Physical activity of people who recovered from COVID-19

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Abstract:

The study of issues aimed at reducing the spread and severity of the viral infection course caused by SARS-CoV-2 seems relevant and timely. *The purpose of the research:* to study the effect of physical activity, body weight and chronic diseases in the pre-COVID period on the severity of COVID-19 disease. *Research materials and methods.* In 2021, in Irkutsk (Russia), 213 people aged 18-80 who had fully recovered after infection with the SARS-CoV-2 virus were interviewed by online questionnaire. All respondents were divided into 2 groups according to their weekly physical activity level before the disease. The first group included individuals with «High physical activity» gradation who performed at least 150 minutes per week of moderate physical activity and/or at least 75 minutes of high physical activity. The group with «Low physical activity» gradation included respondents who did not perform the recommended amount of physical activity. An additional questionnaire was conducted on the clinical aspects of the disease: the location during treatment, the severity of the disease, the presence of concomitant chronic diseases and anthropometric parameters (weight, kg and body length, cm). To assess the relationship between the severity of COVID-19 and the state of body weight, BMI was calculated. *Research results.* The predominant spread of COVID-19 diseases among the population of the older age group (65-80 years) has been established. The number of hospitalized men with low weekly physical activity was 1.5 times, and women 1.6 times more than the number of patients with a high level of physical activity, $p < 0.05$. Among outpatient patients, men with low weekly physical activity turned out to be 2.5 times less than men with high physical activity, $p < 0.05$. Chronic diseases in all respondents with low physical activity who had had COVID-19 infection were 2.9 times more common than in all participants of the project with high physical activity. About 70% of hospitalized men and women with a low weekly level of physical activity were overweight or obese, which is 2.6 times more than the number of patients (26.5%) with a high weekly level of physical activity, $p < 0.05$. There are more men and women with normal BMI who have been ill with COVID-19 disease in the outpatient group than in the hospitalized group. *Conclusions.* For purposeful explanation and popularization of regular motor activity among the population, especially the elderly, and people with low physical activity, chronic diseases and overweight should be allocated to the COVID-19 risk group. According to the health protocol, it is necessary to promote the performance of physical activity during the pandemic, using individual aerobic physical activities at home or outdoors.

Key Words: having had covid-19, physical activity, chronic diseases, recovered from covid-19

Introduction

The COVID-19 pandemic caused by the SARS-CoV-2 virus has led to significant changes in the daily lives of a huge number of the world's population. Today COVID-19 has no geographical, socio-economic, gender, age and national borders.

Restrictive measures aimed at compliance with the health protocol to prevent the spread of this infection have led to the social isolation of people (Kraemer et al., 2020), the closure of sports facilities and sports events (Adedoyin, & Soykan, 2020), which leads to a violation of the motor regime and a person's healthy lifestyle.

Under forced isolation conditions, a part of the population has a decrease in physical activity (Anugrahsari et al., 2021; Harrison et al., 2021; Sunda et al., 2021), deterioration in the psycho-emotional state and a decrease in the stress resistance of the body, appears depression (Grajek, Sobczyk, 2021). Such a trend can lead to the development of a number of severe non-communicable diseases (Chen et al., 2020; Dominski, Brandt, 2020) and functional disorders of the human body (Mozolev et al., 2020) associated with hypokinesia. Prolonged quarantine changes a person's eating behavior (Hermassi et al., 2021), it often leads to overweight and obesity (Jordan, et al., 2020). The direct significance of physical activity for COVID-19 prevention has not been established (Anugrahsari et al., 2021). There is information about immunity growth in a physically active person (Lasselin et al., 2016). Physical activity reduces the occurrence of many severe chronic diseases (De la Camara et al., 2021), which, in turn, are aggravating factors of the course of COVID-19 infection.

Taking into account the high mortality rate from this infection, WHO and the governments of various countries have recognized vaccination of the population, isolation and physical distancing as preventive measures to contain the spread of the SARS-CoV-2 virus. Behavioral measures such as personal hygiene, wearing masks, healthy eating and physical activity are important on the part of the population, which are potential strategies for preventing or mitigating disease (Sadarangani et al., 2021).

