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Original Research Article

Prevalence and patterns of physical deconditioning and fatigue in post-COVID-19 patients: evidence from a case-control study

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ABSTRACT

Background: Physical deconditioning and fatigue are increasingly recognized as a significant consequence of the COVID-19 pandemic, especially in individuals recovering from infection. The aim of the study was to determine the proportion, pattern and severity of physical deconditioning and fatigue among post-COVID-19 patients versus non-infected controls.
Methods: Physical deconditioning and fatigue are increasingly recognized as a significant consequence of the COVID-19 pandemic, especially in individuals recovering from infection. This study aimed at determining the proportion, pattern and severity of physical deconditioning and fatigue among post-COVID-19 patients versus non-infected controls.
Results: Demographically both groups were similar with male predominance in this study. Significantly higher proportions of fatigue (89.3% vs. 64.6%) and physical deconditioning (94.0% vs. 68.3%) were observed among cases compared to controls. Moderate to severe fatigue and higher grades of deconditioning were notably prevalent among cases, whereas controls reported milder symptoms. COVID-19 patients suffered more severe deconditioning across functional mobility, productivity.
Conclusions: COVID-19 survivors exhibit a higher prevalence and greater severity of physical deconditioning and fatigue across daily life domains compared to non-infected individuals. Integration of comprehensive rehabilitation and early intervention is critical for optimizing recovery and restoring quality of life in affected patients.

Keywords: Fatigue, Physical deconditioning, COVID-19, Canadian occupational performance measure, Modified medical research council

INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, is a highly contagious respiratory infection that first appeared in Wuhan, China, in December 2019. It quickly expanded worldwide, prompting the World Health Organization to proclaim it a global pandemic on March 11, 2020.[1] COVID-19 has have a devastating global impact, leading to around 7 million fatalities.[2] Data from Bangladesh indicates that

approximately twenty-nine thousand COVID-19 fatalities were recorded by 2025.[3]

The outbreak has posed substantial problems to human society, impacting health, the economy, and lifestyle profoundly.[4] Deconditioning denotes the syndrome marked by physical, psychological, and functional deterioration due to prolonged inactivity and the resultant loss of muscular strength. Deconditioning can manifest at any age; but, in older persons, it may advance more swiftly and with increased severity.[5,6] Severe COVID-19 patients often require extended hospital stays or intensive care unit (ICU) admission.[7] A hyper-inflammatory state, along with diminished mobility and inadequate nutritional intake, constitutes considerable risk factors for acute sarcopenia, which is defined by a reduction in muscle mass and strength in people experiencing acute illness.[8] Hospitalization and bed rest-induced immobilization, coupled with physical inactivity from extended quarantine and social isolation, can impair the organ systems' ability to resist viral infections. This illness may increase the risk of harm to the immunological, respiratory, cardiovascular, musculoskeletal systems, and the brain.[9] Evidence indicates that prolonged immobility and bed rest in hospital or ICU settings, particularly for 4-6 weeks, adversely affects multiple bodily systems, leading to muscle atrophy, a 6-40% reduction in muscle strength, and accelerated functional decline.[10] COVID-19 patients, regardless of infection severity, experience negative impacts on lung function, exercise capacity, and physical activity.[11] Measures like quarantine, lockdown, remote work, and stay-at-home orders were instituted to mitigate transmission.[12] Extended durations of reduced physical activity, social seclusion, increased anxiety about health, insecurity, and disorientation lead to an escalation in both physical and mental health problems.[13,14] Research indicates that social isolation has led to a 28% increase in sedentary lifestyles and poor dietary practices. [15] The lengthy isolation during the Covid-19 outbreak has markedly deconditioned millions of people. The COVID-19 epidemic has precipitated a deconditioning crisis, underscoring the necessity for an immediate reconditioning initiative to enhance physical, cognitive, and emotional engagement, especially for those residing in isolation.[16]

