UDC 796.411:159.9:613.8

INFLUENCE OF CROSSFIT TRAINING ON THE MENTAL CONDITION AND QUALITY OF LIFE OF YOUNG PEOPLE

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https://doi.org/10.29038/2220-7481-2019-01-62-70

Abstracts

Topicality*.** Despite significant achievements and a detailed study of the biological, social and behavioral aspects and the importance of motor activity for a person's mental health, open to consideration and discussion remains the question of understanding the mechanisms of the influence of physical activity on the mental health of children and adolescents. The ***purpose was to evaluate the impact of CrossFit training on the mental status and indicators of life quality of adolescents. ***Methods.*** The study involved 14 people aged 14–16 years. CrossFit training lasted 1 hour 3 times a week for two months. The training included multifunctional complex exercises, mainly of strength orientation, which participants performed in the aerobic mode in a zone of high intensity, duration of no more than 20 minutes. The PedsQL™ questionnaire (Generic Core, Ukrainian version for respondents aged 13–18 years) was used to assess the quality of life. Participants perception about themselves (self-concept) was studied by the assessment of the physical self- concept, mood, sports and academic competencies. Dependent nonparametric samples were compared using the Wilcoxon Z-criterion. ***Results.*** After participating in the 8-week program, there was an increase ($p<0,01$) of the level of physical preparedness by the results of the performance of exercise complexes. The average values of all indicators of the self- concept increased after participating in the program. Positive dynamics was observed for indicators «Mood» ($p=0,09$), «Sports Competence» ($p=0,09$), «Academic Competence» ($p=0,10$). At the end of the program, the quality of life indicators increased by 4–10 points and exceeded the value of 75 points. Changes were observed to the indicators of the Physical Functioning Scale (10 %, $p=0,1$), Emotional Functioning Scale (14 %, $p=0,09$) and School Functioning Scale (15 %, $p=0,03$). ***Conclusions.*** Simultaneously with raising in the level of physical preparedness, 8-week CrossFit program was useful for increasing of self-confidence and improving mood. The participants have observed an increase in the quality of life by 10–15 %.

Key words: health-related quality of life, mental health; PedsQL, CrossFit, strength fitness, adolescent.

Юлія Павлова, Олена Заставська. Вплив занять кросфітом на психічний стан та якість життя молоді. ***Актуальність***. Незважаючи на значні напрацювання, детальне вивчення біологічних, соціальних та поведінкових аспектів і значення рухової активності для психічного здоров'я людини, відкритими для розгляду й дискусії залишаються питання розуміння механізмів впливу фізичної активності на психічне здоров'я дітей та підлітків. ***Мета*** статті – оцінити вплив занять кросфітом на психічний стан і показники якості життя осіб підліткового віку. ***Методи.*** У дослідженні взяли участь 14 осіб віком 14–16 років. Тренування з кросфіту тривалістю 1 год відбувалися тричі на тиждень упродовж двох місяців. До складу тренувань входили багатофункціональні комплексні вправи переважно силової спрямованості, які учасники виконували в аеробному режимі в зоні високої інтенсивності, тривалістю не більше ніж 20 хв. Для оцінювання якості життя застосовували анкету PedsQL™ (Generic Core, український варіант для респондентів віком 13–18 років). Уявлення учасників про самого себе («Я»-концепція) вивчали за оцінкою фізичного «Я», настрою, спортивної й академічної компетентностей. Залежні між собою непараметричні вибірки порівнювали за допомогою Z-критерію Вілкоксона. ***Результати.*** Після участі у 8-тижневій програмі спостерігали зростання ($p<0,01$) рівня фізичної підготовленості за результатами виконання комплексів вправ. Середні значення всіх показників «Я»-концепції зростали після участі в про- грамі. Позитивну динаміку спостерігали для показників «Настрій» ($p=0,09$), «Спортивна компетентність» ($p=0,09$), «Академічна компетентність» ($p=0,10$). По завершенню програми показники якості життя зросли на 4–10 балів та перевищували значення 75 балів. Зміни спостерігали щодо показників шкал «Фізичне функціонування» (на 10 %, $p=0,1$), «Емоційне функціонування» (на 14 %, $p=0,09$) і «Функціонування в школі» (на 15%, $p=0,03$). ***Висновки.*** Одночасно зі збільшенням рівня фізичної підготовленості, 8-тижневі тренування з кросфіту сприяли зростанню впевненості в собі, поліпшенню настрою. В учасників програми спостерігали зростання показників якості життя на 10–15 %.

