

# INFLUENCE OF THE LEVEL OF PHYSICAL ACTIVITY ON SYMPTOMS AND DURATION OF RECOVERY FROM COVID-19

# UTJECAJ NIVOA TJELESNE AKTIVNOSTI NA SIMPTOME I TRAJANJE OPORAVKA OD BOLESTI COVID 19

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**Abstract:** Insufficient physical activity and sedentary lifestyle have exposed most of the population with chronic diseases, to higher risk of infection of COVID-19, with extremely severe consequences and exhausting and long recovery after the illness. Regular physical activity, as one way of prevention and faster recovery from COVID-19, is an important priority for improvement health and quality of life in people. The aim of this paper is to determine the connection between regular physical activity of the population with the presence of symptoms and duration of recovery from COVID-19. Total number of subjects was 100 people of both genders (male 32 and female 68) of younger age (age: 30-44) without existing chronic diseases and healed from COVID. Data of regularity of exercising, symptoms, and recovery period were obtained by survey of this study: Active group of subjects ( $A=53$ ) in continuity at least 3 months, two times a week, 60 minutes and Inactive group ( $N=47$ ), who never exercised, nor they are physically active. Chi-square test was used ( $\chi^2$  test differences between groups), to determine differences of extensive frequencies. Results of the research showed that there are statistically significant differences between two groups ( $p<0.001$ ) on the behalf of group with active subjects, in terms of severity of symptoms of COVID-19 and their recovery lasted shorter than in inactive group of subjects. Study shows that regular physical exercise has significant impact on human body and is important factor of enhancing immune system, which enables faster recovery and easier dealing with symptoms of COVID-19.

**Keywords:** health, physical exercising, Coronavirus, COVID-19. recovery, symptoms.

**Apstrakt:** Nedovoljna tjelesna aktivnost i sedentarni način života su veliki dio populacije sa hroničnim bolestima izložili puno većem riziku obolijevanja od COVID-19 sa izuzetno teškim posljedicama po zdravlje, kao i dugotrajnijim iscrpljujućim oporavkom nakon bolesti. Redovna tjelesna aktivnost kao jedan od načina prevencije i bržeg oporavka od bolesti COVID-19 predstavlja važan prioritet unapređenja zdravlja i kvalitete života ljudi. Cilj rada je bio utvrditi povezanost redovne tjelesne aktivnosti stanovništva sa prisustvom simptoma i vremenom oporavka od COVID-19. Ukupan broj ispitanika za ovo istraživanje je činilo 100 osoba, oba spola (muškarci=32, žene=68) mlađe životne dobi (age: 30-44 godine), bez postojećih hroničnih bolesti, a prebolovale su COVID-19. Podaci o redovnosti vježbanja, simptomima i vremenu koje je bilo potrebno za oporavak, dobivene su na osnovu anketnog upitnika osmišljenog za potrebe ovog istraživanja. Ispitanici su na osnovu nivoa aktivnosti podijeljeni u dvije skupine: Aktivni ( $A=53$ ) u kontinuitetu najmanje tri mjeseca dva puta sedmično po 60 minuta i skupina Neaktivni ( $N=47$ ) koje nisu nikada vježbali niti su tjelesno aktivni. Za utvrđivanje razlika opaženih frekvencija korišten je Chi-square test ( $\chi^2$  test razlika između grupa). Rezultati istraživanja su pokazali da između dvije grupe postoje statistički značajne razlike ( $p<0.001$ ) u korist grupe aktivnih ispitanika kada je u pitanju težina simptoma bolesti COVID-19, a njihov oporavak nakon bolesti trajao je kraće u odnosu na neaktivnu grupu ispitanika. Istraživanje pokazuje da redovno tjelesno vježbanje ima značajan učinak na organizam čovjeka i čini važan preduslov jačanja odbrambenog imunološkog sistema što omogućava brži oporavak i lakše podnošenje simptoma bolesti COVID-19.

**Ključne reči:** zdravlje, tjelesno vježbanje, Coronavirus, COVID-19, oporavak.

## INTRODUCTION

COVID-19 was first described at the end of 2019 in Wzhan, China, according to assessment of multiple cases of acute respiratory infection (Liu and Saif 2020). In fact, the cause of this disease was mutant and new virus from the family of Coronavirus named as severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2), which, in time, spread all over the world (Gorbalenya et al. 2020). Therefore on 11 March 2020 World Health Organization declared state of emergency; virus became global pandemic (Cuthbertson et al., 2020.). the most common symptoms of the disease were high temperature, shortness of breath, rapid loss of taste or smell and septic shock and in more severe cases there were: severe pneumonia , syndrome of acute heavy breathing, sepsis and septic shock, that can cause death of a patient (Coronavirus.hr, 2021). Researchers have reported that patients who suffer from diabetes, hypertension, cardiovascular and lung diseases had higher risk of severe diseases caused by virus and could have consequently bigger rate of hospitalization and death ((Huang et al. 2020; Wang et al. 2020). However, many other features of this new Coronavirus and other factors of risk for weight stay unclear. On the other hand, everyday exercising can help in fighting COBID-19 by enhancing immune system and repression of comorbidity such as: obesity, diabetes, hypertension, and heart diseases which increase severe disease of COVID-19 (Siordia 2020). Recent great average study concluded that regular sport activity can decrease severeness of disease and the authors discovered that hospitalization of athletes, who participate in sport regularly, was 33% less than in non-athlete groups (Halabchi, et al. 2020). It is evident that regular physical exercising raises level of psychophysical and functional abilities, which are the main indicators of the levels of health. The level of health is one of the basic indicators of level of quality of living, which is more evident in the mid age and further on, therefore it leads to the conclusion that regular physical exercising in adults, is an important condition of their quality of life

Nedavna velika presječna studija zaključila je da redovno bavljenje sportom može smanjiti (Mustajbegović, 2000; Rakovac & Heimer, 2003). In the study of Sallis et al., (2021) on connection of inactivity with severe consequences, after overcoming COVID-19 virus, it is concluded that following the instructions for physical activity is closely related to reduced risk for of severe outcomes after overcoming the virus. Physical activity has many benefits and some of them are presented as an excellent asset in fighting COVID-19 and its consequences on human health. (Wedig, Duelge & Elmer 2020). Results of Tavakol et al (2021) show that physical inactivity is significantly con-

## Uvod

COVID-19 je prvi put opisan krajem 2019. u Wuhanu u Kini, prema procjeni višestrukih slučajeva akutne respiratorne infekcije (Liu i Saif 2020). Zapravo, uzročnik ove bolesti je mutant i novi virus iz obitelji koronavirusa nazvan teški akutni respiratorni sindrom koronavirus 2 (SARS-CoV-2), koji se u kratkom vremenu proširio svijetom (Gorbalenya et al. 2020). U skladu s tim, 11. Marta 2020., Svjetska zdravstvena organizacija (WHO) proglasila je izvanredno stanje: virus je postao globalna pandemija (Cuthbertson et al., 2020.).

