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RESEARCH ARTICLE

Treatment of Childhood and Adolescent Depression with Physical Rehabilitation

Olga Taranina[1*], Vladimir Starostin[2], Vadim Anurov[3]

1. *Federal state budgetary educational institution of higher education N. N. Burdenko Voronezh State Medical University of the Ministry of health of the Russian Federation, Voronezh, Russian Federation.*
2. *Yakut state agricultural Academy, Yakutsk, Russian Federation.*
3. *Financial University under the Government of the Russian Federation, Moscow, Russian Federation.*

***Corresponding Author: Olga Taranina**

Abstract

One of the effective methods of treating depression in children and adolescents is exercising. The aim of the research is to study the effectiveness of physical activity in the treatment of psychogenic depression in children and adolescents. The sampling contained 90 children and adolescents (age 11-15 years) suffering from psychogenic depression, they were divided into 2 groups: group 1 (control group) – 45 children undergoing psychotherapy for 8 weeks; group 2 (study group) – 45 children who, in addition to psychotherapy, were treated with a complex of physical exercises 1 hour a day 4 times a week for 8 weeks. The main methods of the study were clinical-anamnestic and clinical-psychopathological methods, analysis of medical history and lifestyle data, anthropometry methods, laboratory and instrumental diagnostics, mathematical statistics methods. At the end of the 8th week of treatment, HAM-D score level of depression significantly decreased by 2.27 times ($p < 0.05$) in patients who underwent psychotherapy and physical rehabilitation, and by 1.7 times ($p < 0.05$) in patients who underwent only psychotherapy, the level of anxiety on the NAM-A scale decreased by 2.23 times ($p < 0.05$) and 1.78 times ($p < 0.05$), adherence to stress on the PSS scale by 2.15 times ($p < 0.05$) and 1.58 times ($p < 0.05$), respectively. The statistically significant intergroup difference was ($p < 0.05$). Physical activity is an effective and inexpensive method of treatment and rehabilitation of childhood and adolescent depression, which can improve their mental and physical health.

Keywords: *Psychogenic depression in children and adolescents, Physical rehabilitation for psychogenic depression, Psychotherapy in children and adolescents, Depression and anxiety scale.*

Introduction

Almost a quarter of the world's population are children and adolescents aged 5 to 17 years, of which 85% live in low- and middle-income countries, where, unfortunately, protecting of public health, including children, not a priority [1]. This fact should cause particular concern, since children's health is a mirror image of the socio-economic well-being and development of a particular country [2].

It is known that "health" includes not only the physical, but also, necessarily, the mental well-being of a particular individual. That is why special attention should be paid to the prevention and treatment of not only “physical disorders”, but also mental [3, 4].

However, the mental health is currently one of the forgotten aspects for the health care system of most countries that attracted attention only at the very point, as an additional, even random component in a local health care system [2]. The prevalence of mental disorders among children and adolescents ranges from 10% to 20% depending on the country [3, 5].

According to the German Health Interview and Examination Survey for Children and Adolescents, the prevalence of mental illness in the country was 10% [6]. According to National Survey of the Mental Health and Wellbeing of Australian Children and Adolescents, conducted in 2013 and 2014,

about 14% of children and adolescents aged 4 to 17 years have mental disorders, including anxiety and depressive disorders (DD) [7]. The most frequent mental disorders are depression (D), anxiety (A), hyperkinetic disorders, and behavioral disorders [6, 4]. The global prevalence of depressive disorders among children and adolescents is 4-5%, while girls suffer from depression twice as often as boys [6, 4, 8].

In Europe, high prevalence rates of depression among adolescents are in Ireland, Germany, Portugal and France that exceed 10% [4]. According to the Mental Health Foundation in the UK, 19.7% of adolescents showed symptoms of depression and anxiety in 2014, which is 1.5% higher compared to 2013, while these disorders were more common among girls [9]. The severity of the DR problem lies in the fact that depression is the main risk factor for suicides in adolescence, which is why early detection and treatment of DR is crucial in its preventing [5]. Moreover, depression negatively affects not only the child suffering from mental disorder, but also his family and the environment as a whole.

In developed countries, in particular in the USA [10], the Netherlands [11], state programs for the early detection and treatment of DR among children and adolescents have been developed, in which, after a screening diagnosis of depression, they immediately treat it (medication, psychotherapy, physical rehabilitation) [10, 11]. Significant issue is that only a third part of children and adolescents suffering from acute or chronic mental pathology receive appropriate medical treatment.

