the risks of infection? *Sport Sciences for Health*, 16, 583-588. DOI:10.1007/s11332-020-00673-z
- Gerber, M., Ludyga, S., Mucke, M., Colledge, F., Brand, S., & Puhse, U. (2017). Low vigorous physical loads is associated with increased adrenocortical reloads to psychosocial stress in students with high stress perceptions. *Psychoneuroendocrinology*, 80, 104-113. DOI:10.1016/j.psyneuen.2017.03.004

- Glazkova, G., Mamonova, O., Gracheva, D., & Pukhovskaya, M. (2020). Social aspects of physical education of students with deviations in health status. *Journal of Physical Education and Sport*, Vol. 20(5), Art 347, pp. 2545 – 2553. DOI:10.7752/jpes.2020.05347
- Hakman, A., Andrieieva, O., Kashuba, V., Nakonechnyi, I., Cherednichenko, S., Khrypko, I., Tomilina, Y., Filak, F., & Moldovan, A. (2020). Characteristics of biogeometric profile of posture and quality of life of students during the process of physical education. *Journal of Physical Education and Sport*, Vol.20 (1), Art 10, pp. 79 – 85. DOI:10.7752/jpes.2020.01010
- Hollis, J.L., Sutherland, R., Williams, A.J., Campbell, E., Nathan, N., Wolfenden, L., Morgan, P.J., Lubans, D.R., Gillham, K., & Wiggers, J. (2017). A systematic review and meta-analysis of moderate-to-vigorous physical loads levels in secondary school physical education lessons. *International Journal of Behavioral Nutrition and Physical Loads*, 14. DOI:10.1186/s12966-017-0504-0
- Katzmarzyk, P.T., Lee, I.M., Martin, C.K., & Blair, S.N. (2017). Epidemiology of Physical Loads and Exercise Training in the United Conditions. *Progress in Cardiovascular Diseases*, 60(1), 3-10. DOI:10.1016/j.pcad.2017.01.004
- Kolokoltsev, M.M., Ermakov, S.S., Tretyakova, N.V., Krainik, V.L., & Romanova, E.V. (2020). Physical activity as a factor in improving the quality of life of students. *Education and science. Scientific journal*, 22(5), 150-168. DOI:10.17853/1994-5639-2020-5-150-168 (in Russian)
- Krasnozhoz, S.V. (2017). Motor activity as a criterion for the level of health. *Physical culture. Sport. Tourism. Motor recreation*, 2(1), 46-52
- Lojdová, M., Kvintová, J., Štěrbová, D., & Krol, P. (2021). Assessment of life satisfaction and its selected components in relation to the level of physical activity. *Journal of Physical Education and Sport*, Vol. 21 (3), Art 171, pp. 1346 – 1353. DOI:10.7752/jpes.2021.03171
- McManus, S., & Gunnell, D. (2020). Trends in mental health, non-suicidal self-harm and suicide attempts in 16–24-year old students and non-students in England, 2000–2014. *Social Psychiatry and Psychiatric Epidemiology*, 55(1), 125-128. DOI:10.1007/s00127-019-01797-5
- Momot, O., Diachenko-Bohun, M., Hrytsai, N., Grygus, I., Stankiewicz, B., Skaliy, A., Hagner-Derengowska, M., Napierała, M., Muszkieta, R., Ostrowska, M., & Zukow, W. (2020). Creation of a Healthcare Environment at a Higher Educational Institution. *Journal of Physical Education and Sport*, Vol 20 (Supplement issue 2), Art 138, pp. 975 – 981. DOI:10.7752/jpes.2020.s2138
- Mozolev, O., Kravchuk, L., Ostrovska, N., Nahorna, O., Polishchuk, O., & Khmara, M. (2020). Checking the effectiveness of the method of conducting physical education classes with 17-19 -year-old female students of special medical group. *Journal of Physical Education and Sport*, Vol. 20(2), Art 124, pp. 870 – 876. DOI:10.7752/jpes.2020.02124
- Park, M., Anaza, E., Shin, H., Pack, S.M., & Chitiyo, M. (2020). Relationship between physical activity and quality of life in older adults: a metaanalysis. *Journal of Physical Education and Sport*, Vol. 20(6), Art 468, pp. 3467 – 3477. DOI:10.7752/jpes.2020.06468
- Pengpid, S., & Peltzer, K. (2019). Sedentary Behaviour Physical Activity and Life Satisfaction, Happiness and Perceived Health Status in University Students from 24 Countries. *International Journal of Environmental Research and Public Health*, 16(12). DOI:10.3390/ijerph16122084
- Rezaei, A., & Khosroshahi, J.B. (2018). Optimism, social intelligence and positive affect as predictors of university students' life satisfaction. *European Journal of Mental Health*, 13(2), 150-162. DOI:10.5708/EJMH.13.2018.2.3
- Santini, Z. I., Stougaard, S., Koyanagi, A., Ersbøll, A. K., Nielsen, L., Hinrichsen, C., Madsen, K. R., Meilstrup, C., Stewart-Brown, S., & Koushede, V. (2020). Predictors of high and low mental well-being and common mental disorders: findings from a Danish population, based study. *European Journal of Public Health*, 30(3), 503-509. DOI:10.1093/eurpub/ckaa021
- Santín-Medeiros, F., Santos-Lozano, A., Cristi-Montero, C., & Garatachea Vallejo, N. (2017). Effect of 8 months of whole-body vibration training on quality of life in elderly women. *Research in Sports Medicine*, 25(1), 101-107. DOI:10.1080/15438627.2016.1258638
- Setiakarnawijaya, Y., Safadilla, E., Rahmadani, E.A., Robianto, A., & Fachrezzy, F. (2021). Android-based physical fitness software guidance. *Journal of Physical Education and Sport*, Vol 21 (Suppl. issue 4), Art 295, pp. 2313 – 2319. DOI:10.7752/jpes.2021.s4295
- Trabal, J., Forga, M., Leyes, P., Torres, F., Rubio, J., Prieto, E., & Farran-Codina, A. (2015). Effects of free leucine supplementation and resistance training on muscle strength and functional status in older adults: a randomized controlled trial. *Clinical Interventions in Aging*, 13(10), 713-723. DOI:10.2147/CIA.S75271
- Ware, J. E., Snow, K. K., Kosinski, M., & Gandek, B. (1993). SF-36 Health Survey. Manual and interpretation guide. The Health institute, New England Medical Center. Boston, Mass., pp. 21–28.
- Zuffianò, A., Martí-Vilar, M., & López-Pérez, B. (2018). Prosociality and life satisfaction: A daily-diary investigation among Spanish university students. *Personality and Individual Differences*, 123, 17-20. DOI:10.1016/j.paid.2017.10.042