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Original Research

Exploring the Relationship of Gender-Specific Symptoms, BMI, and Comorbidities in COVID-19 patients: A cross sectional study

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Abstract

Background: Coronaviruses are important pathogens that can affect the lower respiratory tract in humans and can cause diseases ranging from a simple cold to severe infection. The COVID-19 pandemic has caused widespread devastation, leading to millions of deaths around the world, including Bangladesh, leaving severe consequences for both physical and mental health.

Objective: The objective of this study was to identify gender specific symptoms, BMI and co-morbidity of COVID-19 and relate those to evaluate the potentiality of COVID.

Method: It was a cross-sectional questionnaire-based study. The study was conducted in Gono Bishwabidyalay and data were collected directly from patients by one-to-one question through prescribed questionnaire from Gonoshasthaya Samaj Vittik Medical College and Hospital (GSVMCH), and Gono Bishwabidyalay, Savar. Statistical significance was defined when $p < 0.05$. All statistical tests were performed using IBM SPSS 27.0 version.

Result: A total number of 110 patients were included in this study, among them 54% were male and 46% were female. The study found significant association of some disease symptoms with gender. 44% male and 47% female were categorized as overweight. The most common symptom was fever 86% in female whereas 93% in male, followed by tiredness (75% in female and 88% in male). Unlike other flu Loss of taste and smell found 68% in female and 71% in male, aches and pains were found 53% in female and 66% in male, sore throat in female was 41% and in male was 61%. The most prevalent comorbidity in COVID-19 patients was diabetes (14% in female and 15% in male). The second close co morbidity were Lipid profile and heart disease. 20% female and 14% male COVID-19 patients were found having the history of Asthma. A significant association was found in symptoms of COVID-19 with gender. The study also indicates that BMI is significantly associated with certain comorbidities and disease histories in COVID-19 patients.

Conclusion: The clinical manifestations of COVID-19 could be differed with respect to age and sex. However, patients with comorbidities have more worsen effect compared with patients without COVID-19. Early diagnosis of Covid-19 clinical manifestations can reduce the rate of morbidity and mortality. The study could help inform gender-specific approaches to managing COVID-19 patients.

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Keywords— *COVID-19, symptom, comorbidity, gender-specific approach, heart disease, lipid profile, BMI*

Introduction

The Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) was first recognized, in December 2019 and World health organization decided to name the as COVID-19 [1]. The novel coronavirus that emerged in Wuhan, China. Since then, the virus has been rapidly spread to all over China and the world resulting various symptoms including fever, difficulty in breathing, cough, and invasive lesions on both lungs of the patients [2], [3]. It can easily affect to the lower respiratory tract and cause viral pneumonia and respiratory distress syndrome [4]. COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and has left a variety of post-COVID-19 conditions (both short and long-term) and has drawn the great attention of researchers and healthcare providers as declining the quality of life of the survivors regularly [5], [6]. This devastating pandemic started back on December 8, 2019, in Wuhan City, Hubei Province, China, and spread very quickly all over the world due to its ability to mutate and a high degree of contagiousness [7], [8]. According to the World Health Organization's (WHO) report, 775 million people were affected and 7 million people died [9]. To combat the fatality rate, first of all, some antiviral drugs such as Favipiravir, Remdesivir, Lopinavir-ritonavir, and Ivermectin were given to the patients [10], [11]. Later, a mass vaccination strategy was applied to the middle age and elderly people on a priority basis including young people in the next phase [12], [13]. However, people who have survived is currently suffering from a range of complications and difficulties that couldn't allow them to back to their previous healthy lives [14]. In North America, thousands of people lost their jobs and billions in lost wages [15]. Symptoms of COVID-19 infection is varied from person to person due to the difference genetic make-up of patients as well as the heterogeneity [16]. Most of the people have their symptoms last for 2-3 weeks after recovery, however, a large number of people experienced these symptoms for a longer period of time even for months to years [17], [18]. Previous studies has already shown some short term (2-3 weeks) physical and mental health complications such as fatigue, joint pain, muscle weakness, cough, dyspenia, gastrointestinal complications, short of breath, insomnia, tiredness, vomiting, confusion, stress, anosmia etc. [19]. However, long COVID symptoms last for at least 12 weeks these includes dyspnea (difficulty in breathing), and reduced exercise capacity, and hypoxia, cardiovascular symptoms includes chest pain, palpitation, arrhythmias, neuropsychiatric problems such as anxiety, depression, feeling unable to do work, chronic fatigue, dementia etc [20]. On the other hand, COVID-19 also possess persistent pathologic conditions, known as persistent post-COVID syndrome that includes metabolic diseases (e.g., diabetes), cardiovascular diseases, autoimmune diseases, organ abnormalities, and long-term cognitive complications. This leads the patient to mortality after recovery and needs extra care and concern [21]. Recent studies show that the rate of comorbidities has come in front and increased in COVID-19 patients in the last 2 years [22]. The continuous record of the onset of complications and symptoms was difficult because a large number of patients had no or very mild symptoms despite being tested positive [23]. As a result, comorbidities such as cardiovascular complications, diabetes, kidney disease, respiratory abnormalities, and metabolic syndromes have developed over time in these patients without showing any major symptoms and remain non-diagnosed and

