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SARS-CoV-2 infection is associated with low back pain: findings from a community-based case-control study

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ABSTRACT

Objectives: Pain is a significant complaint of patients with postacute COVID-19 syndrome; however, little is known about the association between SARS-CoV-2 infection and pain. This study aimed to (1) examine the association between SARS-CoV-2 infection and low back pain (LBP) and (2) identify independent predictors of LBP among survivors of COVID-19.

Methods: This case-control study involved 878 participants aged ≥18 years. Data were collected from February 24 to April 7, 2022, in Bangladesh. LBP was measured using the musculoskeletal subscale of subjective health complaints produced by Eriksen et al. Descriptive analysis was performed to compute LBP prevalence and compare the prevalence across groups. Multiple logistic analyses helped to identify the predictors of LBP for survivors of COVID-19.

Results: Overall, 20% of participants reported LBP; however, the prevalence of LBP was significantly high among patients with postacute COVID-19 compared with their counterparts (24.4% vs 15.7%, $P = 0.001$). Regression analysis for all participants suggested that SARS-CoV-2 infection was independently associated with LBP (adjusted odds ratio 1.837, 95% confidence interval 1.253–2.692). However, moderate COVID-19 symptom (adjusted odds ratio 1.754, 95% confidence interval 0.984–3.126) was the only statistically significant predictor of LBP among postacute COVID-19 patients.

Conclusion: SARS-CoV-2 infection was associated with LBP, and moderate COVID-19 symptom was an independently associated factor of LBP. The health care facilities must be prepared to deal with the burden of LBP among patients with postacute COVID-19.

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Introduction

Low back pain (LBP) is a widespread public health concern and the leading cause of disability worldwide (Hartvigsen et al., 2018). The monetary influence of LBP is intersectoral because it raises expenses in both health care and social support systems (Carregaro et al., 2020). A 2015 study revealed that 540 million individuals were affected by activity-limiting LBP at any one time, giving a global prevalence of 7.3% (GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, 2016). In Bangladesh, the prevalence of LBP was 36.6% among sedentary office workers (Ali et al., 2020, 2021c). Previously, LBP was thought to be the problem of industrialized nations, and the prevalence of LBP was significantly high in high-income countries (Freburger et al., 2009). However, in the past few decades, the most significant increases in disability caused by LBP have occurred in low-income and middle-income countries, including countries in Asia, Africa, and the Middle East (Hoy et al., 2015). The global point prevalence of LBP was 8.20% in 1990 and decreased slightly to 7.50% in 2017; nonetheless, in Africa, the point prevalence of LBP has increased from 32%

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in 2006 to 39% in 2017 (GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, 2017; Louw et al., 2007; Morris et al., 2018). As a result, the whole world was experiencing a wave of the subtle pandemic of LBP.

Subsequently, the world is experiencing the unprecedently prolonged COVID-19 pandemic. Since 2019, approximately 7% (0.52 billion) of the world's population has already been infected by SARS-CoV-2, and the number is increasing every minute (World Health Organization, 2021). Furthermore, a significant portion of patients with COVID-19 are asymptomatic and do not know about their illness (Ma et al., 2021). Consequently, the actual number of patients with COVID-19 will be much higher than the estimated number, and an enormous portion of the world population will be bearing the health consequences of postacute COVID-19 syndrome.

A previous study suggested that COVID-19 affected the survivor's health even if the infection was asymptomatic (Long et al., 2020). A range of conditions, such as extreme tiredness, shortness of breath, chest pain, the problem with memory and concentration, insomnia, heart palpitation, dizziness, joint pain, high temperature, cough, headache and depression, and anxiety, were identified as very common in patients with postacute COVID-19 (Nalbandian et al., 2021). Similarly, a large sample size cohort study revealed that 57% of the survivors of COVID-19 were experiencing long-COVID and the overall incidence of pain (of any kind) recorded after COVID-19 was 34.2% (Taquet et al., 2021). Pain, therefore, appears to be a prominent and relatively persistent element of long-COVID-19 (Bileviciute-Ljungar et al., 2022). However, very little is known about the specific impact of SARS-CoV-2 infection on the world's leading cause of pain-related disability that is LBP. Therefore, this study aimed to (1) examine the association between SARS-CoV-2 infection and LBP and (2) identify independent predictors of LBP among patients with postacute COVID-19.