Najčešći simptomi bolesti su povišena temperatura, suhi kašalj, nedostatak zraka te nagli gubitak mirisa, okusa ili promjene okusa, a u težim slučajevima dolazi i do teške upale pluća, sindroma akutnog otežanog disanja, sepse i septičkog šoka koji mogu uzrokovati smrt pacijenta (Koronavirus.hr, 2021). Istraživači su izvijestili da su pacijenti koji pate od dijabetesa, hipertenzije, kardiovaskularnih i plućnih bolesti imali veći rizik od teških bolesti uzrokovanih virusom i posljedično veću stopu hospitalizacije i smrti (Huang et al. 2020; Wang et al. 2020). Međutim, mnoge druge karakteristike ovog novog koronavirusa i drugi faktori rizika za težinu ostaju nejasni. S druge strane, svakodnevna tjelovježba može pomoći u borbi protiv COVID-19 jačanjem imunološkog sistema i suzbijanjem komorbiditeta kao što su pretilost, dijabetes, hipertenzija i srčana oboljenja koja povećavaju tešku bolest COVID-19 (Siordia 2020). Nedavna velika presječna studija zaključila je da redovno bavljenje sportom može smanjiti ozbiljnost bolesti, a autori su otkrili da su hospitalizacije sportaša koji redovno učestvuju u sportu bile 33% niže od neatletskih skupina (Halabchi, et al. 2020). Jasno je da redovno tjelesno vježbanje podiže nivo psihofizičkih i funkcionalnih sposobnosti koje su osnovni pokazatelji stepena zdravlja. Stepenn zdravlja jedan je od osnovnih pokazatelja nivoa kvalitete života, što je posebno uočljivo od srednjih godina života na dalje, pa upućuje na zaključak da je redovno tjelesno vježbanje odraslih važan uslov kvalitete njihova života (Mustajbegović, 2000; Rakovac & Heimer, 2003). U istraživanju Sallis et al., (2021) o povezanosti neaktivnosti sa težim posljedicama nakon prebolovanog virusa COVID-19 zaključeno je da je ispravno pridržavanje smjernica za fizičku aktivnost usko povezano sa smanjenim rizikom za teške ishode nakon prebolovanog virusa. Tjelesna aktivnost ima mnoge prednosti, a neke od njih su prikazane i kao odlično sredstvo u borbi protiv COVID-19 i njegovih posljedica po zdravlje čovjeka (Wedig, Duelge & Elmer 2020). Rezultati istraživanja Tavakol i sar. (2021) pokazuju da je tjelesna neaktivnost značajno povezana s

nected to the severeness of the disease of COVID-19 and that level of physical activity of moderate intensity can protect individual from getting bigger number of symptoms of COVID-19 (Zeigler, 2021). Consequently, based on mention studies it appears that moderate physical activity can be recommended as non-pharmacy, cheap and sustainable way of prevention of severe cases of COVID-19 infection. The assumption of the study was that most of the physically active people had milder symptoms of this disease and faster recovery in relation to physically inactive population.

## METHODS

### *Design of the Study and Data collecting*

The study is classified as an average study with the aim to establish differences in symptoms and recovery period in individuals, who overcame COVID-19 in relation to the previous level of physical activity. Collecting data was conducted by survey, which was designed for the needs of this study and included 10 questions related to: i) regularity of physical exercising ii) severeness of symptoms of COVID-19 (loss of senses, high temperature, muscle pain, weakness and exhaustion, pneumonia, infusion, oxygen support, hospitalization) and iii) duration of recovery after the disease. Generat part of the survey referred to collecting of basic demographic data, such as: age, work commitments and basic life habits.

Active population was selected by animation from local fitness recreation centers on voluntary base, and most inactive population, within working population. Level of activity was determined by the survey. Overall procedure of answering the questions lasted aprox 10 min.

### *Subjects*

Total number of subjects included in the study was N=100, both sexes (male=32, female=68) of younger age (30-44 age- age group according to standards of WHO), physically healthy, without chronicle diseases and who overcame COVID-19 in the last 6 months. Apartf from overcoming COVID-19, the criterion for active subjects was that they exercise continuously for three months, more that 120 minutes a week. Group of inactive subjects was selected from working population, randomly. Surveys were filled by subjects personally using online tools and all data about participants of the study were protected, respecting ethical aspects of the study, regulated by Helsinki Declaration. Based on the answers on survey question about regular physical activity subjects

težinom bolesti COVID-19, kao i da povećan nivo tjelesne aktivnosti umjerenog intenziteta može zaštititi od dobivanja većeg broja simptoma COVID-19 (Zeigler, 2021). Posljedično, na temelju navedenih istraživanja, čini se da se umjerena tjelesna aktivnost može preporučiti kao nefarmakološki, jeftin i održiv način prevencije teških slučajeva COVID-19. Pretpostavka istraživanja je bila da većina tjelesno aktivnih ljudi ima lakše simptome ove bolesti i brži oporavak u odnosu na tjelesno neaktivnu populaciju.

## METODE

### *Dizajn istraživanja i prikupljanje podataka*

Istraživanje je klasifikovano kao presječna studija s ciljem da se utvrde razlike u simptomima i vremenu oporavka kod osoba koje su prebolovale COVID-19 u odnosu na prethodni nivo tjelesne aktivnosti. Prikupljanje podataka je provedeno upotrebom anketnog upitnika koji je osmišljen za potrebe ovog istraživanja, a koji se sastojao od 10 pitanja vezanih za: i) redovnost tjelesnog vježbanja, ii) težinu simptoma bolesti COVID-19 (gubitak osjeta, pojava temperature, bolovi u mišićima, osjećaj slabosti i iscrpljenosti, upala pluća, infuzija, kiseonička potpora, hospitalizacija), te iii) trajanje oporavka nakon bolesti. Anketni upitnici elektronski su dostavljeni ispitanicima putem web linka. Opšti dio upitnika odnosio se na prikupljanje osnovnih demografskih podataka, poput godina starosti, radnih obaveza i osnovnih životnih navika. Aktivna populacija je selektirana animiranjem iz lokalnih fitness rekreativnih centara na dobrovoljnoj bazi, a najveći dio neaktivne populacije u okviru radnog stanovništva. Nivo aktivnosti je utvrđen anketnim upitnikom. Cjelokupna procedura odgovora na pitanja trajala je cca 10 min.