treated for a long time [24], [25], [26]. As a result, the indolent phase of these comorbidities helps them to become severe or sometimes fatal for the patients, especially for the elderly [22], [27]. The post COVID-19 syndromes following no boundaries and new complications are arising every day. Peoples are noticing new complications with the change of time [28]. The objectives of this study are to gain a comprehensive understanding of the clinical symptoms and risk factors associated with COVID-19 infection. The first objective is to identify the most prevalent disease symptoms of COVID-19 in individual patients, which will aid in evaluating the likelihood of a COVID-19 diagnosis based on symptom presentation. The study also focused on assessing the previous disease history of patients to identify underlying health conditions that may predispose individuals to more severe consequences of COVID-19. We also examined the risk of comorbidity among COVID-19 patients, considering how pre-existing conditions like diabetes, hypertension, or heart disease may exacerbate the severity of the illness. Finally, the study assessed the body mass index (BMI) of COVID-19 patients to understand the relationship between obesity and the potential for more severe outcomes, helping to clarify the role of obesity as a risk factor in the progression of the disease.

Materials and Methods

It was a cross-sectional study. A total of 110 patients were included in this study. The study was carried out by collecting data through questionnaires from Gonoshasthaya Samaj Vittik Medical College and Hospital and from nearby areas of Gonoshasthaya Samaj Vittik Medical College and Hospital (GSVMCH), Savar. All the patients from October 2022 to December 2022 who tested positive for COVID-19 previously and individuals re-infected with COVID-19 have been included in this study. The data were collected from individuals aged 18 to 40 who had suffered from COVID-19. The study was conducted at both Gonoshasthaya Samaj Vittik Medical College and Hospital (GSVMCH), Savar and Gono Bishwabidyalay,Savar.

Statistical analysis

Descriptive statistics (frequency, percentages, and means) were used to examine the participants' responses and demographic distribution. The Pearson's chi-squared was applied to determine the association of different predictors in the prevalence of the symptoms, co-morbidity and history of previous disease. Statistical significance was defined when $p < 0.05$. All statistical tests were performed using IBM SPSS 27.0 version.

Result and Discussions

The current study estimated the symptoms related to COVID-19. The analysis consisted of 110 respondents where 54% (n = 59) were male, and 46% (n = 51) were female (Table 1). All 110 COVID-19 respondents who are COVID-19 survivors confirmed positive by RT-PCR test. Among these 110 patients, 5% patients were asymptomatic while the rest (95%) had single or multiple clinical symptoms during the course of COVID 19.

The table 1 represents the gender-based data on COVID-19 patients, their vaccination status. 75% of males and 65% of females had received vaccination that suggest higher proportion of

males had received vaccination compared to females. 25% of males and 35% of females were not vaccinated that represent a small percentage of both male and female patients were unvaccinated.

Table 1: General information about Vaccination of COVID-19 patients.

Traits	COVID patients.	Not Vaccinated	Vaccinated
Male	59 (54%)	15(25%)	44(75%)
Female	51 (46%)	18 (35%)	33 (65%)

According to the results of the analysis (Figure 1), the common symptoms in respondents with COVID-19 include: Sneezing and Coughing (72.7%), Nasal discharge (76.4%), Headache (70.9%), Fever (90%), Loss of taste and smell (69.1%), Tiredness (80.8%), Aches and pains (60%), Sore throat (51.8%), Diarrhea (15.5%), Conjunctivitis (7.3%), Shortness of breathing (46.4%), Chest Pain (44.5%), loss of speech (14.5%) and Skin Rash (6.4%).