Materials and methods

Study design and participants

In this case-control study, individuals who were previously infected with SARS-CoV-2 were considered as "cases," and those who never tested positive for COVID-19 were considered as "controls." Data were collected from apparently healthy, ambulatory Bangladeshi individuals, for both case and control. Regarding the specific eligibility criteria of the participants of this study, we included individuals who were apparently healthy, aged 18 years and older, and currently living in Bangladesh, and we excluded individuals who were diagnosed with acute COVID-19, bedridden, pregnant, or had severe chronic health conditions, such as rheumatoid arthritis, stroke, or cancer.

Sample size determination

A confidence level of 95%, a response distribution of 50%, and a margin of 5% error were used to determine the sample size to target 1.9 million laboratory-tested individuals who were COVID-19-positive in Bangladesh (World Health Organization, 2021) and secure a minimum sample size of 385 participants for case data (Ali and Hossain, 2021).

Ethical approval

The ethical review committee of Uttara Adhunik Medical College and Hospital formally approved the study. Prospective registration for the case-control study was obtained from the WHO-endorsed Clinical Trial Registry-India: CTRI/2022/02/040449 (registered on 21/02/2022). The Strengthening the Reporting of Observational studies in Epidemiology guideline for the case-control study was followed strictly throughout the study. All the invited participants were required to provide written informed consent for participation and collection and analysis of their data.

Definition of postacute COVID-19

Acute COVID-19 usually lasts until 4 weeks from the onset of symptoms, beyond which replication-competent SARS-CoV-2 has not been isolated. Postacute COVID-19 is defined as persistent symptoms and delayed or long-term complications beyond 4 weeks from the onset of symptoms (Nalbandian et al., 2021). In this study, we collected data (for cases) from the individuals who tested positive at least 6 weeks ago. Therefore, the patients were considered survivors of postacute COVID-19 after 6 weeks of acute symptoms.

The questionnaire

Data were collected using a paper-based questionnaire, which was composed of four parts. The first part of the questionnaire asked a wide range of sociodemographic questions, including sex, age, marital status, education, employment status, monthly household income in Bangladeshi Taka (BDT), and current address. In the second part, participants were asked whether they had a chronic disease diagnosis (e.g., hypertension, diabetes, kidney disease, and asthma), whether they were current tobacco users, and whether they regularly performed physical exercise. These questions were answered by choosing between dichotomous options (yes/no). In the third part (only for case data), participants were asked to provide information about their COVID-19 illness. Information about the symptoms that appeared during COVID-19 (mild, moderate, severe, and very severe), facilities used to treat the patient (home, hospital's general ward, or hospital's intensive care unit), and the COVID-19 vaccine dose they received (no vaccine, one dose, two doses, or three doses) were recorded. The information about symptoms of COVID-19 was taken from the medical records preserved by the participants. The period (in days) after recovery from acute COVID-19 was also recorded.

The last part of the questionnaire measured the complaints about LBP. The questions on LBP were based on the musculoskeletal subscale of subjective health complaints produced by Eriksen et al. that measured LBP complaints experienced in the last 30 days (Ali et al., 2020, 2021a; Eriksen et al., 1999). Participants were asked to rate the occurrence of pain in the lower back using four answering categories. The severity of each complaint was rated on a 4-point scale (0 = none, 1 = some, 2 = much, 3 = severe). Each complaint was also scored for the duration (number of days) during the last 30 days. Severity X duration has often been used to obtain a total score (0–90), indicating the degree of complaint (Ali et al., 2021b; Eriksen et al., 1999). In this study, participants who had a complaint of at least some pain for 3 days ($1 \times 3 = 3$) in the last month and those who scored ≥ 3 were considered to have LBP (Ali et al., 2020). Finally, the participants were asked whether their LBP started or worsened after SARS-CoV-2 infection (yes/no).