There are research materials in the literature on the correlation of physical activity with the incidence of COVID-19 (Rahmati-Ahmadabad & Hosseini, 2020). Some researchers recommend the population not to reduce physical activity during the pandemic (Adamakis, 2021) and perform a set of aerobic physical education programs aimed primarily at developing endurance, flexibility and balance (Rodríguez et al., 2020). It is necessary to observe remote measures of physical activity, more often using outdoor classes for this (Raiola, Felice Di Domenico, 2021) or online exercises (Aksay, 2021).

With the development of the COVID-19 pandemic, people's interest in physical activity has increased in some countries (Ding et al., 2020), against the background of a decrease in the daily number of steps associated with a decrease in visits to the workplace and an increase in the remote form of work. Some researchers consider it a paradox to increase physical activity during a pandemic (Sfyri E. et al., 2021).

During the COVID-19 pandemic, the importance of physical exercise and healthy lifestyle has increased, as evidenced by the materials of WHO (Responding to the community spread of COVID-19: interim guidance, 2020). According to the WHO global recommendations on human physical activity, people aged 18-64 and older, in order to maintain a level of health, need to have at least 150 minutes of moderate intensity or 75 minutes of high intensity per week (WHO. Global recommendations on physical activity for health, 2010). Physical activity exceeding the minimum in time brings additional benefits to human health.

The current epidemiological situation in the world is developing negatively, the number of cases of morbidity and mortality among various population groups is growing, as evidenced by the fourth wave of COVID-19. Therefore, a comprehensive study of various factors that can have a positive impact on changing the situation of the COVID-19 pandemic is necessary. Currently, it is relevant to expand scientific knowledge and project research on trends, habits and perceptions of physical activity among the population. It will increase the effectiveness of the COVID-19 prevention protocol and reduce the risk of new infections (Raiola, Domenico, 2020).

Research aim: is to study the effect of physical activity, body weight and chronic diseases in the pre-COVID period on the severity of COVID-19 disease.

Material & methods

The research project was conducted in 2021 in Irkutsk (Russia). An online questionnaire was used to interview 213 men and women aged 18-80, who had fully recovered after infection with the SARS-CoV-2 virus. Depending on the severity of the infection and the place of treatment, all project participants were divided into 2 groups: hospitalized and outpatient. According to the results of the responses of the IPAQ-SF (International activity questionnaire), Craid et. al., 2003., all respondents were divided into 2 groups according to the level of weekly physical activity before the disease. Using the IPAQ-SF questionnaire, we found out how many minutes of physical activity, including sports, respondents had according to WHO (Global recommendations on physical activity for health, 2010) during the last week before the COVID-19 disease. The respondents of the first group with «High physical activity» gradation performed at least 150 minutes per week of moderate physical activity and/or at least 75 minutes of high physical activity.

The group with «Low physical activity» gradation included project participants with weekly physical activity < 150 minutes per week of moderate physical activity and/or less than 75 minutes of high physical activity. Walking was not included in moderate physical activity.

An additional questionnaire was conducted on anthropometric parameters (weight, kg and body length, cm) and on clinical aspects of the disease, location during treatment, severity of the disease, the presence of concomitant chronic diseases (diabetes, hypertension, coronary heart disease, obesity, metabolic syndrome).

To assess the effect of body weight on the severity of COVID-19, BMI was calculated using the formula: $BMI = \text{body weight/body length}^2$, kg/m^2 (WHO. Global Database on Body Mass Index (BMI), 2012). According to the materials of the WHO Memorial of the meeting arranged by USAID, WHO, PAHO and Mother Care Organization «Mother Care», (1991) all project participants were divided into categories: underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), obese: grade I (30.0–34.9 kg/m^2), grade II (35.0– 40.0 kg/m^2).

The obtained research materials were statistically processed using the licensed version of the STATISTICA 10.0, MS Excel 2010 programs. The sample size (n); average value (M); minimum, maximum, standard deviation (σ); standard error (m) were calculated. Using the Student's t criterion, the reliability of the difference in the values of the indicators ($p < 0.05$) was determined. The statistical significance of qualitative differences was determined using chi-squared (χ^2), (at $p < 0.05$, the critical value of $\chi^2 = 3.841459$; statistically significant differences were taken into account at $\chi^2 > \chi^2_{\text{critical}}$).