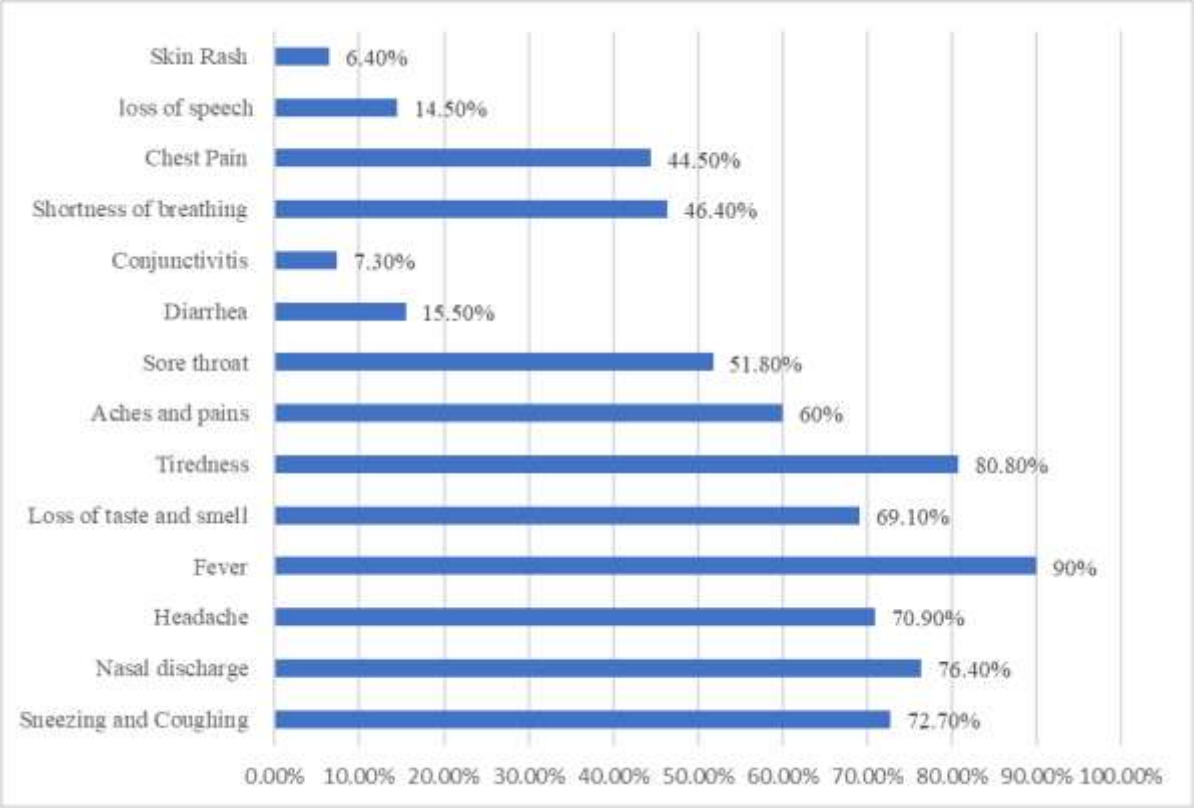

Figure 1: Common symptoms in patient with COVID-19

Prevalence of common clinical symptoms between female and male COVID-19 patients were depicted in Figure 2. The most common symptom was fever whereas 86% in female and 93% in male, followed by tiredness 75% in female and 88% in male, Sneezing was 59% in female and 85% in male, Nasal discharge was found 67% in female and 85% in male. In female symptom of headache was 67% whereas 75% in male, Loss of taste and smell found 67% in female and 71% in male, aches and pains were found 53% in female and 66% in male, sore

throat in female was 41% and in male was 61%, diarrhea was found 20% in female whereas 12% in male, conjunctivitis was 6% in female and 8% in male, Difficulty of breathing was found 31% in female and 59% in male, chest pain was found 33% in female and 54% in male, loss of speech or mobility was found 10% in female and 19% in male, rash on skin was found 8% in female and 5% in male, oxygen saturation level was found low 31% in female and 39% in male.