Sampling technique and data collection

Six expert data collectors collected the data. First, 10 government-approved COVID-19 testing centers were conveniently selected in different locations in Bangladesh. Second, the data collector gathered particulars of randomly selected 600 (60 from each center) subjects, aged 18 and older, who previously tested positive for COVID-19 but have no active illness. Considering inclusion and exclusion criteria, 450 subjects were found to be eligible for this

study. Finally, participants who consented to have their data collected underwent individual face-to-face interviews at their homes or workplaces; therefore, 439 case data were secured.

In contrast, control subjects were chosen from the case's eligible family members, neighborhoods, or office colleagues. As a result, 439 age- and sex-matched individuals who provided informed consent were interviewed face-to-face. All data were collected from February 24, 2022, to April 7, 2022.

Participants and public involvement

The participants and the public were not involved in our research design, conduct, reporting, and dissemination plans. This study's aims and objectives were explained, and assurance of anonymity was given before receiving written informed consent from the participants.

Data analysis

Data were analyzed using SPSS version 22.0 (IBM) software. Chi-square tests were used to compare categoric variables with and without LBP. To compute the adjusted odds ratios (aORs) with a 95% confidence interval (CI), multiple logistic regression analyses were performed with LBP as a dependent variable and sociodemographic characteristics, clinical factors, and COVID-19 illness–related factors as predictor variables for LBP. Variables were found statistically significant in the descriptive analysis of all data included in the regression model 1. Similarly, regression model 2 consisted of variables found statistically significant in the descriptive analysis of case data. The Hosmer-Lemeshow goodness-of-fit test was used to ensure that the models adequately fit the data. *P*-values $\leq$0.05 were considered statistically significant.

Results

Participant characteristics

Overall, 878 individuals (50.5% women), with a mean age (SD) of 38.30 (12.77) years, participated in this study. For 439 (50% of all participants) cases, the mean age (SD) was 38.33 (12.53) years, whereas the mean age (SD) was 38.28 (13.01) years for the controls. In addition, 49.2% and 51.7% of women participated in the case and control groups.

Most participants were married (81.3%), had a bachelor's degree (34.1%), were service holders (33.7%), had a monthly household income BDT >45,000 (42.5%), were from a nuclear family (66.6%), and lived in the city (61.5%). However, only 24.0% had hypertension, 23.5% had diabetes, 10.3% had kidney disease, and 16.4% had asthma. Furthermore, only 19.8% and 38.8% of participants reported that they performed regular physical exercise and were current tobacco users, respectively. Results are shown in Table 1.

Similarly, primary analysis of case data suggested that most participants were married (83.8%), had a bachelor's degree (33.9%), were service holders (34.4%), had a monthly household income BDT >45,000 (45.1%), were from a nuclear family (67.9%), and lived in the city (54.4%). However, only 27.3% had hypertension, 26.7% had diabetes, 14.4% had kidney disease, and 23.9% had asthma. Furthermore, only 24.4% and 44.9% of participants reported that they perform regular physical exercise and were current tobacco users, respectively. In addition, the majority of the patients with postacute COVID-19 tested negative for the illness for more than 180 days (36.7%), experienced mild COVID-19 (49.9%), were treated at home (65.1%), and received two doses of COVID-19 vaccine (41.9%) before catching the disease. (Table 2).

Results of the descriptive analysis

The overall one-month prevalence of LBP was 20%; however, the prevalence was significantly higher among the participants who tested positive for COVID-19 than their counterparts (24.4% vs 15.7%, $P = 0.001$). In addition, for all data, a statistically significant higher prevalence was found in women (23.0%, $P = 0.026$), individuals older than 60 years (27.3%, $P = 0.016$), divorced/widows (40.0%, $P = 0.005$), participants who received high school or lower education (32.1%, $P \leq 0.001$), homemakers (29.9%, $P \leq 0.001$), those with a monthly household income BDT 15,000–30,000 (34.7%, $P \leq 0.001$), participants from a joint family (23.9%, $P = 0.044$), and those who lived in rural areas (30.6%, $P \leq 0.001$). Furthermore, subjects with hypertension (26.1%, $P = 0.012$) and tobacco users (24.0%, $P = 0.018$) also reported high prevalence of LBP (Table 1).