### *Ispitanici*

Ukupan broj ispitanika uvrštenih u istraživanje bio je N=100, oba spola (muškarci=32, žene=68), mlađe životne dobi (30-44 godine starosti – dobna skupina prema mjerilima WHO), tjelesno zdravih bez hroničnih bolesti, a prebolovale su COVID-19 unazad 6 mjeseci. Pored prebolovanog COVID-19, kriterij za aktivne subjekata je bio da u kontinuitetu najmanje tri mjeseca vježbaju više od 120 minuta sedmično. Grupa neaktivnih ispitanika izabrana je iz radno aktivne populacije nasumičnim izborom. Ankete su ispunjavali ispitanici osobno koristeći online alate, a svi podaci o učesnicama istraživanja su zaštićeni, poštujući etičke aspekte istraživanja propisane Helsinškom deklaracijom. Na osnovu odgovora na anketno pitanje o redovnoj tjelesnoj aktivnosti ispitanici su

were divided in two groups (Table 1) : Active (N=53) and Inactive (N=47).

**Statistical analysis**

Analysis of answers was evaluated by Office Excel program and SPSS 21 (SPSS Inc., Chicago, IL, USA). All results of the answers were transferred to the adequate excel matrix. Chi-square test ( $\chi^2$  test of differences among groups) was used for determination of significance of differences of detected frequencies ( $f_o$ ). Direction of significance of differences was classified based on standard residential means. Data were shown as number of detected frequencies and percentage of representation. Level of statistical conclusion was set on  $p < 0.05$

**RESULTS**

**Table 1.** Difference of detected frequencies in relation to regular exercising in fitness center

		<b>How long do you exercise in continuity? / Koliko dugo vježbate u kontinuitetu?</b>		
		<b>Inactive / Neaktivni</b>	<b>Active / Aktivni</b>	<b>Total / Ukupno</b>
3-5 years / godina	$f_o$	0 (0%)	9 (100%)	9
	$S_{RES}$	-2.1	1.9	
2-3 years / godine	$f_o$	0 (0%)	11 (100%)	11
	$S_{RES}$	-2.2	2	
1-2 years / godine	$f_o$	0 (0%)	13 (100%)	13
	$S_{RES}$	-2.4	2.2	
6 -9 months / mjeseci	$f_o$	0 (0%)	9 (100%)	9
	$S_{RES}$	-2.1	1.9	
3-6 months / mjeseci	$f_o$	0 (0%)	11 (100%)	11
	$S_{RES}$	-2.1	1.9	
I don't exercise at all / ne treniram uopće	$f_o$	31 (100%)	0 (0%)	31
	$S_{RES}$	3.9	-2.1	
I sometimes walk / ponekad šetam	$f_o$	16 (100%)	0 (0%)	16
	$S_{RES}$	2.6	-2.4	
Total / Ukupno	$f_o$	47 (47%)	53 (53%)	100

$f_o$  - detected frequencies;  $S_{RES}$  - standardized residuals

Based on the answers on survey question about regular physical activity subjects were divided in two groups (Table 1): Active (N=53) and Inactive (N=47) group.

podijeljeni u dvije grupe (Tabela 1): Aktivni (N=53) osobe skupina Neaktivni (N=47).

**Statistička analiza**

Analiza odgovora je procijenjena korištenjem Office programa Excel i SPSS 21 (SPSS Inc., Chicago, IL, USA). Sve rezultati odgovora su prebačeni u adekvatnu excell matricu. Za utvrđivanje značajnosti razlika opaženih frekvencija ( $f_o$ ) korišten je Chi-square test ( $\chi^2$  test razlika između grupa). Smjer značajnosti razlike klasifikovan je na osnovu standardiziranih rezidualanih vrijednosti. Podaci su prikazani kao broj opaženih frekvencija i procentualna zastupljenost. Nivo statističkog zaključivanja postavljen je na  $p < 0.05$ .

**REZULTATI**

**Tabela 1.** Razlika opaženih frekvencija u odnosu na redovno vježbanje u fitness centru

$f_o$  - opažene frekvencije;  $S_{RES}$  - Standardizirani reziduali

Na osnovu odgovora na anketno pitanje o redovnoj tjelesnoj aktivnosti ispitanici su podijeljeni u dvije grupe (Tabela 1): Aktivni (N=53) osobe skupina Neaktivni (N=47).



**Table 2.** Differences of detected frequencies of answers to the question about the symptoms and progress of the disease between active and inactive individuals, who overcame COVID-19.

**Tabela 2.** Razlika opaženih frekvencija odgovora na pitanja o simptomima i toku bolesti između aktivnih i neaktivnih osoba koje su prebolovale COVID-19.

Questions / Pitanja			Yes / Da (%)	No / Ne (%)	Total / Ukupno	$\chi^2$
Did you lose sense of smell and taste? / Da li ste izgubili čulo mirisa i ukusa?	inactive / neaktivni	$f_o$	35 (74%)	12 (26%)	47	$\chi^2= 3.494a;$ $p=0.062$
		$S_{RES}$	0.8	-1.1		
	active / aktivni	$f_o$	30 (57%)	23 (43%)	53	
		$S_{RES}$	-0.8	1		
Total / Ukupno	$f_o$	65 (65%)	35 (35%)	100		
Pronounced muscle pain during the disease? / Izražena bol u mišićima tokom bolesti?	inactive / neaktivni	$f_o$	42 (89%)	5 (11%)	47	$\chi^2= 213.259a;$ $p<0.001$
		$S_{RES}$	1.4	-2.2		
	active / aktivni	$f_o$	30 (57%)	23 (43%)	53	
		$S_{RES}$	-1.3	2.1		
Total / Ukupno	$f_o$	72 (72%)	28 (28%)	100		
Did you feel exhaustion and tiredness? / Da li ste osjećali iscrpljenost i umor?	inactive / neaktivni	$f_o$	42 (89%)	5 (11%)	47	$\chi^2= 13.966a;$ $p=0.001$
		$S_{RES}$	1.3	-2.2		
	active / aktivni	$f_o$	30 (57%)	23 (43%)	53	
		$S_{RES}$	-1.2	2.1		
Total / Ukupno	$f_o$	71 (72%)	28 (28%)	100		
Did you have high temperature? / Da li ste imali povišenu temperaturu?	inactive / neaktivni	$f_o$	44 (94%)	3 (6%)	47	$\chi^2= 23.553a;$ $p<0.001$
		$S_{RES}$	1.9	-3		
	active / aktivni	$f_o$	26 (49%)	27 (51%)	53	
		$S_{RES}$	-1.8	2.8		
Total / Ukupno	$f_o$	70 (70%)	30 (30%)	100		
Did you have pneumonia? / Da li ste imali upalu pluća?	inactive / neaktivni	$f_o$	22 (47%)	25 (53%)	47	$\chi^2= 19.957a;$ $p<0.001$
		$S_{RES}$	2.8	-1.7		
	active / aktivni	$f_o$	4 (8%)	49 (92%)	53	
		$S_{RES}$	-2.6	1.6		
Total / Ukupno	$f_o$	26 (26%)	74 (74%)	100		
Were you hospitalized? / Da li ste bili hospitalizovani?	inactive / neaktivni	$f_o$	5 (11%)	42 (89%)	47	$\chi^2= 5.935a;$ $p=0.015$
		$S_{RES}$	1.7	-0.4		
	active / aktivni	$f_o$	0 (0%)	53 (100%)	53	
		$S_{RES}$	-1.6	0.4		
Total / Ukupno	$f_o$	5 (5%)	95 (95%)	100		
Did you receive IV (infusion)? / Da li ste primili infuziju?	inactive / neaktivni	$f_o$	12 (26%)	35 (74%)	47	$\chi^2= 15.377a;$ $p<0.001$
		$S_{RES}$	2.7	-1		
	active / aktivni	$f_o$	0 (0%)	53 (100%)	53	
		$S_{RES}$	-2.5	0.9		
Total / Ukupno	$f_o$	12 (12%)	88 (88%)	100		
Were you on oxygen support? / Da li ste bili na kiseoničkoj potpori?	inactive / neaktivni	$f_o$	4 (9%)	43 (91%)	47	$\chi^2= 4.699a;$ $p=0.030$
		$S_{RES}$	1.5	-0.3		
	active / aktivni	$f_o$	0 (0%)	53 (100%)	53	
		$S_{RES}$	-1.5	0.3		
Total / Ukupno	$f_o$	4 (4%)	96 (96%)	100		