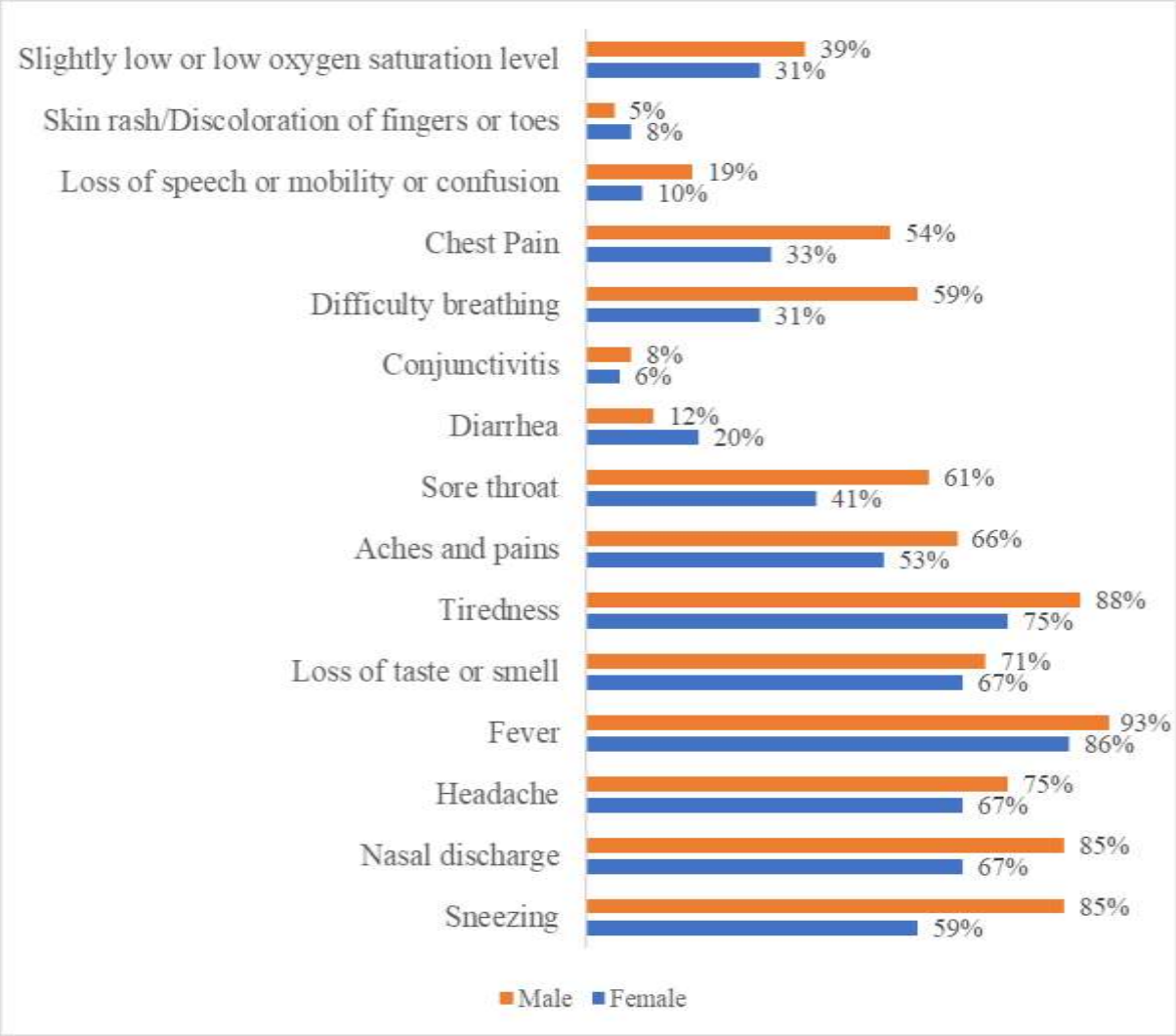

Figure 2: Comparative prevalence of Symptoms during COVID-19 between gender

Except diarrhea and skin rash were found higher in female otherwise all other clinical parameters were found higher in male.