The respondents' consent to voluntarily participate in the survey was obtained. The ethical standards of the Human Rights Committee of the Helsinki Declaration of 2008 were observed.

Results

It was found that out of 213 participants of the research project who had COVID infection in 2021, 131 people (61.5%) were hospitalized with a severe form of the disease (60.3% of men and 39.7% of women), the remaining 82 people (38.5%) had a mild form of the disease and were treated outpatient at home (47.5% of men and 52.5% of women). In the I age category (18-39 years), the number of men and women who were ill was the smallest among other ages (Fig.1).

Fig. 1. Age distribution of respondents (%)

In the IInd age category (40-64 years), there were 5 times more men and 6.6 times more women than in the Ist one. The largest number of all patients was registered in the IIIrd age category (65-80 years). Among them, there were 5.5 times more men and 8.6 times more women than in the Ist age category, 2.8 times and 3.8 times (respectively) more than in the IInd age category, $p < 0.05$. These data indicate the predominant spread of COVID-19 diseases among the population of the older age group.

We considered the question of the relationship of physical activity with the disease severity. A significant difference was found between the levels of weekly physical activity before COVID-19 disease in hospitalized and outpatient respondents, $p < 0.05$ (Table 2).

Table 2. Weekly physical activity of respondents before the disease (abs., %)

Respondents	Sex	Weekly physical activity		χ^2
		Low (<150 min)	High (>150 min)	
Hospitalized	Male (n=79)	47 (59,4)	32 (40,6)*	9,36
	Female (n=52)	32 (61,5)	20 (38,4)*	12,35
Total :	n=131	79(60,3)	52(39,6) *	11,76
Outpatient	Male (n=39)	11 (28,2)	28 (71,7)*	13,15
	Female (n=43)	13 (30,2)	30 (69,7)*	8,92
Total :	n=82	24(29,3)	58(70,7) *	12,74

Note. * $p < 0,05$ - significant difference

The number of hospitalized respondents with low weekly physical activity was 2 times more and those with high physical activity was 1.8 times less than in the outpatient group.

The number of hospitalized men with low weekly physical activity before the disease was 1.5 times, and women 1.6 times more than the number of patients with a high level of physical activity, $p < 0.05$.

The number of men with low weekly physical activity in the outpatient group was 2.5 times less than men with high physical activity, $p < 0.05$. The number of women with low physical activity in the outpatient group was 2.3 times less than women with high physical activity, $p < 0.05$. We believe that these data indirectly indicate the fact that high weekly physical activity before the disease provided a mild degree of viral infection in outpatient respondents.

We considered the issue of the relationship between the age of the research project participants and their weekly physical activity before the disease. The physical activity recommended by WHO (>150 min/week) in the first age category (18-39 years) was performed by 70.4% of all patients, 20.2% in the second category (39-64 years) and 9.4% in the third age category (65-80 years).

The presence of chronic non-communicable diseases in humans can aggravate the clinical course of new diseases. According to the results of the survey of 213 participants of the project according to the International physical activity questionnaire, 110 people (51.6%) indicated the presence of concomitant chronic diseases from the endocrine and cardiovascular systems and metabolic disorders in the pre-COVID period.

The number of all men with chronic diseases and low physical activity was 2.8 times more than men with high physical activity (73.7% and 26.2%, respectively), $p < 0.05$. The number of all women with chronic diseases and low physical activity was 3.1 times more than women with high physical activity (75.5% and 25.4%, respectively), $p < 0.05$, (Fig.2).

Fig. 2. Distribution of respondents with chronic diseases by physical activity levels before the disease (%)

As a result of our research, it was found that all respondents with low physical activity who had COVID infection had chronic diseases 2.9 times more often than all participants in the project with high physical activity.

Next, we considered the issue of the weekly physical activity effect of in the pre-COVID period over the metabolic processes of the human body, which may affect COVID-19 disease severity in respondents.

Analysis of the results shows that 29.1% of hospitalized men and women with normal BMI (18.5-24.9 kg/m²) had a low level of weekly physical activity before the disease, and 51.9% had a high weekly level of physical activity, $p < 0.05$ (Table 3).