Ключові слова: якість життя, пов'язана зі здоров'ям; психічне здоров'я, PedsQL, CrossFit, силовий фітнес, підлітки.

Юлия Павлова, Елена Заставская. Влияние занятий кросфитом на психическое состояние и качество жизни молодежи. ***Актуальность.*** Несмотря на значительные наработки, детальное изучение биологических, социальных и поведенческих аспектов и значения двигательной активности для психического здоровья человека, открытыми для рассмотрения и дискуссии остаются вопросы понимания механизмов влияния физической активности на психическое здоровье детей и подростков. ***Цель*** статьи – оценить влияние занятий кросфитом на психическое состояние и показатели качества жизни лиц подросткового возраста. ***Методы***. В исследовании приняли участие 14 человек в возрасте 14–16 лет. Тренировки с кросфита продолжительностью 1 час происходили три раза в неделю в течение двух месяцев. В состав тренировок входили многофункциональные комплексные упражнения, преимущественно силовой направленности, которые участники выполняли в аэробном режиме в зоне высокой интенсивности, длительностью не более чем 20 мин. Для оценки качества жизни применяли анкету PedsQL™ (Generic Core, украинский вариант для респондентов в возрасте 13–18 лет). Представление участников о самом себе («Я»-концепция) изучали по оценке физического «Я», настроения, спортивной и академической компетентности. Зависимые между собой непараметрические выборки сравнивали с помощью Z-критерия Вилкоксона. ***Результаты.*** После участия в 8-недельной программе наблюдали рост ($p < 0,01$) уровня физической подготовленности по результатам выполнения комплексов упражнений. Средние значения всех показателей «Я»-концепции росли после участия в программе. Положительную динамику наблюдали для показателей «Настроение» ($p=0,09$), «Спортивная компетентность» ($p=0,09$), «Академическая компетентность» ($p=0,10$). По завершению программы показатели качества жизни выросли на 4–10 баллов и превышали значение 75 баллов. Изменения наблюдали по показателям шкал «Физическое функционирование» (на 10 %, $p=0,1$), «Эмоциональное функционирование» (на 14 %, $p=0,09$) и «Функционирование в школе» (на 15 %, $p=0,03$). ***Выводы.*** Одновременно с увеличением уровня физической подготовленности 8-недельные тренировки с кросфита способствовали росту уверенности в себе, улучшению настроения. В участников программы наблюдали рост показателей качества жизни на 10–15 %.

Ключевые слова: качество жизни, связанное со здоровцем; психическое здоровье, PedsQL, CrossFit, силовой фитнес, подростки.

Introduction. One of six inhabitants of our planet is a person aged 10-19. This category of people is generally considered to have the best health. However, a detailed analysis of the morbidity and the number of years lost due to disability reveals that the health disorders of this age group make up 15% of the total morbidity in the world. In most countries, the main causes of illness are road accidents, iron deficiency anemia, intentional harm to their own health, anxiety and depression. In 2015, in Europe, 1.480 years per 100,000 people aged 10-19 (DAILY index) were lost due to mental health problems, while anemia and road injury accounted for 786 and 445 lost years, respectively [26]. Poor mental health at a young age is particularly dangerous as it becomes a trigger for the development of risky behavior, different dependencies, and deterioration of physical condition [9]. All these in complex continue to contribute to negative changes that have long-term effects and can significantly impair the quality of life in adulthood.

Monitoring various aspects of health and promoting healthy behavior among young people are important not only for early prevention and anticipation, but also an excellent investment in the development and prosperity of the country.

Introduction. Violations of mental health are socially debilitating, they are directly related to suicide, drug abuse, homelessness. 20 % of children and young people have minor mental health problems, and 7–10 % are serious violations that impede normal development [10]. In addition to serious cases, emotional and depressive disorders are very common, a large number of people are negatively assessing their own appearance and ability, suffering from chronic stress, and complaining of hopelessness and anxiety.