Severity of sneezing and coughing differs significantly between male and female COVID-19 patients ***(p = 0.002)***. A significant gender-based association was found in nasal discharge ***(p = 0.026).*** A p-value of 0.038 suggests a significant association between gender and sore throat during COVID-19 infection. Difficult breathing or shortness of breath was found to be significantly associated with gender ***(p = 0.003),*** indicating that one gender is more likely to experience respiratory distress or difficulty breathing. A significant association was also observed in chest pain with gender ***(p =0.028).***

Table 2: Clinical characteristics during the period with COVID-19

Variables	Clinical characteristics (n=110)				P-value
	Gender				
	Male		Female		
	Yes	No	Yes	No	
Sneezing and coughing	50 (45%)	9 (8%)	30 (27%)	21 (19%)	.002
Nasal Discharge	50 (45%)	9 (8%)	34 (31%)	17 (15%)	.026
Sore Throat	36 (32%)	23 (20%)	21 (19%)	30 (27%)	.038
Difficult breathing	35 (32%)	24 (20%)	16 (15%)	35 (32%)	.003
Chest Pain	32 (28%)	27 (26%)	17 (15%)	34 (31%)	.028

P value >0.05 is considered as significant

Fever and pain were very common impact of COVID-19 Vaccine in both male and female patients (Figure 3). Throat discomfort was found higher in female (78%) than male (15%).

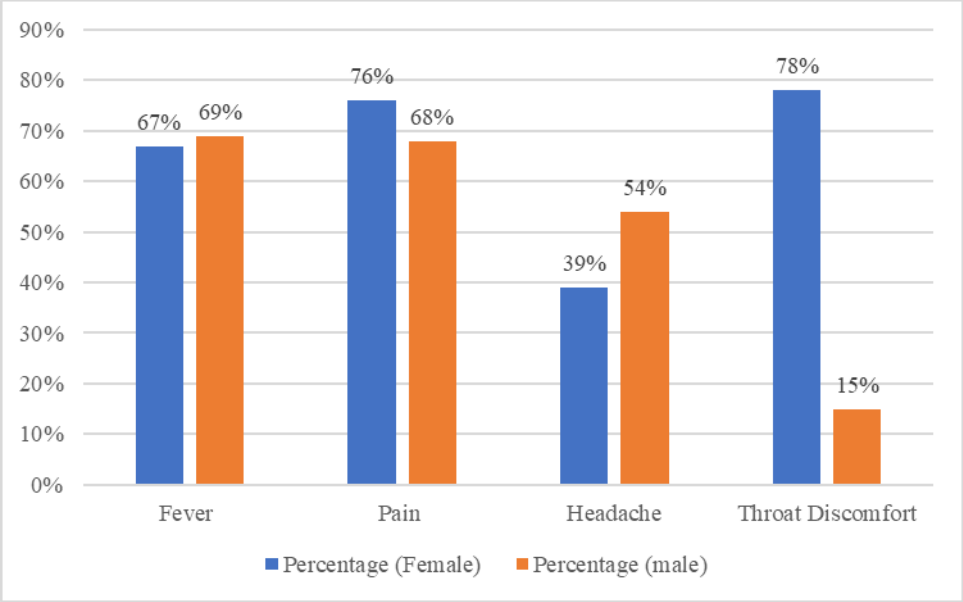

Figure 3: Observed side effects of vaccinated COVID-19 patients.

The most prevalent comorbidity (Figure 4) in COVID patients were diabetes (14% in female and 15% in male). The second close prevalent comorbidity in COVID patients were Lipid profile disorder (12% in female and 7% in male). The other comorbidity found were; heart disease (10% in female and 7% in male), Endocrine disorder (10% in female and 2% in male), Liver disease (4% in female and 7% in male), kidney disease (6% in female and 5% in male) were also found in male and female COVID patients.