Table 3. The number of hospitalized respondents with different weekly physical activity levels and BMI values (%)

Physical activity	Sex (n=131)	BMI (kg/m ²)				
		Underweight <18,5	Normal weight 18,5–24,9	Increased body weight		
				Overweight 25,0–29,9	Obesity: grade I 30,0–34,9	Obesity: grade II 35,0–40,0
Low	Male (n=47)	2(4,2)	14(29,7)	22(46,8)	6(12,7)	3(6,3)
	Female (n=42)	1(2,4)	10(23,8)	20(47,6)	7(16,6)	4(9,5)
High	Male (n=32)	1(3,1)	23(71,8)	5(15,6)	3(9,3)	0
	Female (n=10)	3(30,0)	4(40,0)	2(20,0)	1(10,0)	0

The largest number (69.6%) of hospitalized men and women with a low weekly physical activity level in the pre-COVID period were overweight or obese. It was 2.6 times more than the number of patients (26.5%) with a high weekly physical activity level $p < 0.05$.

The number of hospitalized men (65.9%) who had a low level of physical activity and overweight or obesity before the disease was 2.5 times significantly higher than men (26.2%) with a high level of physical activity and increased weight, $p < 0.05$. The number of hospitalized women (73.8 per cent), which, had a low level of physical activity and excess body weight or obesity before the disease was significantly 2.5 times more than women (30,0%) with a high level of physical activity and overweight, $p < 0.05$, (Tab.3). Table 4 presents the number of respondents with different level of weekly physical activity and BMI values that were treated on an outpatient basis.

Table 4. The number of outpatient respondents with different levels of weekly physical activity and BMI values (%)

Physical activity	Sex (n=131)	BMI (kg/m ²)				
		Underweight <18,5	Normal weight 18,5–24,9	Increased body weight		
				Overweight 25,0–29,9	Obesity: grade I 30,0–34,9	Obesity: grade II 35,0–40,0
Low	Male (n=11)	1(9,1)	2(18,2)	4(36,4)	2(18,2)	2(18,2)
	Female (n=13)	1(7,7)	3(23,1)	4(30,8)	3(23,1)	2(15,3)
High	Male (n=28)	2(7,1)	19(67,8)	3(10,7)	3(10,7)	1(3,6)
	Female (n=30)	3(10)	20(66,6)	4(13,3)	2(6,6)	1(3,3)

It was found that 73.9% of outpatient men and women with a low weekly level of physical activity before the disease were overweight or obese. This is 3.1 times more than the number of men and women (24.1%) with a high weekly level of physical activity, $p < 0.05$. The number of outpatient men (72.7%) with a low level of physical activity and overweight or obesity was 2.9 times significantly higher than the number of men (25.0%) with a high level of physical activity and overweight, $p < 0.05$. The number of outpatient women (69.2%) with a low level of physical activity and overweight or obesity was 2.9 times significantly higher than women (23.3%) with a high level of physical activity and increased weight $p < 0.05$, (Table 4).

There were more men and women with normal body weight (18.5–24.9 kg/m²) who had COVID disease in the outpatient group than in the hospitalized one (53.7% and 38.9%, respectively), $p < 0.05$. Overweight or obese respondents (55.7%) were 1.5 times more likely to be hospitalized in a medical institution than the group of outpatient men and women (38.3%), $p < 0.05$. These data confirm our opinion that overweight or obesity are risk factors for severe viral infection caused by SARS-CoV-2.

Older age, chronic diseases, overweight or obesity, low physical activity before the COVID-19 disease burden the course of the infectious process in the human body.

Discussion

COVID-19 pandemic development in the world is characterized by an increase in the number of cases and high mortality, which requires a comprehensive study of issues related to new ways and methods of combating and preventing this infection (Wu & McGoogan, 2020). One of the effective measures to prevent and improve the health of the population from various diseases is regular physical activity (Chen et al., 2020; Dominski, Brandt, 2020), which improves physical health and functional indicators of the human body ((Mozolev et al., 2020) and increases immunity (Aksay, 2021).