$f_o$  - detected frequencies ;  $S_{RES}$  - standardized residuals;  $\chi^2$  - Chi square test

$f_o$  - opažene frekvencije;  $S_{RES}$  - Standardizirani reziduali;  $\chi^2$  - Chi square test

In Table 2 differences of detected frequencies to the question “Did you lose sense of smell and taste?” between physically active and physically inactive individuals show that there are no significant differences between in symptoms of losing smell and taste ( $\chi^2= 3.494a$ ;  $p=0.062$ ). Observing differences of detected frequencies to the question “Did you experience pain in the muscles?” it is noticed that there is a significant difference in symptoms of muscle pain between active 57% and inactive 89% individuals ( $\chi^2=213.259a$ ;  $p<0.001$ ). most of active participants (A=43%) did not feel the pain in muscles in relation to the inactive (N=11%) during the COVID-19 disease (inactive 5; active 23  $S_{RES} = -1.3$  i 2.1). differences of detected frequencies to the question “Did you feel exhaustion and tiredness?” show that there is a small difference in symptoms of exhaustion and tiredness between active 57% and inactive 89% individuals ( $\chi^2= 13.966a$ ;  $p=0.001$ ). Bigger number of active subjects 43% did not feel the exhaustion and tiredness during the disease (inactive 5; active 23  $S_{RES} = -1.2$  i 2.1). Observing differences of detected frequencies to the question “Did you have high temperature?” it is shown that there is significant difference between symptoms of high temperature between active and inactive individuals ( $\chi^2= 23.553a$ ;  $p<0.001$ ). a significant number of active subjects 51% did not have symptoms of high temperature during the COVID-19 disease, but 6% of inactive subjects did not have temperature (inactive 3; active 27  $S_{RES} = -3.0$  i 2.8). Differences of detected frequencies to the question “Did you have pneumonia?” show that there is significant difference in symptoms between active and inactive individuals ( $\chi^2= 19.957a$ ;  $p<0.001$ ). 47% of inactive and 8% of active subjects had pneumonia during the COVID-19 disease (inactive 25; active 49  $S_{RES} = -2.6$  i 1.6). Differences of detected frequencies to the question “Were you hospitalized?” show that there is statistical difference in symptoms between active 0% and inactive 11% individuals ( $\chi^2= 5.935a$ ;  $p=0.015$ ). Not a single one subject from active group was hospitalized during the COVID-19 disease (inactive 5; active 0;  $S_{RES} = -1.7$  i .4). Differences of detected frequencies to the question “Did you receive IV (infusion)?” show that there is statistical difference in symptoms between active 0% and inactive 26% individuals ( $\chi^2= 15.377a$ ;  $p<0.001$ ). None of the subjects of active group received IV (infusion) during the COVID-19 disease (inactive 12; active 53;  $S_{RES} = -2.7$  i -1.0). Differences of detected frequencies to the question “Were you on oxygen support?” show that there is statistical difference in symptoms between active 0% and inactive 9% individuals ( $\chi^2= 4.699a$ ;  $p=0.030$ ). None of the subjects of active group was on the oxygen support (inactive 4; active 0;  $S_{RES} = -1.5$  i .3).

U tabeli 2 razlike opaženih frekvencija na pitanje „Da li ste gubili miris i ukus?“ između fizički aktivni i neaktivnih osoba pokazuju da ne postoji značajna razlika u pojavi simptoma gubitka mirisa i okusa ( $\chi^2= 3.494a$ ;  $p=0.062$ ). Podjednak broj ispitanika je imao simptome gubitka mirisa i okusa (neaktivni 35; aktivni 30;  $S_{RES} = 0.8$ ). Uvidom u razlike opaženih frekvencija na pitanje „Da li ste osjetili bol u mišićima?“ vidljivo je da postoji značajna razlika u pojavi simptoma bola u mišićima između aktivnih 57% i neaktivnih osoba 89% ( $\chi^2=213.259a$ ;  $p<0.001$ ). Veći broj aktivnih ispitanika (A=43%) nije osjetio bolove u mišićima u odnosu na neaktivne (N=11%) u toku bolesti COVID-19 (neaktivni 5; aktivni 23;  $S_{RES} = -1.3$  i 2.1). Razlike opaženih frekvencija na pitanje „Da li ste osjećali iscrpljenost i umor?“ pokazuju da postoji mala razlika u pojavi simptoma iscrpljenosti i umora između aktivnih 57% i neaktivnih 89% osoba ( $\chi^2= 13.966a$ ;  $p=0.001$ ). Veći broj aktivnih ispitanika 43% nije osjetio iscrpljenost i umor tokom bolesti (neaktivni 5; aktivni 23;  $S_{RES} = -1.2$  i 2.1). Uvidom u razlike opaženih frekvencija na pitanje „Da li ste imali povišenu temperaturu?“ vidljivo je da postoji značajna razlika u pojavi simptoma povišene temperature između aktivnih i neaktivnih osoba ( $\chi^2= 23.553a$ ;  $p<0.001$ ). Značajno veći broj aktivnih ispitanika 51% nije je imao simptome povišene temperature tokom bolesti COVID-19, kod neaktivnih 6% nije imalo temperaturu (neaktivni 3; aktivni 27;  $S_{RES} = -3.0$  i 2.8). Razlike opaženih frekvencija na pitanje „Da li ste imali upalu pluća?“ pokazuju da postoji značajna razlika u pojavi simptoma upale pluća između aktivnih i neaktivnih osoba ( $\chi^2= 19.957a$ ;  $p<0.001$ ). Upalu pluća je imalo 47% neaktivnih i 8% aktivnih ispitanika tokom bolesti COVID-19 (neaktivni 25; aktivni 49;  $S_{RES} = -2.6$  i 1.6). Uvidom u razlike opaženih frekvencija na pitanje „Da li ste bili hospitalizovani?“ uočeno je da postoji statistička razlika između aktivnih 0% i neaktivnih osoba 11% ( $\chi^2= 5.935a$ ;  $p=0.015$ ). Niti jedan ispitanik aktivne skupine nije bio hospitalizovan tokom bolesti COVID-19 (neaktivni 5; aktivni 0;  $S_{RES} = -1.7$  i .4). Uvidom u razlike opaženih frekvencija na pitanje „Da li ste primili infuziju?“ uočeno je da postoji statistička razlika između aktivnih 0% i neaktivnih 26% osoba ( $\chi^2= 15.377a$ ;  $p<0.001$ ). Nijedan ispitanik aktivne skupine nije primio infuziju tokom bolesti COVID-19 (neaktivni 12; aktivni 53;  $S_{RES} = -2.7$  i -1.0). Razlike opaženih frekvencija na pitanje „Da li ste bili na kiseoničkoj potpori?“ uočeno je da postoji statistička razlika između aktivnih 0% i neaktivnih osoba 9% ( $\chi^2= 4.699a$ ;  $p=0.030$ ). Niti jedan ispitanik aktivne skupine nije bio na kiseoničkoj potpori (neaktivni 4, aktivni 0,  $S_{RES} = -1.5$  i .3).