Assessing physical deconditioning in COVID-19 patients is crucial for the prompt identification of those susceptible to long-term disability and for the execution of focused rehabilitation approaches. Assessment instruments, such as the six-minute walk test (6MWT), handgrip strength evaluations, Functional Independence Measure (FIM) score, and Canadian Occupational Performance Measure (COPM), provide insights into the extent of deconditioning and guide rehabilitation strategies.[17–19] Research indicates that rehabilitation for COVID patients enhances functional capacity, mitigates the effects of deconditioning following extended ICU stays, and reduces stress by offering essential support during the recovery process. [20]

Although there is growing recognition of physical deconditioning as a notable outcome of COVID-19, research on this subject remains inadequate. This study aims to clarify the pattern of physical deconditioning in post-COVID-19 patients. Understanding these characteristics is crucial for developing evidence-based treatments to reduce long-term disability and support recovery in affected individuals.

METHODS

A case-control study was conducted at the Post COVID clinic and outpatient department of the Department of Physical Medicine and Rehabilitation at Bangladesh Medical University (BMU), Dhaka, Bangladesh, from May 2021 to April 2022. Formal ethical permission for the study was obtained from the Institutional Review Board of BMU (Ref: BSMMU/2021/3530). The study's objectives, procedures, risks, and potential benefits were communicated to the patients in a comprehensible local language, after which informed consent was obtained. Individuals who were previously positive for COVID-19 (RT-PCR) and subsequently tested negative were classified as cases, whereas those who were COVID-19 negative or deemed normal were categorized as controls. A total of 314 patients participated in the study, with enrolment of 150 in the case group and 164 in the control group, purposively. Patients aged ≥18 to <70 years of both genders with oxygen saturation >96% as measured by pulse oximeter in room air were enrolled as case and control groups. Participants with oxygen saturation < 96% on a pulse oximeter, chronic obstructive pulmonary disease, bronchial asthma, ischemic heart disease, and pregnancy were excluded from the study. A comprehensive history on demography, body mass index, fatigue, dyspnea, physical deconditioning, and the severity of deconditioning was collected from the study subjects. Data was gathered using a pretested semi-structured interviewers' questionnaire via face-to-face interviews. Subsequent to pretesting, essential modifications to the data collection sheet were made and finalized prior to data collection.

Fatigue and deconditioning assessment

The characteristics of deconditioning in patients were evaluated regarding physical functioning and the execution of activities of daily living (ADLs) using the Canadian Occupational Performance Measure (COPM).[19] The COPM is a semi-structured interview method that detects deficiencies in occupational performance or challenges with daily activities (self-care, productivity, and leisure) that are of utmost significance to the patient. The patients recognize deficiencies in occupational performance (objectives) and prioritize them based on significance utilizing a 10-point scoring system. Scores of 1-3 were classified as mild, 4-6 as moderate, and 7-10 as severe level of deconditioning.

The Medical Research Council (MRC) scale was employed to evaluate the fatigue/severity of dyspnea or exercise performance among the subjects. The original MRC scale, initially established by Fletcher, was subsequently refined into the "Modified Medical Research Council" dyspnea scale (mMRC) currently in use.[21] The mMRC is a four-item scale assessing varying degrees of physical exercise that induce dyspnea.

Participants are requested to specify the degree of activity that induces dyspnea, with 0 representing mild and 4 denoting severe shortness of breath.

The collected data sheets were carefully stored in a guarded vault at the Department of Physical Medicine and Rehabilitation, accessible only to the lead investigator for assessment. Outliers and missing values were thoroughly analyzed and corrected.

Statistical analysis

The study's statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) for Windows, version 23. Numerical variables were presented with their mean, standard deviation, median, and range. The data for categorical variables was presented in terms of frequency and percentage. Using the Shapiro-Wilk test, the normality of the data was evaluated. The Chi-Square test was utilized to analyze the disparity in proportions of fatigue, dyspnea, personal care capabilities, functional mobility, community management, productivity, recreational activities, and other variables between the case and control groups. The Mann-Whitney U test was utilized to compare age and body mass index (BMI) between the case and control groups. The results were presented using tables, graphs, and charts. P values below 0.05 were considered statistically significant.