In the postacute COVID-19 cohort, higher prevalence was found among divorced/widows (50.0%, $P = 0.037$), participants who received high school or lower education (35.1%, $P = 0.002$), homemakers (35.0%, $P = 0.030$), those with a monthly household income BDT 15,000–30,000 (36.5%; $P = 0.010$), participants from a joint family (31.2%, $P = 0.022$), participants who lived in rural areas (28.3%, $P \leq 0.001$), and participants who received a diagnosis of hypertension (26.1%, $P = 0.012$). In addition, participants with severe COVID-19 reported a higher rate of LBP (32.6%, $P = 0.039$). Overall, 93.5% (n = 100) of participants who reported LBP complained about developing new LBP or that their pre-existing problem worsened after SARS-CoV-2 infection. Details are shown in Table 2.

Results of the regression analysis

After adjusting the potential confounder, the multiple logistic regression model 1 (Table 3) revealed that the SARS-CoV-2 infection was one of the strongest independent predictors of LBP (aOR 1.837, 95% CI 1.253–2.692). Other groups with significantly higher odds of LBP were found to be women (aOR 1.860, 95% CI 1.097–3.152), participants who received high school or lower education (aOR 2.263, 95% CI 1.022–5.008), those with a monthly household income BDT 15,000–30,000 (aOR 1.854, 95% CI 1.055–3.264), participants from a joint family (aOR 1.623, 95% CI 1.046–2.519), and participants with hypertension (aOR 1.590, 95% CI 0.989–2.554).

Regression model 2 suggested that in the postacute COVID-19 cohort, higher odds of LBP were found in participants who received high school or lower education (aOR 1.834, 95% CI 0.714–4.714), have a monthly household income BDT 15,000–30,000 (aOR 1.670, 95% CI 0.837–3.331), and were diagnosed with hypertension (aOR 1.704, 95% CI 0.924–3.141). However, moderate COVID-19 illness (aOR 1.754, 95% CI 0.984–3.126) was the only statistically significant predictor of LBP in this cohort (Table 4).

Discussion

This case-control study found a significantly higher prevalence of LBP among participants in the postacute COVID-19 cohort than among subjects without COVID-19. Regression analysis suggested that SARS-CoV-2 infection was a robust independent predictor of LBP. Among subjects with postacute COVID-19, a higher prevalence of LBP was found in participants with low education and low income, participants from a joint family, individuals who lived in rural settings, and those were diagnosed with hypertension. Remarkably, participants with moderate COVID-19 reported LBP at a significantly higher rate, and this variable showed independent predictability for LBP in the regression model.

A previous study suggested that the SARS-CoV-2 infection influenced human health in many ways during the active illness; additionally, the long-term effect of this disease is also a growing

Table 1
Descriptive analysis: sociodemographic and clinical factors and LBP (for all participants).