Our research results indicate that regular physical activity, in the amount of at least 150 minutes of moderate physical activity per week, reduced the risk of hospitalization of sick men by 1.5 times, women by 1.6 times, compared with the group of people who had low weekly physical activity before the disease (Kolokoltsev et al., 2021). Similar results are confirmed by other researchers (Kokhan, et al., 2021). In our project, the number of all respondents with a severe degree of viral infection and low weekly physical activity in the pre-COVID period turned out to be 2 times more, and with high physical activity 1.8 times less than in the outpatient group. It is known that physical activity contributes to the prevention of chronic diseases development, as reported by Galan et al. (2019). As a result of our research, it was found that all respondents with low physical activity who had COVID infection had chronic diseases 2.9 times more often than all participants in the project with high physical activity. Concomitant pathology of the body refers to aggravating risk factors for COVID-19 infection (De la Camara et al., 2021). Active motor activity of a person during life, including physical education and sports, are considered by us as a preventive measure reducing the severity of any disease, including those caused by the SARS-CoV-2 virus. Low physical activity negatively affects a person's health and motor qualities, contributes to the emergence and exacerbation of chronic diseases and disruption of metabolic processes, especially in elderly people's body. The data obtained by us indicate that low pre-COVID physical activity of older respondents contributes to the occurrence of severe damage to the body and hospitalization, which is consistent with the results of other researchers (Aksay, 2021).

Another aggravating factor in the transition of COVID-19 disease to a severe form is an increased human body weight (Denisova, G.S., 2019). Excessive visceral adipose tissue can disrupt a person's immunological state, which makes such people more susceptible to the occurrence and development of infectious diseases (Demidova et al., 2020). Hypokinesia and hypodynamia are considered as predictors of overweight and obesity appearance (Jordan, et al., 2020). According to our data, about 70% of hospitalized men and women with a low weekly level of physical activity in pre-COVID period were overweight. This is 2.6 times more than the number of having the disease respondents with high weekly physical activity and metabolic disorders. We believe that people with low physical activity (< 150 min/week moderate or 75 min/week

intensive), chronic diseases and increased body weight, older people should be allocated to the COVID-19 risk group. For such people, in addition to the activities provided for by the health protocol, targeted popularization of active recreation and regular motor activity is necessary, especially in the group of elderly people (Wettstein, 2020).

During the pandemic, it is recommended to continue physical activity to prevent weight gain (Felber, 2020). In choosing the forms of classes, you should be guided by the priority of performing individual aerobic exercises at home with good ventilation of the room or outdoor classes. Physical exercises should be aimed at developing motor qualities: general endurance, general flexibility, balance, coordination of movements (Rodríguez et al., 2020). It is allowed to use online training during the pandemic (Aksay, 2021; Kokhan, et al., 2021). Currently, the appearance of the fourth wave of the COVID-19 pandemic indicates the difficulties of the fight and the lack of a quick victory over the pathogen SARS-CoV-2. Therefore, there is an urgent need for further comprehensive consideration of the importance of human physical activity in the prevention and reduction of the severity of COVID-19 disease.

Conclusions

As a result of the conducted research, it was found that more than 60% of respondents suffered from severe illness and were hospitalized, the rest were on outpatient treatment. The largest number of patients was recorded in the older age group (65-80 years). Hospitalized men with low weekly physical activity before the disease turned out to be 1.5 times, and women 1.6 times more than the number of patients with high physical activity, $p < 0.05$. Hospitalized respondents with low weekly physical activity were 2 times more, and those with high physical activity were 1.8 times less than in the outpatient group. These data indirectly indicate that high weekly physical activity before the disease provided a mild degree of viral infection in outpatient respondents.

Our research results showed that all project participants with low physical activity before infection with the SARS-CoV-2 virus had chronic diseases 2.9 times more often than respondents with high physical activity. About 70% of hospitalized men and women with a low weekly level of physical activity were overweight or obese. It is 2.6 times more than the number of patients with a high weekly level of physical activity, $p < 0.05$.

We believe that healthy people of the older age group and people with low physical activity, with chronic diseases and increased body weight should be attributed to the risk group of COVID-19 disease. Ongoing work should be made in this group to promote regular physical activity and healthy lifestyle, which will reduce the risk of infection with the SARS-CoV-2 virus.

We recommend not reducing physical activity during the pandemic by using individual aerobic physical exercises at home using online training or outdoor classes. We believe that physical activity can reduce the risk of COVID-19 infection.

We believe that a comprehensive study of issues related to the prevention of COVID-19 using physical culture and sports should be carried out constantly to reduce the risk of COVID infection in the world.

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