**Table 3.** Difference of detected frequencies to the question “How long did it take you to recover?” between physically active and physically inactive individuals who overcame COVID-19.

**Tabela 3.** Razlika opaženih frekvencija odgovora na pitanje „Koliko vam je trebalo da se oporavite?“ između fizički aktivni i neaktivnih osoba koje su prebolovale COVID 19.

		How long did it take you to fully recover from COVID-19? / Koliko vam je trebalo da se potpuno oporavite nakon bolesti Covid-19?					
		2-3 months / mjeseca	3-6 months / mjeseci	30 days / dana	7 - 14 days / dana	more than 6 months / više od 6 mjeseci	Total / Ukupno
Criterion of activity / Kriterij aktivnosti	Inactive / Neaktivni	f <sub>o</sub> 15 (31.9)%	6 (12.8)%	12 (25.5)%	10 (21.3)%	4 (8.5)%	47
		S <sub>RES</sub> 1.8	1.9	-2	-2.1	0.7	
	Active / Aktivni	f <sub>o</sub> 5 (10.6)%	0 (0)%	15 (31.9)%	31 (66)%	2 (4.3)%	53
		S <sub>RES</sub> -1.7	-1.8	.2	2.0	-.7	
Total / Ukupno		f <sub>o</sub> 20	6	27	41	6	100

$\chi^2 = 22.477^a$ ;  $p < 0.001$

f<sub>o</sub> - detected frequencies; S<sub>RES</sub> - standardized residuals;  $\chi^2$  - Chi square test

Table 3. differences of detected frequencies to the question “How long did it take you to recover?” between physically active and physically inactive individuals who overcame COVID-19 show that there is statistical difference between active and inactive individuals ( $\chi^2 = 22.477^a$ ;  $p < 0.001$ ). 66% of active individuals recovered within 7-14 days and 31% of inactive individuals recovered within 2-3 months..

### DISCUSSION

The aim of this paper is to determine correlation between physical activity of the population with the presence of the symptoms and time necessary for recovery from COVID-19. Results of the study have shown that there are significant differences between active and inactive subjects in terms of symptoms and recovery period after the COVID-19 disease. In active group all symptoms of the disease were less pronounced in relation to inactive group of subjects, except for the symptoms of loss of smell and taste where there was no significant difference between groups. The exact reason for disorder of smell and taste after COVID-19 has still not been understood completely (Bubaš and Capak, 2022). It can be caused by virus nerve damage, local infection and damage of supportive cells and nasal epithelia cells or both. In about 90% or 96% of patients sense of smell will be returned within 30 days from the beginning of the recovery. In a small percentage of individuals who overcame COVID-19 sense of smell and taste comes back in function after twelve months even (Bubaš and Capak 2022). Study shows that there is no significant difference between active

f<sub>o</sub> - opažene frekvencije; S<sub>RES</sub> - Standardizirani reziduali;  $\chi^2$  - Chi square test

Uvidom u tabelu 3. razlike opaženih frekvencija na pitanje „Koliko vam je trebalo da se oporavite?“ između fizički aktivnih i neaktivnih osoba koje su prebolovale COVID 19 uočeno je da postoji statistička razlika između aktivnih i neaktivnih osoba ( $\chi^2 = 22.477^a$ ;  $p < 0.001$ ). Kod aktivnih osoba 66% se oporavilo u roku od 7 do 14 dana, a kod neaktivnih 31% se oporavilo u periodu 2-3 mjeseca.

### DISKUSIJA

Cilj rada je bio utvrditi povezanost redovne tjelesne aktivnosti stanovništva sa prisustvom simptoma i vremenom potrebnim za oporavka od bolesti COVID-19. Rezultati istraživanja pokazali su da između aktivnih i neaktivnih ispitanika postoje značajne razlike u prisustvu simptoma i trajanju oporavka nakon bolesti COVID-19. U aktivnoj skupini svi simptomi bolesti su bili slabije izraženi u odnosu na neaktivnu skupinu ispitanika, osim simptoma gubitak mirisa i okusa gdje nije bilo značajne razlike između grupa. Tačan razlog poremećaja njuha i okusa nakon COVID-19 još nije potpuno shvaćen (Bubaš i Capak, 2022). Može biti izazvan virusnim oštećenjem živaca, lokalnom upalom i oštećenjem potpornih stanica i sin nazalnog epitela, ili oboje. U približno 90 % do 96 % pacijenata osjet mirisa će se barem djelimično vratiti unutar 30 dana od početka oporavka. Kod malog postotka osoba koje su preboljele COVID-19 osjet mirisa i okusa vraća se u funkciju tek nakon dvanaest mjeseci (Bubaš i Capak, 2022). Istraživanje pokazuje da kod lakših simptomima bolesti kao što je gubitak okusa i mirisa nema značajne razlike između aktivnih i neaktivnih ispitanika.

and inactive subjects in terms of lighter symptoms such as loss of smell and taste. The problems with pain in the joints and muscles are common symptoms of COVID-19 and they affect shoulders, neck and knees. In this study symptom of pronounced pain in muscles during the disease had 89% of inactive and 57% of active subjects. During the treatment of the disease, due to general weakness, patients rest and don't move and it can also cause or make them worse, pains, stiffness and muscle weakness. During the treatment of the disease, lying and non-moving lead to termination of loading of skeleton muscles, which cause their gradual atrophy (losing muscle mass). Together with losing muscle mass, termination of loading musculature leads to denervation of muscle fibers and damaging connector between muscle and motor nerve, which causes reduced muscle function, motor control and balance. It is assumed that in physically active subjects trained muscles have less tendency to weaken and faster ability to recover. Weakness of the muscles can later turn into difficulties in activities such as: standing, climbing the stairs, catching and holding objects in hands or lifting arms above the head, so this is one more reason why recovery in inactive group of subjects lasted longer in relation to the active group. Since the body, during the disease, uses all energy to fight the virus, it is expected, in that process, that many valuable resources are consumed, especially, muscles. Active muscle mass as a consequence of regular training, is additional benefit and help in easier overcoming of the disease and it affected the weaker symptoms of exhaustion and tiredness in active group of subjects. Subjects of active group (43%) didn't have symptoms of exhaustion and tiredness at all, while subjects of inactive group (89%) experienced this pronounced symptom during the disease.