RESULTS

The mean age of participants in the case group was 41.74±11.57 years, while it was 40.3±11.39 years in the control group. In both groups, the majority of participants were within the 20-40-year age range. Male participants predominated in both groups. However, no significant difference in age and gender between groups was observed. Participants in the case group had significantly higher educational attainment and were more commonly engaged in occupations that required working outside the home environment compared to those in the control group.

Body mass index (BMI) was found to be significantly higher among the case group (25.49±2.23 kg/m²) compared to the control group (24.79±1.36 kg/m²), indicating a higher prevalence of overweight and obese status in the case group. Moreover, there was no statistically significant difference in the presence of comorbidities between the case and control groups (Table 1).

In the case group, more than three-fourth of the participates were symptomatic. About 77.9% of the participants of the cases group received both 1st and 2nd doses of COVID-19 vaccine, whereas only half of the participants of the control group were vaccinated.

Nearly nine percent of the participants in case group had history of COVID-19 reinfection. A significant difference in clinical symptomatic status, 1st and 2nd dose of vaccination and reinfection was observed between case and control group (Table 2).

Among the case group of participants, 89.3% were fatigue and in the control group about 64.6% was fatigue. The proportion of fatigue was significantly higher among the case group than control group (p value<0.001) (Table 3).

In the case groups, among the participants who were suffering from fatigue more than 13% participants were suffering from severe fatigue, 47.8% were from moderate fatigue and 38.8% from mild fatigue. In the control group, among the participants who were suffering from fatigue more than 97.2% participants were suffering from mild fatigue, rest 2.8% were from moderate fatigue and no one suffered from severe fatigue (Figure 1).

Among the case group of participants, 94.0% were suffering from deconditioning and in the control group the proportion was 68.3%. The proportion of deconditioning was significantly higher among the case group than control group (p value<0.001) (Table 4).

In the case groups, among the participants who were suffering from deconditioning, almost 3.0% participants were suffering from grade 4 deconditioning, 10.6% were from grade 3 deconditioning and 41.8% from grade 2 deconditioning and rest 44.7% from grade 1 deconditioning. In the control group, among the participants who were suffering from deconditioning, more than 95% participants were suffering from grade 1 deconditioning, rest 4.5% were from grade 2 deconditioning (Figure 2).

Participants in the case group were suffering from more severe form of deconditioning in taking personal care (feeding, dressing, bathing, grooming and personal hygiene) than control group (Table 5).

Participants in the case group were suffering from more severe form of deconditioning in functional mobility (transfers, indoors, outdoors) and Community management (Transportation, shopping, finances) than control group (p value<0.001) (Table 6).

Participants in the case group were suffering from more severe form of deconditioning in productivity (paid and unpaid work, household management, play skills) and leisure (Quiet recreation, active recreation, socialization) than control group (p value<0.001) (Table 7).

Table 1: Distribution of the study subject according to demographic characteristics and comorbidities (n=314).

Demographic characteristics		Case (n=150)		Control (n=164)		P value
Age (years)	20-40	84	56.0	87	53.0	[a]0.458
	41-60	57	38.0	71	43.3	
	>60	9	6.0	6	3.7	
	Mean±SD	41.74±11.57		40.3±11.39		[b]0.368
	Range	39.50 (21-70)		40.0 (20-70)		
Gender	Male	103	68.7	102	62.2	[a]0.229
	Female	47	31.3	62	37.8	
Body mass index (kg/m^2)	18.5-24.9	63	42.0	82	50.0	[a]0.019
	25.0-29.9	81	54.0	82	50.0	
	≥30	6	4.0	0	0.0	
	Mean±SD	25.49±2.23		24.79±1.36		[b]0.017
	Range	19.7-32.1		21.1-29.0		
Education	Illiterate	0	0.0	1	0.6	[a]<0.001
	Primary	2	1.0	35	21.3	
	SSC	19	12.7	75	45.7	
	HSC	36	24.0	37	22.6	
	University	93	62.0	16	9.8	
	Housewife	25	16.7	56	34.1	[a]<0.001
	Service holder	64	42.7	28	17.1	
	Businessman	19	12.7	17	10.4	
	Physician	21	14.0	2	1.2	
	Others	21	14.0	61	37.2	
Comorbidities	Tuberculosis	10	6.7	6	3.7	[a]0.226
	Diabetes mellitus	62	41.3	57	34.8	
	Hypertension	61	40.7	73	44.5	

Note: a- Chi square test, b- Mann Whitney U test was done.