Factors	LBP		Total (%)	*P*-value
	No (%)	Yes (%)		
All participants	702 (80.0)	176 (20.0)	878 (100)	-
Tested positive for COVID-19				**0.001**
Yes	332 (75.6)	107 (24.4)	439 (50.0)	
No	370 (84.3)	69 (15.7)	439 (50.0)	
Biological sex				**0.026**
Female	341 (77.0)	102 (23.0)	443 (50.5)	
Male	361 (83.0)	74 (17.0)	435 (49.5)	
Age group (y)				**0.016**
18–30	270 (86.0)	44 (14.0)	314 (35.8)	
31–40	207 (76.4)	64 (23.6)	271 (30.9)	
41–50	118 (76.6)	36 (23.4)	154 (17.5)	
51–60	67 (79.8)	17 (20.2)	84 (9.6)	
>60	40 (72.7)	15 (27.3)	55 (6.3)	
Marital status				**0.005**
Single	126 (87.5)	18 (12.5)	144 (16.4)	
Married	564 (79.0)	150 (21.0)	714 (81.3)	
Divorce/widow	12 (60.0)	8 (40.0)	20 (2.3)	
Education				**<0.001**
≤ High school	180 (67.9)	85 (32.1)	265 (30.2)	
College education	171 (78.4)	47 (21.6)	218 (24.8)	
Bachelor's degree	269 (90.0)	30 (10.0)	299 (34.1)	
≥ Master's degree	82 (85.4)	14 (14.6)	96 (10.9)	
Occupation				**<0.001**
Service	248 (83.8)	48 (16.2)	296 (33.7)	
Business	101 (75.9)	32 (24.1)	133 (15.1)	
Unemployed	59 (83.1)	12 (16.9)	71 (8.1)	
Student	45 (90.0)	5 (10.0)	50 (5.7)	
Homemaker	155 (70.1)	66 (29.9)	221 (25.2)	
Health care	94 (87.9)	13 (12.1)	107 (12.2)	
Monthly household income (BDT)				**<0.001**
<15,000	93 (72.1)	36 (27.9)	129 (14.7)	
15,000–30,000	94 (65.3)	50 (34.7)	144 (16.4)	
31,000–45,000	202 (87.1)	30 (12.9)	232 (26.4)	
>45,000	313 (83.9)	176 (20.0)	373 (42.5)	
Family type				**0.044**
Nuclear family	479 (81.9)	106 (18.1)	585 (66.6)	
Joint family	223 (76.1)	70 (23.9)	293 (33.4)	
Current address				**<0.001**
Village	125 (69.4)	55 (30.6)	180 (20.5)	
City	446 (82.6)	94 (17.4)	540 (61.5)	
Semi-city	131 (82.9)	27 (17.1)	158 (18.0)	
Hypertension				**0.012**
No	546 (81.9)	121 (18.1)	667 (76.0)	
Yes	156 (73.9)	55 (26.1)	211 (24.0)	
Diabetes				0.590
No	540 (80.4)	132 (19.6)	672 (76.5)	
Yes	162 (78.6)	44 (21.4)	206 (23.5)	
Kidney disease				0.571
No	628 (79.7)	160 (20.3)	788 (89.7)	
Yes	74 (82.2)	16 (17.8)	90 (10.3)	
Asthma				0.064
No	595 (81.1)	139 (18.9)	734 (83.6)	
Yes	107 (74.3)	37 (25.7)	144 (16.4)	
Exercise habit				0.302
No	558 (79.3)	146 (20.7)	704 (80.2)	
Yes	144 (82.8)	30 (17.2)	174 (19.8)	
Current tobacco user				**0.018**
No	443 (82.5)	94 (17.5)	537 (61.2)	
Yes	259 (76.0)	82 (24.0)	341 (38.8)	

BDT, Bangladeshi Taka; COVID-19, coronavirus disease 2019; LBP, low back pain.
Bold *P*-values are significant at a 5% significance level.

concern (Nalbandian et al., 2021). The association between COVID-19 infection and mental health symptoms, cognitive dysfunction, cardiac conditions, renal conditions, muscle weakness, and joint pain has been evaluated (Proal and VanElzakker, 2021); nonetheless, to the best of our knowledge, this is the first study to assess the relationship between postacute COVID-19 infection and LBP. Although the exact mechanisms causing postacute COVID-19 pain in any part of the body are largely unknown, a phenomenon of protracted immunosuppression (commonly known as persistent inflammation, immunosuppression, and catabolism syndrome) has been presented as a potential major contributing factor to the presentation of postacute COVID-19 symptoms, which facilitates inflammation, immunosuppression, and catabolism that may exacerbate or make patients more susceptible to the angiotensin-converting enzyme 2 (ACE2)–mediated infiltration of sites of pain in the body (Fiala et al., 2022). Furthermore, COVID-19 is now acknowledged as a multiorgan disease, with an extensive spectrum of clinical involvement (Mokhtari et al., 2020; Peiris et al., 2021);

Table 2
Descriptive analysis: sociodemographic, clinical, and COVID-19–related factors and LBP (for patients with postacute COVID-19).