Higher level of muscle abilities is important for metabolism of substance and hormones (Mišigoj-Duraković, 1999). Training increases number of red blood cells and transport of oxygen to the cells, faster blood circulation, faster transport of antibodies, immunoglobulin and white blood cells (defense cells) from the body to the place where their effect is needed. Increased blood circulation also stimulates release of hormones, which warn the cells on presence of pathogen bacteria or viruses. Better metabolism of substance and hormones probably caused less exhaustion during the disease, in active group of subjects, therefore they didn't have the need to take an infusion during the disease, while in inactive group of subjects, 26% of them need to take the infusion. In the last 4 decades many studies on sport and general population have shown that the training of moderate and high intensity and 60 minute duration has positive acute effect to the immune system (Nieman, 1990). Such training stimulation leads to increase of anti-pathogen

Problemi sa bolom u zglobovima i mišićima su česti simptomi COVID-19 i zahvaćaju ramena, vrat, leđa i koljena. U ovom istraživanju simptom izražene boli u mišićima tokom bolesti je imalo 89% neaktivnih i 57% aktivnih ispitanika. Tokom liječenja od bolesti zbog opće slabosti oboljeli miruju i ne kreću se, a to također može prouzročiti ili pogoršati bolove, ukočenost i slabost mišića. U toku bolesti, ležanja i nekretanja dolazi do prestanka opterećivanja skeletnih mišića, što izaziva njihove postepenu atrofiju (gubitak mišićne mase). Usporedo s gubitkom mišićne mase, prestanak opterećivanja muskulature dovodi i do denervacije mišićnih vlakana i oštećenja spojnice između mišića i motoričkog živca, a što za posljedicu ima smanjenu mišićnu funkciju, motoričku kontrolu i ravnotežu. Pretpostavka je da kod tjelesno aktivnih ispitanika utrenirani mišići imaju manju tendenciju da slabe i bržu sposobnost oporavka. Slabost mišića može poslije stvoriti poteškoće u aktivnostima kao što su stajanje, penjanje stepenicama, hvatanje i držanje predmeta u rukama ili podizanje ruku iznad glave, tako da je to još jedan od razloga zašto je oporavak kod neaktivne grupe ispitanika trajao duže u odnosu na aktivnu grupu.

Kako tokom bolesti tijelo upotrebljava svu energiju koju ima kako bi se borilo s virusom, u tom je procesu očekivano da se mnogi vrijedni resursi troše, pogotovo mišići. Aktivna mišićna masa kao posljedica redovnog treninga je dodatni benefit i pomoć u lakšem prevazilaženju bolesti, te je utjecala na manje izraženim simptomima iscrpljenosti i umora kod aktivne skupine ispitanika. Ispitanici aktivne grupe 43% u toku bolesti nisu uopće osjećali simptom iscrpljenost i umora, dok kod neaktivnih ispitanika 89% je osjećalo izražen ovaj simptom tokom bolesti.

Viša razina mišićnih sposobnosti važna je za metabolizam tvari i hormona (Mišigoj-Duraković, 1999). Trening povećava broj crvenih krvnih zrnca, a time i transport kisika do ćelija, bržu cirkulaciju krvi, brži transport antitijela, imunoglobulina i bijelih krvnih stanica (obrambenih stanica) tijelom do mjesta gdje je potrebno njihovo dejstvo. Ubrzana cirkulacija krvi također potiče oslobađanje hormona koji upozoravaju stanice na prisutne patogene bakterije ili viruse. Upravo bolji metabolizam tvari i hormona vjerovatno je uzrokovao manju iscrpljenost tokom bolesti kod aktivne skupine ispitanika, a samim tim nisu imali potrebe za primanjem infuzije tokom bolesti, dok je kod neaktivnih ispitanika 26% je moralo primiti infuziju.

Kako trening umjerenog do visokog intenziteta i trajanja do 60 minuta ima pozitivan akutni učinak na imunološki sistem pokazuju i druge brojne studije na sportskoj i općoj populaciji u zadnje 4 dekade (Nieman, 1990). Kod takvog trenažnog podražaja dolazi do povećanja anti-patogene aktivnosti tkivnih makrofaga, paralelno s povećanjem cirkula-



activities of tissue macrophage, parallel with the increase of circulation of immunoglobulin, anti-inflammatory cytokines, neutrophil, NK cells, cytotoxic T cells and B cells (Adams 2011). Stated acute changes play the key role in defense activity of immune system and metabolic health of a human. If the training stimulus is repeated continuously, for a longer period of time (few months and years) it comes to permanent strengthen of defense function of immune system which has an influence on weaker symptoms of the disease (Booth, 2014). In active group, probably more subjects, due to continuous months-long exercising, had better immune response of their body, therefore the symptom of high temperature, during the disease, had 49% of active subjects in relation to the 94% of inactive subjects. In the context of pandemic of COVID-19, the effect of exercising on infection of respiratory system of the trainee is especially interesting. Inverse correlation between exercising with moderate intensity and appearance of infection of upper respiratory tract (Nieman, 2000), where acute immune response to the exercising depends on intensity and duration of loading, is determined. Studies show that moderate physical activity is recommended has optimal health effects and strengthening immune system (Chagas et. al., 2020). Results of this study show that 47% of inactive and 8% of active subjects had pneumonia. Since these were recreational athletes, who exercise mostly in moderate intensity and shorter duration of loading, it can be assumed that there was a strong acute response of their immune system. Previous studies showed that immune system responds highly on physical activity of moderate intensity and is related to lower incidence, duration and severeness of infection of respiratory tract (Powel, 1994). Improved immune function, which is induced by moderate intensity of exercising, can decrease flow of inflammatory cells to lungs, reduce loading to pathogens, improve disease outcome and reduce chemokines and anti-inflammatory cytokines in lungs and bronchoalveolar lavage (Kohut et al 2009; Lowder et al; Warren et al 2015). In fighting COVID-19, active subjects have the advantage because training has the impact on healthy respiratory system and cardio-vascular system, because it activates all muscles in the body, heart muscle and thorax muscles, as well, which participate in process of breathing, which supports the data that no subject from active group needed oxygen support, during the disease. 9% of subjects of inactive group needed oxygen support, during the disease. Studies show that there is increased vital capacity of lungs in active individuals in relation to inactive population (Dodig, 1992). Physical exercise has a great impact on respiratory system. It increases thorax, size of lung alveoli, vital capacity and all ventilation parameters. Exercising affects breathing center. Results of