Table 2: Distribution of the clinical symptomatic status and vaccination status of COVID-19 of the study subject (n=314).

Variables		Case (n=150)		Control (n=164)		P value
Clinical symptomatic status	Symptomatic	114	76.0	0	0.0	<0.001
	Asymptomatic	36	24.0	164	100.0	
1st and 2nd dose	Yes	116	77.9	82	50.0	<0.001
	No	33	22.1	82	50.0	
Reinfection	Yes	13	8.7	0	0.0	<0.001
	No	137	91.3	164	100.0	

Note: Chi square test was done.

Table 3: Distribution of fatigue of the study subject (n=314).

Fatigue	Case (n=150)		Control (n=164)		P value
Yes	134	89.3	106	64.6	<0.001
No	16	10.7	58	35.4	

Note: Chi square test was done.

Table 4: Distribution of deconditioning status according to modified medical research council scale (n=314).

Deconditioning status	Case (n=150)		Control (n=164)		P value
Yes	141	94.0	112	68.3	<0.001
No	9	6.0	52	31.7	

Note: Chi square test was done.

Table 5: Distribution of the deconditioning severity in personal care among case and control (n=314).

Demographic characteristics		Case (n=150)		Control (n=164)		P value
Feeding	No	65	43.3	164	100.0	<0.001
	Mild	56	37.3	0	0.0	
	Moderate	23	15.3	0	0.0	
	Severe	6	4.0	0	0.0	
Dressing	No	62	41.3	162	98.8	<0.001
	Mild	57	38.0	2	1.2	
	Moderate	24	16.0	0	0.0	
	Severe	7	4.7	0	0.0	
Bathing	No	39	26.0	156	95.1	<0.001
	Mild	57	38.0	8	4.9	
	Moderate	46	30.7	0	0.0	
	Severe	8	5.3	0	0.0	
Grooming	No	61	40.7	147	89.6	<0.001
	Mild	55	36.7	17	10.4	
	Moderate	30	20.0	0	0.0	
	Severe	4	2.6	0	0.0	
Personal hygiene	No	11	7.3	102	62.2	<0.001
	Mild	72	48.0	62	37.8	
	Moderate	57	38.0	0	0.0	
	Severe	10	6.7	0	0.0	

Note: Chi square test was done.

Table 6: Distribution of the deconditioning severity according to functional mobility and community management (n=314).

Variables		Case (n=150)		Control (n=164)		P value
Functional mobility						
Transfers	No	8	5.3	126	76.8	<0.001
	Mild	54	36.0	38	23.2	
	Moderate	71	47.4	0	0.0	
	Severe	17	11.3	0	0.0	
Indoors	No	18	12.0	50	30.5	<0.001
	Mild	55	36.7	114	69.5	
	Moderate	61	40.7	0	0.0	
	Severe	16	10.7	0	0.0	
Outdoors	No	5	3.3	13	7.9	<0.001
	Mild	49	32.7	145	88.4	
	Moderate	76	50.7	6	3.7	
	Severe	20	13.3	0	0.0	
Community management						
Transportation	No	12	8.0	125	76.2	<0.001
	Mild	52	34.7	39	23.8	
	Moderate	68	45.3	0	0.0	
	Severe	18	12.0	0	0.0	
Shopping	No	45	30.0	159	97.0	<0.001
	Mild	68	45.3	5	3.0	
	Moderate	36	24.0	0	0.0	
	Severe	1	0.7	0	0.0	
Finances	No	27	18.0	149	90.9	<0.001
	Mild	75	50.0	14	8.5	
	Moderate	38	25.3	1	0.6	
	Severe	10	6.7	0	0.0	

Note: Chi square test was done.

Table 7: Distribution of the deconditioning severity in productivity and leisure among case and control (n=314).