Factors	LBP		Total	*P*-value
	No (%)	Yes (%)		
Biological sex				0.158
Female	157 (72.7)	59 (27.3)	216 (49.2)	
Male	175 (78.5)	48 (21.5)	223 (50.8)	
Age group (y)				0.212
18–30	125 (81.7)	28 (18.3)	153 (34.9)	
31–40	104 (72.7)	39 (27.3)	143 (32.6)	
41–50	57 (73.1)	21 (26.9)	78 (17.8)	
51–60	30 (75.0)	10 (25.0)	40 (9.1)	
>60	16 (64.0)	9 (36.0)	25 (5.7)	
Marital status				**0.037**
Single	54 (85.7)	9 (14.3)	63 (14.4)	
Married	274 (74.5)	94 (25.5)	368 (83.8)	
Divorce/widow	4 (50.0)	4 (50.0)	8 (1.8)	
Education				**0.002**
≤ High school	85 (64.9)	46 (35.1)	131 (29.8)	
College education	82 (75.9)	26 (24.1)	108 (24.6)	
Bachelor's degree	126 (84.6)	23 (15.4)	149 (33.9)	
≥ Master's degree	39 (76.5)	12 (23.5)	51 (11.6)	
Occupation				**0.030**
Service	118 (78.1)	33 (21.9)	151 (34.4)	
Business	51 (81.0)	12 (19.0)	63 (14.4)	
Unemployed	28 (75.7)	9 (24.3)	37 (8.4)	
Student	16 (94.1)	1 (5.9)	17 (3.9)	
Home Maker	76 (65.0)	41 (35.0)	117 (26.7)	
Healthcare	43 (79.6)	11 (20.4)	54 (12.3)	
Monthly household income (BDT)				**0.010**
<15,000	39 (69.6)	17 (30.4)	56 (12.8)	
15,000–30,000	47 (63.5)	27 (36.5)	74 (16.9)	
31,000–45,000	93 (83.8)	18 (16.2)	111 (25.3)	
>45,000	153 (77.3)	45 (22.7)	198 (45.1)	
Family type				**0.022**
Nuclear family	235 (78.9)	63 (21.1)	298 (67.9)	
Joint family	97 (68.8)	44 (31.2)	141 (32.1)	
Current address				0.086
Village	39 (65.0)	21 (35.0)	60 (13.7)	
City	230 (76.4)	71 (23.6)	301 (68.6)	
Semi-city	63 (80.8)	15 (19.2)	78 (17.8)	
Hypertension				**0.015**
No	251 (78.7)	68 (21.3)	319 (72.7)	
Yes	81 (67.5)	39 (32.5)	120 (27.3)	
Diabetes				0.532
No	246 (76.4)	76 (23.6)	322 (73.3)	
Yes	86 (73.5)	31 (26.5)	117 (26.7)	
Kidney disease				0.287
No	281 (74.7)	95 (25.3)	376 (85.6)	
Yes	51 (81.0)	12 (19.0)	63 (14.4)	
Asthma				0.159
No	258 (77.2)	76 (22.8)	334 (76.1)	
Yes	74 (70.5)	31 (29.5)	105 (23.9)	
Exercise habit				0.425
No	248 (74.7)	84 (25.3)	332 (75.6)	
Yes	84 (78.5)	23 (21.5)	107 (24.4)	
Current tobacco user				0.826
No	184 (76.0)	58 (24.0)	242 (55.1)	
Yes	148 (75.1)	49 (24.9)	197 (44.9)	
Period after recovery from acute COVID-19				0.319
<30 days	10 (83.3)	2 (16.7)	12 (2.7)	
30–60 days	26 (68.4)	12 (31.6)	38 (8.7)	
61–90 days	78 (70.9)	32 (29.1)	110 (25.1)	
91–120 days	36 (87.8)	5 (12.2)	41 (9.3)	
121–150 days	25 (75.8)	8 (24.2)	33 (7.5)	
151–180 days	36 (81.8)	8 (18.2)	44 (10.0)	
180+ days	121 (75.2)	40 (24.8)	161 (36.7)	
COVID-19 symptoms				**0.039**
Mild	178 (81.3)	41 (18.7)	219 (49.9)	
Moderate	75 (68.8)	34 (31.2)	109 (24.8)	
Severe	31 (67.4)	15 (32.6)	46 (10.5)	
Very severe	48 (73.8)	17 (26.2)	65 (14.8)	
Treatment facilities used				0.214
Home	221 (77.3)	65 (22.7)	286 (65.1)	
Hospital general word	45 (67.2)	22 (32.8)	67 (15.3)	
Hospital intensive care	66 (76.7)	20 (23.3)	86 (19.6)	
Vaccine dose before COVID-19				0.446
No vaccine	104 (72.7)	39 (27.3)	143 (32.6)	
1 dose	80 (82.5)	17 (17.5)	97 (22.1)	
2 dose	137 (74.5)	47 (25.5)	184 (41.9)	
3 dose	10 (71.4)	4 (28.6)	14 (3.2)	

BDT, Bangladeshi Taka; COVID-19; coronavirus disease 2019; LBP, low back pain.
Bold *P*-values are significant at a 5% significance level.