cije imunoglobulina, protuupalnih citokina, neutrofila, NK stanica, citotoksičnih T stanica i B stanica (Adams, 2011). Navedene akutne promjene igraju ključnu ulogu u obrambenoj aktivnosti imunološkog sistema, te metaboličkom zdravlju čovjeka. Ukoliko se trenažni podražaj kontinuirano ponavlja dovoljno dugo (više mjeseci i godina), dolazi do trajnog jačanja obrambene funkcije imunološkog sistema, što ima utjecaj na lakše simptome bolesti (Booth, 2014). Kod aktivne skupine vjerovatno je veći broj ispitanika uslijed kontinuiranog višemjesečnog vježbanja imao bolji imunološki odgovor organizma te je simptom povišene tjelesne temperature tokom bolesti je imalo 49% aktivnih ispitanika u odnosu na 94% neaktivnih ispitanika.

U kontekstu pandemije COVID-19, posebno je interesantan utjecaj tjelovježbe na infekcije respiratornog sistema vježbača. Utvrđena je inverzna povezanost između tjelovježbe umjerenim intenzitetom i pojavnosti infekcije gornjeg respiratornog traka (Nieman, 2000) gdje akutni imunološki odgovor na vježbanje ovisi o intenzitetu i trajanju napora. Istraživanja pokazuju da se za optimalne zdravstvene efekte i jačanje imunološkog sistema preporučuje umjerana tjelesna aktivnost (Chagas et. al., 2020). Rezultati ovog istraživanja pokazuju da je upalu pluća imalo 47% neaktivnih i 8% aktivnih ispitanika. Pošto se radi o rekreativcima koji većinom vježbaju umjerenim intenzitetom i kraćim trajanjem napora može se pretpostaviti da je kod njih upravo bio prisutan jak akutni odgovor imunološkog sistema. Dosadašnja istraživanja pokazuju da imunološki sistem visoko reagira na tjelesnu aktivnost umjerenog intenziteta i povezan je s manjom incidencijom, trajanjem i težinom infekcija disajnog trakta (Powel, 1994). Poboljšana imunološka funkcija koja je inducirana umjerenim intenzitetom vježbanja može smanjiti priljev upalnih stanica u pluća, smanjiti opterećenje patogenima, poboljšati ishod bolesti i smanjiti kemokine i proupalne citokine u plućima ili bronhoalveolarnoj lavažnoj tekućini (Kohut i sur. 2009; Lowder i sur. 2006; Warren i sur. 2015).

U borbi sa COVID-19 prednost imaju aktivni ispitanici jer trening ima utjecaj na zdrav respiratorni i kardio-vaskularni sistem tako što aktivira sve mišiće na tijelu pa tako i onaj najvažniji srčani mišić i mišiće grudnog koša koji učestvuju u samom procesu disanja, čemu u prilog govori podatak da je na kiseoničkoj potpori nije bio ni jedan ispitanik iz aktivne grupe. Kiseoničku potporu je trebalo 9% ispitanika iz neaktivne skupine. Istraživanja pokazuju da je kod aktivnih osoba generalno povećan vitalni kapacitet pluća u odnosu na neaktivnu populaciju (Dodig, 1992). Tjelesno vježbanje ima velik utjecaj na respiratorni sistem. Povećava se prsni koš, površina plućnih alveola, vitalni kapacitet i svi ventilacijski parametri. Vježbanje utječe i na

exercising is prolonged breathing and improvement of vital capacity of lungs and improvement of ratio of residential volume and overall capacity of lungs. Lung diffusion is better in trained individuals than in untrained. Saving the oxygen is a sign of good shape. Trained individual learns how to reduce number of movements and to use necessary muscles, purposefully. In physiological sense aerobic capacity is the most direct indicator of maximal ability of heart-blood and respiratory system. The most important feature of level of active health is high functional ability of transport respiratory system. Physical exercising has an impact on respiratory and circulatory, functional abilities and develops heart-vein and respiratory system (Mišigoj-Duraković, 1999).

Regular physical exercise is related to improved cardio-respiratory conditioning, which can be seen with bigger oxygen consumption ( $VO_2$  max) in Ergometric test.  $VO_2$ max has shown to be an important indicator for stratification of risk of surgical complications, interventions and hospital admission due to COVID-19 (Ahmed 2020). In active group of subjects no one was hospitalized during the disease, while inactive subjects 11% of them had to be hospitalized. It is believed that people with bigger cardio-respiratory capacity linked with physical exercising have lower risk of complications and death rate of COVID -19 and with aerobic capacity, bigger performance of strength is also linked to the smaller risk of death outcome (García-Hermoso 2018). It took 7 to 14 days for 66% of subjects of active group to recover. 31.9% of subjects of inactive group needed 2-3 months to recover. Study shows that regular physical activity has positive acute effect on immune system and metabolic health of an individual, it enables faster recovery and better toleration of symptoms of COVID-19. In study (Tavakol et al, 2021) similar results were obtained, which showed that physical inactivity is significantly connected to the severeness of the disease of COVID-19. As an illustration, patients with lower levels of physical activity or lower MET.min/week were hit with more severe form of disease (mid means 343.6 in relation to 779.3 MET.min/week) ( $p=0,03$ ). Correlation between duration of signs and symptoms and physical activity suggests that patients with lower physical activity suffer longer in comparison to the groups with moderate to high levels of physical activity. Study leads to conclusion that increase of levels of physical activity can partially reduce severeness of disease of COVID-19 and accelerate recovery period. Other studies (Zeigler, 2021) also indicate that similar results, where increased level of physical activity of moderate intensity can protect individual from getting bigger number of symptoms of COVID-19. This is confirmed by the study where physical inactivity is directly or indirectly linked to the bad immune re-

centar za disanje. Rezultat vježbanja je produženo disanje te poboljšanje vitalnog kapaciteta pluća i poboljšanje odnosa rezidentalnog volumena i ukupnog kapaciteta pluća. Plućna difuzija bolja je kod uvježbanih osoba nego kod neuvježbanih. Štednja u iskorištavanju kisika je znak dobre kondicije. Uvježbana osoba nauči smanjiti broj pokreta i svrsishodnije upotrijebiti potrebne mišiće. U fiziološkom pogledu aerobni kapacitet je najdirektniji pokazatelj maksimalne sposobnosti srčano-krvnog i respiratornog sistema. Najznačajnija odlika nivoa aktivnog zdravlja su visoke funkcijske sposobnosti transportnog sistema za kisik. Tjelesno vježbanje utječe na dišne i cirkulacijske funkcijske sposobnosti te razvija srčano – žilni i dišni sustav (Mišigoj-Duraković, 1999).