Thus, such a low level of use of appropriate qualified medical care for children and adolescents with mental health problems is not only a local, but also an international problem [7, 12]. Among the main reasons for this is the fear of mental disorder and stigmatization, the uncertainty of children and / or their parents in the need for treatment of a specific mental disorder, lack of awareness of medical services or lack of access to the necessary specialist, religious beliefs in the family or cultural barriers etc [12].

Depression is a big burden for the healthcare system and the economy in the developed countries, since DR treatment require a large amount of funds [13, 14]. For example, in the United States, the annual cost of treating depression is about $ 53 billion, of which $ 10.9 billion is spent on treating this mental disorder in children [13]. The depression treatment cost are between $ 1,000 and $ 2,500 per person yearly, and generally makes up almost 13% of total healthcare costs in Western countries (Guo 2019).

A Canadian study showed that medical costs for individuals with depression are 3.5 times ($p < 0.05$) higher than those without them ($ 10,064 for patients with DD and $ 2,832 for mentally healthy people) and adds $ 8,244 per person to the average total cost, yearly [14]. Another problem associated with the treatment of depression in children and adolescents, as well as adults in general, is a significant number of side effects associated with the use of antidepressants.

Particularly, they can be addictive and have negative effect on the gastrointestinal tract (hepatotoxicity, gastropathy, increased risk of gastrointestinal bleeding), as well as tachycardia, rhythm disturbances, hypertensive crises, cramps, sleep disturbance, weight gain, sweating, sexual dysfunction, effect on the ability to drive a car, etc [15].

Therefore, the issue of the effectiveness and safety of antidepressants for children and adolescents is still discussing. The only antidepressants approved by the European Medicines Agency for the treatment of childhood and adolescent depression in European countries are selective serotonin reuptake inhibitors (SSRI). Tricyclic antidepressants can be used as second-line drugs, but they are not approved as clinically effective for the treatment of DD and A in children and adolescents.

Serotonin– norepinephrine reuptake inhibitors (SNRIs) and specific serotonergic antidepressants are allowed only for adults [15]. Considering the high prevalence of DD, the high cost of treatment and the wide range of side effects associated with the use of antidepressants, the medical community urgently needs to develop effective, but less expensive strategies for treating depression and improving mental health of children and adolescents without DD. One of such approaches is exercising and fitness to improve mental health [16, 5, 17].

The positive effect of physical activity on the course of mental disorders has been proven by many studies and is explained by the interaction of a number of neurobiological, psychological and social mechanisms, including structural and functional changes in the brain, changes in feelings of confidence and competence, and increased opportunities for social interaction and growth [5].

There are studies on the effect of physical activity on the course of DD and A [17], schizophrenia [18], on the state of the cognitive sphere [5, 17], as well as data on the positive effects of physical activity and fitness on the course of autism in children [19]. However, most studies on the positive effects of physical activity on various types of mental disorders have been conducted for adults as well, while there are much less data for children.

Moreover, the results obtained among adults are far from applicable to children. Currently, there is no specific set of exercises recommended for a particular mental disorder, especially depression, which requires detailed studies in this direction.The aim of the research is to study the effectiveness of physical activity in the treatment of psychogenic depression in children and adolescents.

Material and Methods

The sampling contained 90 children and adolescents (age 11-15 years) suffering from psychogenic depression, as well as 30 healthy individuals (HI) of the corresponding age. The study was conducted from January 2017 to December 2019. To study the effectiveness of physical activity on the course of depression, the children and adolescents included in the study were divided into 2 groups: group 1 (control group) - 45 children undergoing psychotherapy for 8 weeks; group 2 (study group) -45 children who, in addition to psychotherapy, were treated with a complex of physical exercises 1 hour a day 4 times a week for 8 weeks.

The psychotherapy included Fernández-Álvarez's Integrative Psychotherapy [20], V.A. Kutasov's Suggestive Psychotherapy [21] and cognitive-behavioral psychotherapy [22]. The set of physical exercises included the following: exercises for the development of flexibility and joint mobility, breathing exercises, aerobic, strength training on simulators, corrective exercises, autogenic training. The frequency of training is 4 times a week during an hour. Informed Consent was mandatory signed by parents of children and adolescents included in the study. Inclusion criteria are a diagnosis of mild or moderate D; age 11-15 years; informed consent signed by the parent.