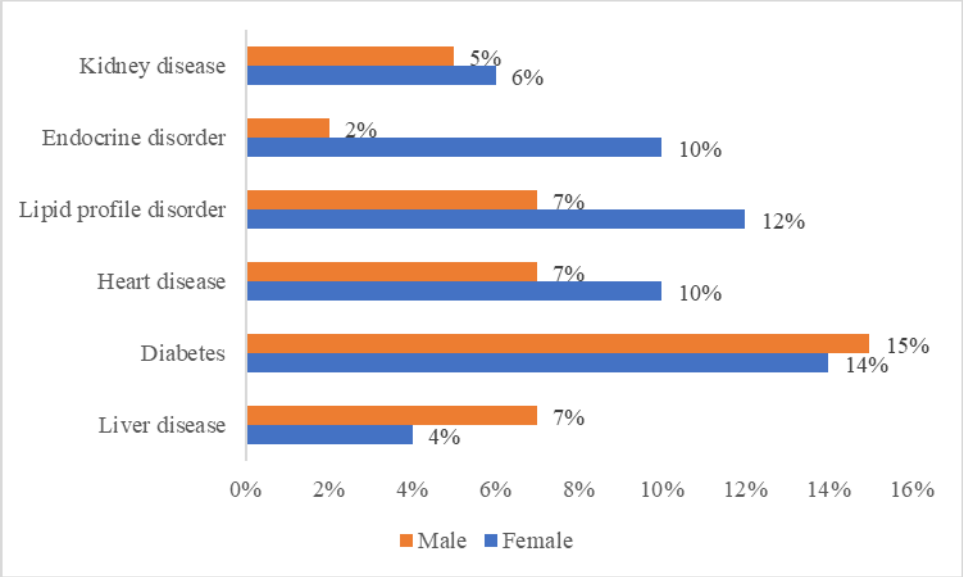

Figure 4: Co-morbidity of patients with COVID-19.

Burden of comorbidity with Endocrine disorder in COVID-19 patients were found much higher in female than male. Comorbidity with liver and kidney disease were found comparatively lower than other diseases in COVID-19 patients.

Among the 110 COVID-19 patients (Figure 5), 20% of female patients and 14% of male patients had a history of asthma before developing COVID-19. History of Dengue were 6% in female patients and 7% in male patients and history of having Tuberculosis was 2% in female patients and 3% in male.

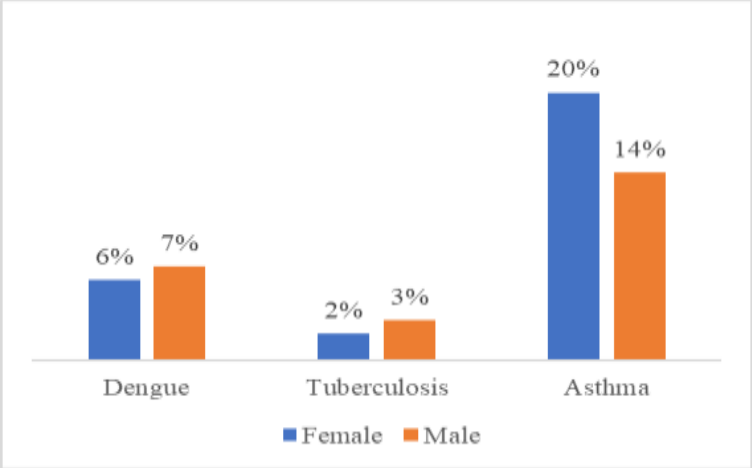

Figure 5: Previous disease history of the respondent

Among 53.6% male of total 110 COVID-19 respondents (Table 3) indicates that 52.7% were normal weight, 38.2% were overweight, 7.3% were obese, 0.9% were thin and 0.9% were underweight.

Table 3: Gender wise BMI Distribution

BMI	**Male**	**Female**	**Total**
Normal	33 (30%)	25 (22.7%)	58 (52.7%)

Over weight	23 (20.9%)	19 (17.3%)	42 (38.2%)
Obese	3 (2.7%)	5 (4.5%)	8 (7.3%)
Thin	0(0%)	1 (0.9%)	1 (0.9%)
Underweight	0(0%)	1 (0.9%)	1 (0.9%)
Total	59 (53.6%)	51 (46.4%)	110 (100%)

From table 03, Among the 110 participants, the majority had a normal Body Mass Index (BMI), accounting for 52.7% of the total, with a higher proportion of males (30%) than females (22.7%). Overweight individuals comprised 38.2%, including 20.9% males and 17.3% females. Obesity was observed in 7.3% of participants, with a slightly higher prevalence among females (4.5%) compared to males (2.7%). Very few participants were classified as thin (0.9%) or underweight (0.9%), both cases occurring only among females. Overall, the male participants slightly outnumbered females, representing 53.6% and 46.4% of the sample, respectively.