Redovna tjelovježba povezana je s poboljšanom kardiorespiratornom kondicijom, što se može uočiti većom potrošnjom kisika ( $VO_2$ max) u ergometrijskom testu. Pokazalo se da je  $VO_2$ max važan pokazatelj za stratifikaciju rizika kirurških komplikacija, intervencija i prijema u bolnicu kod bolesti COVID-19 (Ahmed, 2020). U aktivnoj grupi ispitanika niko nije bio hospitalizovan tokom bolesti, dok kod neaktivnih ispitanika njih 11% je moralo biti hospitalizovano. Vjeruje se da ljudi s većim kardiorespiratornim kapacitetom povezanim s tjelesnim vježbanjem imaju manji rizik od komplikacija i stopu smrtnosti od COVID-19, a uz aerobni kapacitet, veća izvedba snage također je povezana s manjim rizikom od smrtnog ishoda (García-Hermoso 2018).

U aktivnoj skupini najvećem broju ispitanika 66% je trebalo 7 do 14 dana da se oporave. Kod neaktivne skupine najvećem broju ispitanika 31.9% bilo je potrebno 2-3 mjeseca za oporavak. Studija pokazuje kako redovna tjelesna aktivnost ima pozitivan akutni učinak na imunološki sistem i metaboličko zdravlje čovjeka, omogućava brži oporavak i lakše podnošenje simptoma bolesti COVID -19. U studiji (Tavakol i sar. 2021) dobijeni su slični rezultati koji su pokazali da je tjelesna neaktivnost značajno povezana s težinom bolesti COVID-19. Kao ilustracija, pacijenti s nižim razinama tjelesne aktivnosti ili nižim MET.min/tjedan bili su pogođeni težim oblikom bolesti (srednja vrijednost 343.6 naspram 779.3 MET.min/tjedan) ( $p=0,03$ ). Korelacija između trajanja znakova i simptoma i tjelesne aktivnosti sugerira da pacijenti s niskom tjelesnom aktivnošću pate duže od bolesti u usporedbi sa skupinama s umjerenom do visokom razinom tjelesne aktivnosti. Istraživanje navodi na zaključak da povećanje nivoa tjelesne aktivnosti može djelomično smanjiti težinu bolesti COVID-19 i ubrzati period oporavka nakon bolesti.

Druga istraživanja (Zeigler, 2021), također pokazuju slične rezultate gdje povećana razina tjelesne aktivnosti umjerenog intenziteta može zaštititi od dobivanja većeg

sponse (Laddu et al. 2020.), through vicious circle between inactivity and obesity (Pietiläinen et al. 2008.). Therefore, unhealthy diet, obesity and inactiveness have negative effect on work of immune system and defense of the host.

This study shows that, in sense of preservation and improvement of psycho-physical health of contemporary man, physical activity has an important role and when it is regular it can improve, prevent or reduce the risk of more severe symptoms and accelerate recover after the disease of COVID-19. Since consequences of this disease are long-term and still studied and subjects of scientific and experts community, it is necessary to conduct similar studies on substantially bigger sample subject. Absence of précised parameters of clinical picture of infected people is one of the shortages of the paper and absence of information on quality of exercising of active group of subjects, diet habits, rest and sleeping phases, social interactions and other important factors of healthy lifestyle.

## CONCLUSION

This average study which is conducted with the aim to establish differences of symptoms and rapidity of recovery in individuals who overcame COVID-19 in relation to the previous level of physical activity, can be one of the factors, which contribute to subjective expressed easier symptoms and faster recovery from COVID-19 and as such it should be mandatory part of public health programs, recommendations as non-pharmacy, cheap and sustainable way of prevention and reduce of risk of numerous diseases of the population. The study has shown that physically active individuals had significantly weaker symptoms and faster recovery after the disease. It is necessary to conduct more studies, to raise the awareness on ways to improve health and benefits of regular physical activity, which is emphasized in this paper. Future studies should be focused on life style as variable factor of risk for controlling COVID-19.

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broja simptoma COVID-19. Što potvrđuje i istraživanje gdje je tjelesna neaktivnost direktno i indirektno povezana s lošim imunološkim odgovorom (Laddu et al. 2020.), kroz začarani krug između neaktivnosti i pretilosti (Pietiläinen et al. 2008.). Dakle, nezdrava prehrana, pretilost i neaktivnost negativno utječu na rad imunološkog sustava i obranu domaćina.

Ovo istraživanje pokazuje da smislu očuvanja i poboljšanja psihofizičkog zdravlja savremenog čovjeka, tjelesna aktivnost ima izrazito važnu ulogu, a kada je redovna može poboljšati prevenirati ili smanjiti rizik težih simptoma i ubrzati oporavak nakon bolesti COVID-19. S obzirom na to da je riječ o bolesti čije su dugotrajne posljedice i dalje predmetom proučavanja i zanimanja znanstvene i stručne zajednice, potrebno je provesti slična istraživanja na znatno većem uzorku ispitanika. Nepostojanje preciznijih parametara kliničke slike oboljelih je jedan od nedostataka rada, te nepostojanje informacija o kvaliteti vježbanja aktivne grupe ispitanika, prehrambenim navikama, fazama odmora i sna, socijalnim interakcijama kao i drugim važnim faktorima zdravog stila života.

## ZAKLJUČAK

Ova presječna studija koja je provedena s ciljem da se utvrde razlike simptoma i brzine oporavka kod osoba koje su prebolovale COVID-19 u odnosu na prethodni nivo tjelesne aktivnosti pokazuje tjelesna aktivnost može biti jedan od faktora koji doprinosi subjektivno izraženim lakšim simptomima i bržem oporavku od COVID -19 i kao takva, trebala bi biti obavezan sastavni dio javno zdravstvenih programa preporuke kao nefarmakološki, jeftin i održiv način prevencije i smanjenja rizika brojnih bolesti stanovništva. Istraživanje je pokazalo da su tjelesno aktivne osobe imale značajno slabije simptome i brži oporavak nakon bolesti. Potrebno je sprovoditi više istraživanja koja podižu svijest o načinima unapređenja zdravlja i benefitima redovne tjelesne aktivnosti na što ovaj rad posebno upućuje. Buduće studije trebale bi se usredotočiti na stil života kao promjenjivi faktor rizika za kontrolu COVID-19.



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Primljen: 15. mart 2023. / Received: March 15, 2023  
Prihvaćen: 15. april 2023. / Accepted: April 15, 2023