Table 3
Multiple logistic regression: predictors of low back pain among all participants.

Variables	Adjusted OR	SE	95% CI	*P*-value
Case-control				
Case	1.837	0.195	1.253–2.692	**0.002**
Control	Reference			
Biological sex				
Female	1.860	0.269	1.097–3.152	**0.014**
Male	Reference			
Age group (y)				
18–30	0.903	0.464	0.364–2.245	0.827
31–40	1.235	0.431	0.530–2.877	0.625
41–50	1.085	0.433	0.464–2.535	0.851
51–60	0.808	0.471	0.321–2.035	0.651
>60	Reference			
Marital status				
Single	1.085	0.299	0.604–1.949	0.785
Married	Reference			
Educational qualification				
≤ High school	2.263	0.405	1.022–5.008	**0.044**
Higher secondary education	1.702	0.393	0.787–3.680	0.177
Bachelor's degree	0.739	0.367	0.360–1.518	0.410
≥ Master's degree	Reference			
Occupation				
Service	0.891	0.370	0.432–1.838	0.754
Business	0.974	0.429	0.420–2.259	0.951
Unemployed	0.638	0.513	0.234–1.742	0.380
Student	0.419	0.639	0.120–1.463	0.173
Homemaker	0.801	0.438	0.339–1.890	0.612
Health care	Reference			
Monthly household income (BDT)				
<15,000	1.153	0.367	0.562–2.365	0.698
15,000–30,000	1.856	0.288	1.055–3.264	**0.032**
31,000–45,000	0.648	0.276	0.377–1.113	0.116
>45,000	Reference			
Family type				
Joint	1.623	0.224	1.046–2.519	**0.031**
Nuclear	Reference			
Current address				
Village	1.318	0.319	0.706–2.461	0.386
City	0.948	0.263	0.566–1.588	0.841
Semi-city	Reference			
Hypertension				
Yes	1.590	0.242	0.989–2.554	**0.050**
No	Reference			
Tobacco use				
Yes	1.208	0.216	0.791–1.847	0.382
No	Reference			

BDT, Bangladeshi Taka; CI, confidence interval; OR, odds ratio; SE, standard error.
Bold *P*-values are significant at a 5% significance level.

thus, COVID-19 might be responsible for spinal derangement that leads to LBP. COVID-19–induced spinal muscle weakness and facet joint pain might be another reason for LBP. Possible undermining factors of LBP, such as depression, anxiety, or cognitive dysfunction (Robertson et al., 2017; Schiltenwolf et al., 2017), which were induced by COVID-19 may also trigger LBP among patients with postacute COVID-19. In line with the evidence, our study found that LBP worsened or was newly introduced after SARS-CoV-2 infection in most cases. Additional studies are required to explore the possible complex causal relationship between SARS-CoV-2 infection and LBP.

Nonetheless, our study found some typical scenarios of LBP among all the participants. For example, we found a high prevalence of LBP among the subjects aged over 60 years, which is in line with the findings of our previous study (Ali et al., 2021a). Similar to the previous study findings, we also found higher odds of LBP among low-educated and low-income groups (Hartvigsen et al., 2018). We found that more women complained about LBP than their male counterparts; however, influence of sex on LBP is a debatable and undecided issue (Fatoye et al., 2019). This study also found a high prevalence of LBP among the homemakers, participants who live in rural settings, or those from a joint family. These individuals may be engaged in farming or heavy weightlifting and are thus more prone to LBP.

Interestingly, we found an independent association between hypertension and LBP. However, there are pieces of evidence in favor or contrary to our findings. A study conducted in 2015 found that hypertension was inversely associated with LBP (Bae et al., 2015); nonetheless, another study in 2017 found a strong positive association between hypertension and LBP (Samartzis et al., 2014). Additional investigation is warranted to find a convincing conclusion.