Despite the fact that all these phenomena significantly impair the quality of human life, they are usually not clinically diagnosed, and accordingly, the prevalence of such problems is difficult to appreciate. It is proved that the indexes of mental illness are higher among the female population and socially unprotected categories of the population [14].

Despite the developed recommendations, well-developed treatment protocols, the presence of social stigma impedes asking potential patients for help, which in its turn requires the search for alternative approaches to mental health correction.

The results of scientific research suggest that physical education and sports cannot only prevent mental health problems, but also mitigate the development of this group of diseases. In general, physical education and sports are considered in four planes, taking into considaration their direct positive impact on mental health – that is the treatment of mental illness and disorder; prevention of mental illness and disorders; improvement of mental and physical well-being of persons with mental illness; improvement of mental well-being of the population as a whole [2; 10; 12; 18; 19; 20; 22].

Among the common positive effects, scientists name the growth of endorphins, mitochondriogenesis, the production of neurotransmitters, the weakening of the reaction of the hypothalamic-pituitary-adrenal system to stress [13; 16; 25], reduction of inflammatory processes [16], increase of self-efficiancy, etc. [3; 7; 15].

Despite significant developments, a detailed study of the biological, social and behavioral aspects and the importance of motor activity for human mental health, scientists recognize that the accumulated data relate to the adult population. Issues of understanding the mechanisms of the influence of physical activity on the mental health of children and teenagers are open for consideriation and discussion.

The purpose of the work is to assess the impact of CrossFit training on the mental state and life quality indicators of teenagers.

Material and methods of research. The study involved 14 people aged 14-16. All participants received informed consent to participate in the study.

According to the concluded program, an hour training was carried out 3 times a week for two months (total number of occupations – 24). The training included multifunctional complex exercises, mainly of force orientation, which the participants performed in an aerobic mode in a zone of high intensity, lasting no more than 20 minutes. The bulk of the training included various exercise complexes (Table 1).

Table 1

The number of class	**The main part complex of exercises**	**Protocol**
1	**2**	**3**
1, 13	1min – 7 push-ups 2-ra mins –10 squats with free weights 4–5 kg, 3min – 100 м running	EMOM[1], 12 mins
2, 14	1min – squats, 2min – rest, 3min – sit-ups, 4min – rest, 5min – Jumping Jack, 6min – rest	2RFT[2]
3, 15	10 push-ups, 10 dumbbell jerking (3–4 kg), 5 sit-ups with ganteleû (5–6 kg), 5 sit-ups, 50 m running	RFT
4, 16	1min– 10 trasters (2–3 kg), 2min– 12 sit-ups, 3min– 10 push-ups, 4min– 12 Jumping Jacks	EMOM, 12 mins
5, 17	1min– 8–10 push-ups lying (10 kg), 2min – 10 jumping pull-ups from stand 40–50 sm	EMOM, 8 mins
	10 floor push-ups , 10 sit-ups, 10 sit-ups and 30 jumps on the jumping rope	3RFT
6, 18	1–3 min– 8 times the capture of 4 kg weight metball in rack, 4–9 min– 6 times the capture of 4–6 kg weight metball	EMOM, 9 mins
	12 hyperèkstenziâ on the simulator GHD, 30 sec level, 1 min rest	5RFT
7, 19	Trasters with free weights (3–4 kg)	21-15-9[3]
	Sit-ups(20 sec), angle (10se c), fold (20 sec), angle (10 sec), the maximum number of approaches without a break	Табата[4]
8, 20	8–10 dumbbell push-ups (3 kg), 8–10 times the capture of weight metball in rack (4 kg), 8–10 times the capture of weight metbal and push-ups	EMOM, 16 mins
9, 21	Forceful squats with dumbbells (5 approaches with 5 repetitions)	
	15 jumping pull-ups from stand 40–50 sm, angle (30 sec), 10 lunges, 10 sit-ups	3RFT
10, 22	8–10 swings with 8 kg kettlebe, 10 trasters (2–3 kg), 30 jumps on the jumping rope	EMOM, 12 mins

End of the Table 1

1	2	3
11, 23	Jumping on a 40–50 sm stand, dumbbell jerking (4–5 kg)	21-15-9
12, 24	8 burps, 8 4 kg metball throwin, 12 sit-ups 7 push-ups , 7 trasters with 2 kg dumbbells, 7 burps	EMOM, 12 mins

Note. [1] - exercises performed for a certain period of time; the faster the participant fulfilled the task, the more time he had to rest, if there was not enough time for the task, the exercise was stopped; [2] - time exercisising of n rounds; [3] - in the first event exercises were performed 21 times, in the second – 15 times, in the third - 9 times; [4] - maximum number of repetitions without breaking.