Exclusion criteria are neurotic or psychotic D; endogenous D; severe D; schizophrenia and other mental disorders; acute somatic disease; the presence of any somatic pathology in exacerbation, sub- or decompensation. Study limitation. The study included only children and adolescents with mild to moderate D. The effect of physical rehabilitation on the course of severe D wasn't studied, as requires medical treatment. Initially, the study included 97 children and adolescents suffering from D, but 7 of them were eliminated during the study (4 - as a result of acute somatic pathology, 3 - due to lack of compliance).

The examination of patients was carried out using clinical and clinical-anamnestic and clinical-psychopathological methods with a detailed study of complaints, medical history and lifestyle data, a mandatory assessment of the physical, neurological and mental status of children and adolescents included in the study. Assessment of the mental status of patients was carried out upon inclusion in the study and at the end of the study.

The mental status of children and adolescents was studied using CGI (Clinical global inventory), Hamilton (HAM-A - to determine the level of anxiety and HAM-D - to assess the level depression), PSS (Perceived Stress Scale - to assess adherence to stress (S)) scales. Additionally, a survey was conducted using the Children's depression inventory (CDI) and Tsung questionnaires [22].

On the HAM-A scale, the level of anxiety was evaluated in points as follows: 0-6 points - no symptoms of anxiety, 7-13 points - possible anxiety, 14-20 points - anxiety, 21-28 points - symptomatic anxiety, 29 or more points - expressed anxiety (in general, 14 points was the border point); on the HAM-D scale: 0-7 points - normal, 8-13 points -mild depression, 14-18 points - moderate depression, 19-22 points – severe depression, 23 and more points - extremely severe depression; PSS: 0-

6 points - low adherence to stress, 7-19 points - normal, 20-30 points - high adherence to C stress 31-40 points - very high adherence to stress. All patients underwent anthropometric measurements examination (body weight, height, waist circumference and hips) with the calculation of DMI (according to Kettle Body Mass Index: BMI = m / h2, where *m* is body weight in kilograms, *h* - height in meters), general blood and urine tests, a biochemical blood test, electrocardiography, ultrasound examination of the abdominal organs in order to exclude somatic pathology.

Statistical processing of the results was carried out with the Wilcoxon T and U-test using Microsoft Excel 2013 (Microsoft, USA), SPSS ™ 17; when the difference $p < 0.05$was considered statistically significant. The method of calculating the odds ratio (OR) by the Past3 program and Fisher's exact test by Microsoft Excel 2013 (Microsoft, USA) were used for compering qualitative attributes.

Results

The general characteristics of children and adolescents included in the study are presented in Table 1. The number of girls was 2.1 times higher than the number of boys among patients with depression. It should be noted that BMI in patients with D was 29% significantly higher compering to healthy children ($p < 0.05$).

Table 1: The general characteristics of children and adolescents included in the study

Characteristics	Groups	
	Healthy children (n=30)	Patients with depression (n=90)
Age, years	13.28±1.16	13.47±1.22
Boys, (%)	19 (63.3%)	61 (67.8%)
Girls, (%)	11 (36.7%)	29 (32.2%)
BMI, k/m^2	22.35±1.14	28.84±1.42*
HAM-D, points	3.95±0.42	14.56±1.07*
HAM-A, points	3.16±0.35	15.93±1.20*
PSS, points	8.87±0.66	28.42±1.48*

Note: * - the difference is significant compering to healthy children ($p < 0.05$)

Analyzing the physical activity of healthy children, it was found that 8 (26.7%) are regularly engaged in sports sections, 12 (40%) engaged in physical activity 3-4 times a week, 10 (33.3%) - less than 3 times a week (exclusively in physical education classes).

The children and adolescents, who regularly visit sports sections, have a low level of depression on the HAM-D scale (2.63 ± 0.34), anxiety on the HAM-A scale (2.49 ± 0.47), and the lowest adherence stress according to the PSS scale (6.92 ± 0.58). The healthy children with the least physical activity had a significantly higher level of D (5.69 ± 0.49) ($p < 0.05$), A (4.11 ± 0.38) ($p < 0.05$), S (10.78 ± 0.73) ($p < 0.05$), compering to those who were regularly engaged in sports sections.