Variables		Case (n=150)		Control (n=164)		P value
Productivity						
Paid/unpaid work	No	11	7.3	85	51.8	<0.001
	Mild	61	40.7	79	48.2	
	Moderate	64	42.7	0	0.0	
	Severe	14	9.3	0	0.0	
Household management	No	10	6.7	91	55.5	<0.001
	Mild	54	36.0	71	43.3	
	Moderate	69	46.0	2	1.2	
	Severe	17	11.3	0	0.0	
Play skills	No	20	13.3	142	86.6	<0.001
	Mild	69	46.0	22	13.4	
	Moderate	54	36.0	0	0.0	
	Severe	7	4.7	0	0.0	
Leisure						
Quiet recreation	No	15	10.0	82	50.0	<0.001
	Mild	59	39.3	82	50.0	
	Moderate	62	41.4	0	0.0	
	Severe	14	9.3	0	0.0	
Active recreation	No	8	5.3	6	3.7	<0.001
	Mild	55	36.7	155	94.5	
	Moderate	66	44.0	3	1.8	
	Severe	21	14.0	0	0.0	
Socialization	No	42	28.0	161	98.2	<0.001
	Mild	68	45.3	3	1.8	
	Moderate	36	24.0	0	0.0	
	Severe	4	2.7	0	0.0	

Note: Chi square test was done.

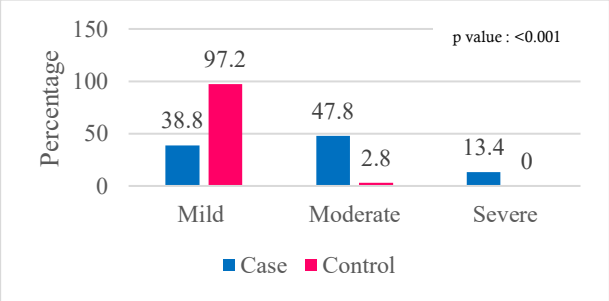

Figure 1: Bar diagram shows the distribution of fatigue severity among the case and control (n=240).

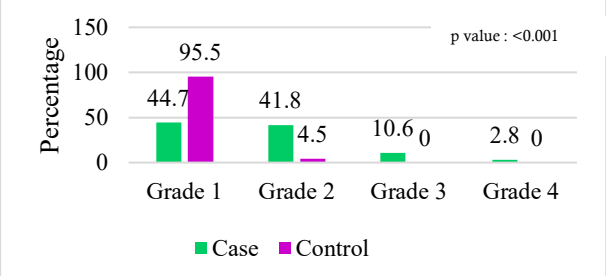

Figure 2: Bar diagram shows the distribution of the deconditioning severity according to modified Medical Research Council among the case and control (n=253).

DISCUSSION

Physical deconditioning, defined by diminished muscle strength, endurance, and functional capacity, has become a prevalent consequence in persons recuperating from COVID-19.[22] The infection, along with extended hospitalization, bed rest, and diminished physical activity during illness, substantially adds to deconditioning.[23] Despite the extensive documentation of COVID-19's global impact, there exists a paucity of comparative research assessing the degree of fatigue and physical deconditioning in post-COVID patients relative to non-COVID controls. Evaluating and comprehending this disparity is essential for directing rehabilitation approaches and enhancing recovery in affected individuals.[24] This study seeks to delineate the pattern of physical deconditioning in post-COVID-19 patients relative to a non-COVID-19 control group. This study revealed that fatigue and physical deconditioning were markedly more prevalent in COVID-19 patients than in non-COVID controls.

Both groups in the study were similar in terms of age and sex, with no significant demographic differences- most participants were male and in the 20-40 years age bracket. These findings are consistent with previous studies by Mahboob et al and Hasan et al.[25,26] However, the case

group stood out for having higher educational attainment and a greater proportion employed in outdoor occupations. This suggests that higher educational attainment, possibly linked to occupational roles requiring physical presence or increased social interaction, may have influenced their increased risk of becoming cases. [27] Importantly, these patterns were observed during the third wave of the pandemic in Bangladesh, driven by the Delta variant from June to November 2021, and the onset of the fourth wave, associated with the Omicron variant, which began in January 2022. These findings reflect the evolving epidemiological landscape and shifting risk factors across different stages of the COVID-19 pandemic.