Before and after participating in the program, the level of physical fitness of participants, quality of life indicators and the «I» -concept were assessed.

To assess *the level of physical preparedness* complexes that consisted of the following exercises were used:

Complex number 1 -10 press-ups, 10 jerks of dumbbells, 5 strict squats, 5 sit-ups, 50 m run; performed according to 3RFT protocol, the results were measured in seconds;

Complex number 2 - trasters, burp through the dumbbell, jumping with a rope; performed according to the protocol «21-15-9», the result - in seconds;

Complex number 3 - 15 jump pulls, 15 sit-ups, 10 lunges, 10 strict squats; performed according to 3RFT protocol, the result was measured in seconds;

Complex number 4 - 7 trasters, 7 strict tightening exercises with a fitness expander, which compensates 20-50 kg, 7 burps; performed according to the EMOM protocol, the result is the maximum number of rounds, the number of repetitions;

Complex number 5 - sit-ups (20 s), angle (10 s), body upsurge to the feet (20 s), angle (10 s); performed according to the protocol of tabat, the result was measured in seconds.

Additional data on the level of physical fitness were obtained by the following exercises: burps (maximum number of repetitions / ms), jumping (maximum number of repetitions / ms), attendance (maximum number of repetitions / ms), trasters (maximum number of repetitions / ms) , strict stretching from the fitness expander, which compensates for 20-50 kg (maximum number of repetitions), strict pressure (maximum number of repetitions), jump in length (cm), jump in height (cm), force squats (kg), bench press (kg), dumbbell press sitting (kg).

The Pediatric Quality of Life Inventory ™ (PedsQL ™ Generic Core, Ukrainian version for respondents aged 13-18 years) was used to determine the life quality indicators [23; 24]. To use it, the study received permission from the organization Mapi Research Trust. The questionnaire consists of 23 questions relating to daily activity and health problems in the last 7 days. The results were counted in points (the maximum value is 100, the minimum value is 0) on the scale «Physical functioning», «Emotional functioning», «Social functioning», «Functioning in school».

The submission of the participants about themselves (the «I» -concept), namely the assessment of the physical self, mood, sport and academic competence, was determined with the help of a set of positive and negative allegations adapted from the works of S. Harter, U. Skifele, B. Bretsnayder and E. Gerlach [27]. For this purpose, such statements were used as – «I am often sad without a reason», «I rarely laugh», «I often stay at home doing nothing, because I do not want to do anything», «If others have fun, I cannot laugh and have fun with them», « I do not enjoy anything more and nothing brings pleasure to me «; «I have reason to be proud of myself», «In general, I am very pleased with myself», «I do not think so much about myself», etc. The emotional state of the respondent during physical education lessons / sports was used as an indicator of the attitude to physical education («If someone mentions sports, then everything seems to be squeezed inside», «I forget about everything during classes / physical education / sports» , «In my spare time I would be most interested in physical education and sports,» etc.).

Sports competence was studied through questions related to the ability to certain types of motor activity, academic competence - on the ability of respondents to cope with school tasks.

Questions were evaluated on a 4-point scale (the maximum value is 4, the minimum value is 1).

Statistical processing of data. The arithmetic mean (M), the standard error of the mean (SE), the smallest and largest value (Xmin, Xmax), Median (Me), confidence intervals (95% Cl) were determined. Dependent nonparametric samples were compared using the Wilcoxon Z-criterion. The difference was considered to be significant at a level of significance not lower than 95% (p≤0,1).

Research results. *Changes in the physical preparedness of teenagers.* After participating in the 8-week program, a statistically significant increase in the level of physical preparedness was observed according to the results of the first (p = 0.03), second (p = 0.02) and fourth (p = 0.01) complexes (Table 2).

According to the additional assessment, the results of the following exercises were also improved: jumping with a rope (p = 0.01), trasters (p = 0.01), strict pressing (p = 0.01), jump in height (p = 0.02), dynamic squats (p <0.001), bench press (p <0.001), seated dumbbells (p <0.001), tightening with fitness expander (p = 0.01).