The study of physical activity influence on the course of childhood and adolescent depression in the dynamics of treatment showed a significantly higher effectiveness of therapy combining psychotherapy and a complex of physical exercises ($p < 0.05$) in comparison with those treated by psychotherapy only (Table. 2). The level of depression on the HAM-D scale at the end of treatment decreased by 1.7 times ($p < 0.05$) in the control group, while by 2.27 times ($p < 0.05$) in the study group, presenting a statistically significant intergroup difference ($p < 0.05$).

Table 2: Dynamics of the level of depression and anxiety according the Hamilton scale and adherence to stress according to the PSS scale, M ± m

Scale	Healthy children, n=30	Group	Before treatment	After treatment
HAM-D, points	3.95±0.72	1	14.53±1.05*	8.56±0.43*/**
		2	14.58±1.08*	6.42±0.51*/**/***
HAM-A, points	3.16±0.65	1	15.90±1.19*	8.92±0.50*/**
		2	15.96±1.21*	7.15±0.38*/**/***
PSS, points	8.87±0.66	1	28.43±2.10*	18.03±1.12*/**
		2	28.41±2.11*	13.21±1.04*/**/***

Note: * - the difference is statistically significant compering to healthy children ($p < 0.05$); ** - the difference is statistically significant in comparison with the indicator before treatment ($p < 0.05$); *** - the difference is statistically significant compared with group 1 after treatment ($p < 0.05$)

According to the effect of the applied therapy on the level of anxiety, a similar positive dynamics was observed: in group 1, the level of anxiety on the HAM-A scale decreased by 1.78 times ($p < 0.05$), in group 2 by 2.23 times ($p < 0, 05$) with a statistically significant intergroup difference ($p < 0.05$). Corresponding positive dynamics was also noted regarding adherence to stress in patients with depression. Thus, adherence to stress on the PSS scale in group 1 decreased by 1.58 times ($p < 0.05$), while in group 2 by 2.15 times ($p < 0.05$) with the statistically significant intergroup difference ($p < 0.05$).

Discussion

It was possible to achieve positive dynamics in the treatment of depression for both groups, at the end of the study. However, the complex of psychotherapy and exercising developed by us proved to be more effective, namely by a statistically significant intergroup difference regarding a decrease in the level of depression ($p < 0.05$) according to the HAM-D scale, anxiety ($p < 0.05$) according to the HAM-A scale and adherence to stress ($p < 0.05$) according to the PSS scale.

This proves the effectiveness of physical rehabilitation for treatment of childhood and adolescent depression. It should be noted that in both groups the final level of depression and anxiety, as well as adherence to stress were statistically different ($p < 0.05$) from those in the healthy children. The result were achieved by a fairly short study period (8 weeks) and requires the continuation of the prescribed complex of mental and physical rehabilitation to achieve a sustainable and effective result, since the treatment of any DD is known to be a long process.

In the dynamics of treatment, there were noted significant increase of self-esteem, decrease of aggression and negativity towards others, mood and general well-being as well as concentration of attention improving, interest in surrounding events, normalizing of sleep.

Moreover, there was a tendency toward a decrease in BMI ($p > 0.05$) in the study group. With a longer physical rehabilitation, a statistically significant decrease in BMI is expected, which will also help to reduce the level of depression, improve self-esteem and well-being of patients. This fact is of considerable importance, over 50% of children and adolescents suffering from depression have overweight or obesity [22]. The study proves that regular physical activity and sports help to treat and prevent depression in healthy children and adolescents, a significantly lower level of depression (p 0.05), anxiety (p 0.05) and adherence to stress (p 0.05) were noted among children and adolescents who regularly engaged in sports sections, comparing to those who had low physical activity (only at physical education lessons - less than 3 times a week.

It is especially important to choose the right set of physical exercises and activity, considering the individual characteristics of each child in order to achieve a positive result in the treatment of depression. In particular, healthy children willingly perform rhythmic breathing and team exercises as well as games and exercises on simulators. Children and adolescents with depression practically did not show interest in team games, while unconditionally followed and performed rhythmic and breathing exercises for the instructor, individually worked on simulators, which is due to their nature, because of depression, isolation, and apartness.

The positive effect of physical activity on the course of psychotherapy can be explained by the action of endorphins, which are produced by the pituitary and hypothalamus during physical activity, and that there are endogenous opioid polypeptides in chemical structure, which cause a feeling of well-being and analgesia resembling opiates. According to research, the opioid system contributes to the formation of social attachment and, considering the correlation between ß-endorphins and depression can affect the course of the latter.