A significant majority of survivors reported experiencing fatigue after SARS-CoV-2, with a noted reduction in fatigue over time.[28] Approximately one in four individuals experiencing fatigue was reported by Badenoch et al.[29] Systematic reviews demonstrate that the pooled prevalence of post-COVID-19 fatigue ranges from 45% to 64%.[30,31] In this study, nearly ninety percent of COVID-19 patients experienced fatigue, while over sixty percent of participants in the control group reported similar symptoms. In the case group, nearly 50% of individuals with fatigue experienced moderate fatigue, while 13% reported severe fatigue. Nevertheless, nearly all participants reported mild fatigue, and none indicated experiencing severe fatigue. While over sixty percent of the control group experienced fatigue, the notably higher prevalence in COVID-19 patients may be linked to the residual effects of the viral infection. COVID-19 is linked to ongoing inflammation, immune dysregulation, and extended physical inactivity, factors that can intensify post-viral fatigue relative to controls.[32-34] The identified factors likely account for the notable disparity in fatigue rates between the groups, notwithstanding the already elevated baseline prevalence. Townsend et al found that more than 50% of study participants exhibited symptoms indicative of severe fatigue, with a median duration of 10 weeks following their initial illness.[32] Chronic fatigue markedly hinders daily functioning, overall quality of life, and reintegration into the workforce, positioning it as a critical focus for post-COVID rehabilitation and support.[33]

This study found that over 90% of participants in the case group experienced deconditioning, compared to nearly 70% in the control group. The incidence of deconditioning was markedly greater in the case group compared to the control group. Compared to the control group, the case group displayed more pronounced deconditioning in areas such as personal care, functional mobility, community management, productivity, and leisure activities. Functional mobility and productivity were significantly impacted among COVID-19 patients. Numerous studies have consistently documented a significant prevalence and severity of deconditioning in COVID-19 survivors, particularly in the areas of daily living and functional capabilities.[23,35] Curci et al observed notable deficiencies in self-care and mobility among post-COVID-19 patients when compared to control groups.[23] Deconditioning symptoms were shown to be more severe in COVID-19 patients compared to non-infected persons, according to Nobi et al (2025).[36] The increased prevalence of physical deconditioning in the case group (COVID-19 patients) is linked to direct viral effects on muscles causing myalgia, prolonged inactivity from illness, isolation, or hospitalization, post-viral fatigue syndrome, persistent symptoms like fatigue, myalgia, and exercise intolerance, autonomic dysfunction, and inflammation and immune responses.[28,37-40] Extended periods of inactivity resulting from isolation, lockdown, and comorbidities in the control group may have led to significant deconditioning, thereby reducing the disparity between groups in certain areas.

The COVID-19 pandemic has initiated a significant deconditioning crisis, underscoring the necessity for extensive reconditioning programs. Programs should prioritize the restoration of physical, cognitive, and emotional well-being within communities, particularly for individuals experiencing isolation. Multidimensional re-engagement initiatives can effectively alleviate the long-term health and quality of life consequences of the pandemic through targeted reconditioning efforts.[16]

Limitation

The study, conducted in a tertiary care hospital in Dhaka, Bangladesh, had a small sample size, limiting the generalizability of its findings. Severe respiratory deconditioning was not evaluated, as participants with oxygen saturation below 96% were excluded.

CONCLUSION

This study demonstrates a substantial prevalence of fatigue and physical deconditioning in post-COVID-19 patients, with nearly ninety percent affected- significantly exceeding the rates observed in control groups. Survivors of COVID-19 experienced significant impairments, especially in functional mobility and productivity. The findings underscore the significant effects of COVID-19 on daily functioning and quality of life, indicating the necessity for immediate, focused interventions. The integration of comprehensive reconditioning programs into post-COVID care, which addresses physical, cognitive, and psychosocial domains, is essential. Early identification and tailored rehabilitation strategies are essential for promoting optimal recovery, restoring functional independence, and facilitating return to work, thereby enhancing long-term health outcomes for affected individuals.

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