Changes in the indicators of the «I» -concept of teenagers. Average values of all indicators of the «I» - concept grew after participating in the program (Table 3). Thus, the indicator «Estimation of the physical» I «increased by 0.2 points,» Estimation of appearance «- by 0.1 points,» Self-esteem «- by 0.3 points,» Mood «- by 0.2 points,» Sports competence «- by 0,2 points,» Academic competence «- by 0,3 points,» Attitude to a physical education lesson «- by 0,1 points. Positive dynamics was observed for indicators «Mood» (p = 0.09), «Sports Competence» (p = 0.09), «Academic Competence» (p = 0.10).

Table 2

The dynamics of the physical preparedness of teenagers

Indicator	Before/ After the programme	M ± SE	95% CI	Min	Me	Max	Z	p
Complex 1, c	**Before**	391,1 ± 4,4	381,5; 400,6	362	390	419	2,13	0,03*
	After	379,6 ± 17,3	341,8; 417,4	213	381	510		
Complex 2, c	**Before**	530,5 ± 1,9	526,4; 534,6	518	530	542	2,28	0,02*
	After	521,6 ± 4,4	512,1; 531,2	472	523	533		
Complex 3, c	**Before**	468,9 ± 2,6	463,3; 474,5	450	470	482	1,54	0,12
	After	468,0 ± 5,2	456,7; 479,3	440	468	520		
Complex 4, the number of repetitions	**Before**	30,4 ± 2,5	24,9; 35,9	19	35	41	-2,56	0,01*
	After	35,2 ± 1,5	31,9; 38,4	29	37	41		
Complex 5, c	**Before**	179,3 ± 7,2	163,6; 195,1	120	180	210	-1,54	0,12
	After	189,3 ± 14,4	158,0; 220,6	121	202	223		

Note * – statistically reliable changes (p ≤ 0,1)

Changes in the quality of teenagers' life. Initial values of quality of life in respondents were in the middle range. For most scales, the quality of life did not exceed 70 points - «Physical functioning» - 69.2 ± 3.4 points, «Emotional functioning» - 63.1 ± 5.5 points, «Functioning in school» - 66.2 ± 4, 0 points (Table 4).

Among the respondents, there were individuals with very low (30-50 points) and high (94-100 points) quality of life indicators, but within the limits of each scale, the spread of data was insignificant, confidence intervals of all scales, except for «Social functioning» (95% Cl - 66.9-89.3 points) were in the range of mean values.

Table 3

The dynamics of the «I»- concept of teenagers (in points)

Indicator	До/ після прог-рами	M ± SE	95% CI	Min	Me	Max	Z	p
Physical «I»	**Before**	2,9 ± 0,3	2,3; 3,6	1,0	3,3	4,0	-0,31	0,76
	After	3,1 ± 0,3	2,5; 3,6	1,0	3,7	4,0		
Appearance evaluation	**Before**	2,5 ± 0,2	2,0; 3,0	1,0	2,8	3,4	-0,24	0,80
	After	2,6 ± 0,2	2,2; 3,1	1,4	2,8	3,6		
Self respect	**Before**	2,9 ± 0,1	2,7; 3,2	2,0	3,0	3,5	-1,39	0,17
	After	3,2 ± 0,1	3,0; 3,4	2,8	3,3	3,8		
Mood	**Before**	3,2 ± 0,1	2,9; 3,5	2,4	3,4	4,0	-1,69	0,09*
	After	3,4 ± 0,1	3,3; 3,6	3,0	3,4	4,0		
Sports Competence	**Before**	3,3 ± 0,1	3,0; 3,6	2,5	3,5	3,8	-1,70	0,09*
	After	3,5 ± 0,1	3,3; 3,8	2,7	3,7	4,0		
Academic Competence	**Before**	2,8 ± 0,2	2,4; 3,2	2,0	2,7	4,0	-1,65	0,10*
	After	3,1 ± 0,1	2,8; 3,4	2,0	3,0	4,0		
Attitude to physical education	**Before**	3,1 ± 0,1	2,8; 3,3	2,3	3,2	3,7	-1,02	0,32
	After	3,2 ± 0,1	2,8; 3,5	2,0	3,3	3,7		

Note * – statistically reliable changes ($p \leq 0,1$)

At the end of the 8-week program, the quality of life scores increased by 4-10 points and exceeded the value of 75 points. Statistically significant changes were observed regarding the indicators of the «Physical functioning» (10%, p = 0.1), «Emotional functioning» (14%, p = 0.09) and «Functioning in school» (by 15%, p = 0.03).