Thus, physical activity stimulates increased secretion of endorphins in the brain, resulting in euphoria and a decrease in pain. However, the mechanisms by which physical exercises are able to reduce the manifestations of depression are still not exactly studied due to methodological limitations in the relevant studies [12, 16, 23, 24]. The results obtained are similar to many other studies on the influence of physical

activity and rehabilitation on the course of depression in children and adolescents. In particular, a recent systematic review shows the results of analyzed data on the influence of physical activity on the mental health of children (42 meta-analyzes were studied for the influence of physical activity on depression, 3 - for the influence of physical activity on anxiety, 10 - on self-esteem, 25- on cognitive functions).

It has been proven that increased physical activity is associated with improved cognitive health and performance, a decrease in the level of depression and anxiety [5]. An Australian cross-sectional observational study of 8256 children and adolescents aged 10-16 years, on the influence of physical activity and time spent in front of a computer monitor / TV on symptoms of depression, showed that shorter time spent in front of a computer monitor / TV and higher physical activity outside the school (OR = 0.70; 0.58, 0.85; p <0.001), high physical activity during physical education classes (OR = 0.77; 0.69, 0.86; p <0.001), active participation in school sports teams (OR = 0.77 ; 0.67, 0.88; p <0.001) or out of school (OR = 0.84; 0.73, 0.96; p = 0.01) were associated with lower possibility of depression.

Compliance with physical activity recommendations (OR = 0.62; 0.44, 0.88; p = 0.007) and a reduction in the time spent in front of a computer / TV monitor (OR = 0.77; 0.59, 0.99; p = 0.04) was also independently associated with lower possibility of depression (Kremer et al., 2014). A crossover study conducted on a large representative sample (n = 11 110) of adolescents from 10 European countries who participated in the SEYLE study (Saving and Empowering Young Lives in Europe) is a great example.

The frequency of physical activity correlated positively with well-being, negatively with symptoms depression and anxiety. A multi-level model of mixed effects showed that more frequent physical activity and exercise independently contribute to improving well-being, reducing symptoms of depression and anxiety in adolescents of both genders [25].

A similar study was conducted in the United States involving 150 students (60 girls and 90 boys aged 7-18 years, of which 48.7% had symptoms of depression according to the Children's Depression Inventory).

It was found that children with moderate and severe depression have a lower level of physical activity compared to those with lower rates of depression according to SDI. A higher level of depression was noted among older children compared to younger, among girls compared to boys. Moreover, the study examined the relationship between the levels of zinc, copper, serotonin and salivary cortisol with the symptoms of depression.

It was found that children with high level of depression according to SDI, have an increased level of cortisol and copper while a decrease in serotonin, zinc, and zinc to copper ratio. Children with low level of depression according to SDI, have higher zinc, serotonin and zinc to copper ratio levels while low cortisol and copper. Thus, adequate physical activity and zinc and copper balance have a positive effect on the treatment of depression according to SDI scale, as well as on the level of serotonin and cortisol in school children [16].

Conclusion

Comprehensive treatment of psychogenic depression in children and adolescents using physical rehabilitation and psychotherapy is significantly more effective (p <0.05) compering to thye use of psychotherapy only.

At the end of the 8th week of treatment, the level of depression on the HAM-D scale significantly decreased by 2.27 times (p <0.05) in patients who underwent psychotherapy and physical rehabilitation, and by 1.7 times (p <0.05) in patients who underwent only psychotherapy, the level of anxiety on the NAM-A scale decreased by 2.23 times (p <0.05) and 1.78 times (p <0.05), adherence to stress on the PSS scale by 2.15 times (p <0.05) and 1.58 times (p <0.05), respectively.

Healthy children and adolescents who regularly practiced in sports sections had the lowest levels of depression, anxiety, and adherence to stress. Physical activity is an effective and inexpensive method of treatment and rehabilitation of depression in children and adolescents, which can improve not only their mental but also physical health, increase their social activity. Moreover, regular physical activity and sports are an effective way to prevent depression among healthy children and adolescents.

Prospects for Further Research

The study of the effectiveness of physical rehabilitation among children and adolescents suffering from severe depression and receiving medical treatment [26].

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