Notably, a previous study suggested that pain is of a particular concern for patients with COVID-19 who have been admitted to the hospital, particularly in the intensive care unit (Fiala et al., 2022). Another study found pain as a significant issue for patients with postacute COVID-19 and called for special attention of the COVID-19–dedicated physicians and public health specialists to mitigate the problem (Bileviciute-Ljungar et al., 2022). In line with these findings, our study also found a significantly high prevalence of LBP among participants with moderate and severe COVID-19. In addition, our study identified the moderate COVID-19 symptom as an independently associated factor of LBP.

Table 4
Multiple logistic regression: predictors of low back pain among the postacute COVID-19 cohort.

Variables	Adjusted OR	SE	95% CI	*P*-value
Marital status				
Single	0.772	0.382	0.365–1.631	0.497
Married	Reference			
Educational qualification				
≤ High school	1.834	0.482	0.714–4.714	0.208
Higher secondary education	1.420	0.471	0.564–3.573	0.457
Bachelor's degree	0.740	0.424	0.322–1.699	0.477
≥ Master's degree	Reference			
Occupation				
Service	0.676	0.432	0.289–1.577	0.364
Business	0.472	0.530	0.167–1.334	0.157
Unemployed	0.718	0.581	0.230–2.241	0.568
Student	0.151	1.151	0.016–1.443	0.101
Homemaker	1.116	0.495	0.423–2.946	0.825
Health care	Reference			
Monthly household income (BDT)				
<15,000	0.815	0.471	0.324–2.053	0.664
15,000–30,000	1.670	0.352	0.837–3.331	0.146
31,000–45,000	0.566	0.361	0.279–1.148	0.115
>45,000	Reference			
Family type				
Joint	1.589	0.275	0.927–2.725	0.092
Nuclear	Reference			
Hypertension				
Yes	1.704	0.312	0.924–3.141	0.088
No	Reference			
COVID-19 symptoms				
Mild	Reference			
Moderate	1.754	0.295	0.984–3.126	**0.050**
Severe	1.763	0.409	0.791–3.925	0.165
Very severe	1.136	0.417	0.502–2.570	0.760

BDT, Bangladeshi Taka; CI, confidence interval; COVID-19, coronavirus disease 2019; OR, odds ratio; SE, standard error.
Bold *P*-values are significant at a 5% significance level.

Limitation of the study

This study has several limitations. First, we did not take data regarding ergonomic factors and work nature (sedentary or heavy weightlifting). Second, participants' height, weight, or body mass index were not measured, which might have confounded the study findings. Furthermore, there might have some asymptomatic patients with postacute COVID-19 in the control group. Finally, because we took information on LBP occurrence in the past month, the chronicity of LBP (acute, subacute, or chronic) cannot be measured from our data. Despite these limitations, this study provided valuable baseline information regarding the association between SARS-CoV-2 infection and LBP.

Conclusions

SARS-CoV-2 infection is associated with LBP. One-month prevalence of LBP among patients with postacute COVID-19 was significantly high, and moderate COVID-19 symptom was a significant independent associated factor of LBP among postacute COVID-19 patients. The results forecast an upcoming wave of LBP burden among the general population worldwide after the pandemic era. Health care facilities must be prepared to mitigate the burden of LBP among patients with postacute COVID-19. Early diagnosis and treatment of postacute COVID-19–induced LBP can prevent further complications and chronicity. However, additional research is warranted to understand the possible complicated relationship between SARS-CoV-2 infection and LBP.

Declaration of Competing Interest

The authors have no competing interests to declare.

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Author contributions

Mohammad Ali: conceived and designed the experiments; performed the experiments; analyzed and interpreted the data; contributed reagents, materials, analysis tools, or data; and wrote the paper. Atia Sharmin Bonna, Abu-sufian Sarkar, Ariful Islam, and Nur-A- Safrina Rahman: performed the experiments and contributed reagents, materials, analysis tools, and data.

Data access, responsibility, and analysis

Dr. Mohammad Ali had full access to all the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis.

Data sharing statement

Data will be made available upon reasonable request.

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