People with COVID-19 have a wide range of symptoms ranging the common cold to more severe disorders. The most common symptoms were cough, fever, diarrhea, chest pain, fatigue, body ache, sore throat, rhinorrhea, tachypnea, dyspnea [29], [30]. Severity could vary in case of COVID 19 with gender. The present study reported that the percentage of severity based on hospitalization was noted higher in male (27%) than female (10%). It indicates that males are more prone to develop severe condition. A study showed that morbidity and mortality in males was higher than females for COVID-19. Determination of gender gap in case of COVID-19 is under studied. But the research found that expression of angiotensin-converting enzyme-2 (ACE 2; receptors for coronavirus) is higher in male than female [31]. In addition, male was more attackable for COVID 19 because of their gender behavior such as higher levels of smoking and alcoholism compared to women [31], [32]. Furthermore, that study also revealed that women are more aware about the COVID-19 pandemic than men. Women normally follows safety measures like tidiness, good hygiene practice, wearing of face mask, and stay at home orders [33]. In our present study the most prevalent symptoms associated with COVID-19 was observed were sneezing and coughing, nasal discharge, sore throat, shortness of breathing and chest Pain. Loss of taste and smell was also one of the major findings in both male and female patients. A study revealed that Among 200 COVID-19 positive, 37.5% patients had smell and taste dysfunction [34]. Smell dysfunction was found in 57.0% of patients, and taste dysfunction was found in 34.0% patients, and both symptoms were present among 9.0% of patients with or without other symptoms of COVID-19. The regain time of smell and taste was disseminated as 63.0% recovered within less than seven days, 20.0% within 14 days, and 17.0% in 14 days. A meta-analysis study supported our present study revealed that COVID-19 patients, showed fever (88.8%) as the most common symptom, followed by dry cough (68%) and fatigue (33%). Other symptoms noted were productive cough (28.5%), SOB (17%), muscle pain (14.4%), sore throat (11.4%), and headache (10.2%). The less common symptoms were diarrhea (4.4%), nausea and vomiting (4.1%), rhinorrhea (3.2%), abdominal pain (0.16%), and chest pain (0.11%) [35]. In our study

the most prevalent comorbidity were Diabetes, Heart Disease, Lipid Profile Disorder and Endocrine Disorder. Comorbidity increases the chance of infection. A study reported on COVID-19 comorbidities, with a total of 1786 patients. The study covered 1044 were male and 742 were female with a mean age of 41 years old. The most prevalent comorbidities identified in these patients were hypertension (15.8%), cardiovascular and cerebrovascular conditions (11.7%), and diabetes (9.4%). That study suggested that COVID-19 patients with comorbidities, such as hypertension or diabetes mellitus, are more possibilities to develop a more severe course and development of the disease. Aged patients, usually those 65 years old and above who had comorbidities and are infected, showed an increased admission rate into the intensive care unit (ICU) and mortality from the COVID-19 disease [36]. A study also reported that nervous or axonal transport of the virus by the trigeminal nerve could damage blood brain barrier. Thus it contributed various types of neurological symptoms due to systemic infection [37].

Limitations of the study

This cross-sectional study exploring the relationship between gender-specific symptoms, BMI, and comorbidities in COVID-19 patients has several limitations. First, the cross-sectional design limits the ability to establish causal relationships between variables. Second, the reliance on self-reported symptoms and comorbidities may introduce recall or reporting bias. Third, the study sample may not be fully representative of the broader population, potentially affecting the generalizability of the findings. Additionally, the relatively small sample size may limit statistical power, particularly for subgroup analyses. Finally, variations in diagnostic criteria or access to healthcare services across participants could influence the accuracy of reported clinical data.

Conclusion and Future Directions

The study demonstrates the association of symptoms with COVID-19. It also indicates the most common symptoms found in male in comparison with female. Abnormal BMI along with comorbidity could deteriorate the condition of COVID-19. Though it seems like normal flu but it can cause severe harm the patient with comorbidly and normal as well. Patient with previous history of respiratory disease like Asthma or tuberculosis, might more prone to having COVID-19.

Authors Contributions

Conceptualization, study design and writing-original draft were contributed by Mahbuba Khatun**,** Data collection. Data entry and figure preparation were done by Asma Farid and Md. Kamrul Hasan Jabed Chowdhury. Data collection was done by Asma Farid, Nahin Islam Lammi, Mostafa Tanvir Tusar, Sumi Islam. Writing review was done by Fuad Hossain**,** Shahnaz Rahman and Sonia Akter. Statistical data analysis and visualization were prepared by Shohal Hossain, Mahbuba Khatun and Md. Afzal Hossain. Citation and References were prepared by Md. Abu Rayhan, Md. Nafij Mashrur and Md. Afzal Hossain. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

The authors declare that they do not have any conflict of interest.

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