Table 4

Dynamics of indicators of quality of life (in points)

Scale	Before / After programme	M ± SE	95% Cl	X_{min}	Me	X_{max}	Z	p
Physical Functioning	Before	69,2 ± 3,4	61,8; 76,7	46,9	75,0	87,5	-1,65	0,10*
	After	76,2 ± 2,3	71,2; 81,2	62,5	78,1	93,8		
Emotional Functioning	Before	63,1 ± 5,5	51,1; 75,0	30,0	65,0	95,0	-1,69	0,09*
	After	71,9 ± 4,5	62,1; 81,8	30,0	75,0	95,0		
Social Functioning	Before	78,1 ± 5,1	66,9; 89,3	40,0	85,0	95,0	-0,74	0,47
	After	82,7 ± 5,0	71,8; 93,6	45,0	90,0	100,0		
Functioning at school	Before	66,2 ± 4,0	57,3; 75,0	50,0	65,0	100,0	-2,15	0,03*

Note * – statistically reliable changes ($p \leq 0,1$)

Discussion. CrossFit training is aimed at developing endurance, speed and power qualities, coordination, agility and balance. When constructing classes, elements of various types of sports -

gymnastics, heavy and athletics, etc. are used [4]. Classes contain exercises of high intensity, which need to be repeated many times, to be performed quickly, with the restoration between exercises virtually absent or minimal. The proposed 8-week program contributed to the enhancement of training level, in particular, the functional capabilities of the cardiopulmonary bypass system, which can be followed by improvement of the indicators of testing exercises. The obtained results confirm the data of other scientific studies [1; 6; 8], in particular after participating in training of similar duration, statistically significant changes were observed in the body mass index and Shuttle-test results [6].

The results of improving mental health as a result of crossFitting are quite ambiguous. In the work of N. Eazera et al. [5] no significant changes were found in the mental health indicators of persons aged 15; however, in the subgroup of participants with an increased risk of mental distress, the rates improved. According to other data of the same group [6], the participants showed completely opposite results.

Interesting is the opinion of scientists that training according to the system of the crossFit is effective for the prevention and treatment of age-related changes (for example, senile dementias), since they stimulate neurogenesis, the development of proteins involved in the differentiation of cells that develop in the hippocampus [17].

Positive statistically significant changes were observed regarding participants' responses to questions related to the ability to certain types of motor activity, understanding of their own school abilities, the success of the lessons, and the effectiveness of the applied efforts to accomplish school tasks. CrossFit training is often offered to young people at risk, including low levels of social support, difficult life situations, etc. [11]. The changes taking place with the participants concern mainly self-esteem and self-confidence growth [21].

The effect of physical exercises on various aspects of quality of life, in particular on social and emotional functioning, is not substantiated enough, but a number of studies have shown that physical education and sports can mitigate the symptoms of depression, promote mood and socialization [27].

After participating in the program, the quality of life of teenagers under the «Physical functioning» scales (76,2 ± 2,3 points), «Functioning at school» (76,2 ± 3,5 points) has changed from medium to high. Such effect can be considered as reliable, as the quality of life associated with health does not improve with the age of the Ukrainian population [27]. Despite the increase in the average indicator of quality of life on the scale of «Social functioning» (assessment of relationships with peers, comparison with oneself), these changes were statistically unreliable, which can be explained by the lack of program duration. According to the literature, positive effects in the mental and social components of quality of life were observed in participants of 3-12 month programs [27].

Conclusion. Alongside with the increase in the level of physical fitness, 8-week crossFit training helped to increase self-confidence (in terms of sports and academic competence) and to improve mood. The participants of the program developed a higher quality of life by 10-15% on the scale of «Physical functioning», «Emotional functioning» and «Functioning in school».

Prospects for further research lie in the development of training programs for the youth at risk.

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Received: 21.03.2019.