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Research Article

Impact of Diet on Physical and Mental Health Consequences of Covid-19 Patients in Bangladesh

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Abstract

Background: The COVID-19 pandemic is the world's worst health crisis since World War II. Fatigue, cough, dyspnea, chest pain, altered smell and taste, and cognitive impairment are among the first documented chronic symptoms of COVID-19. Research shows that isolation and many other enforced limits exacerbate psychological suffering, including depression and anxiety symptoms. When a novel disease causes severe symptoms or mortality, a lack of understanding can lead to stereotyping and discrimination of people who have it. Boosting the immune system by taking nutritious food in the unavailability of medicine is still the best way to control the pandemic. This study examined the persistent symptoms, mental health outcomes, and social consequences after 90 days of being tested positive for covid-19. Besides, it assessed the influence of disease days' diet on persistent Symptoms and mental health outcomes.

Methods: A cross-sectional survey of 200 COVID-19-affected people was conducted (69.5% male; mean age = 38.36±10.19; age range = 20 to 60 years). Information was collected via a phone-to-phone interview using a predesigned structured questionnaire. Questions included basic patient demographics, persistent symptoms, PHQ-9 tools to assess depression, a 5-item perceived discrimination scale previously used to determine HIV patients' discrimination, and the patient's dietary pattern during disease days.

Result: According to this study, the common persistent symptoms among the participants are fatigue (69.50%), dyspnea (40.50%), and alopecia (35.5%). While 48.50 % of the patients have memory impairment, 34.50% have difficulty concentrating. Furthermore, 17.50% of people have eating disorders, and 36.50% have sleep disturbances. Our findings showed that 71 patients (35.5%) had moderate or severe depression. More female participants (42.6%) have depression than male participants (32.4%). Suffering from persistent symptoms, eating disorders, and sleep disturbances are more common among women than men. Besides, 18.50% of the participants faced severe discrimination by their community. Moreover, 61.5% of patients suffering from depression never ate other fruits except for citrus fruits. Participants who did not take other fruits regularly are suffering from fatigue (100%), Cough (61.5%), and also having difficulty completing their daily tasks (23.1%). Participants who had vegetables regularly; most of them are free from cough (71.4%), dyspnea (62.3%), and Chest distress (81.7%). Sleeping disruption (66.7%) and chest distress (48.8 %) were frequent among those who had never had eggs or milk.

Conclusions: According to this study, survivors of COVID-19 experience fatigue, dizziness, and alopecia more often. The occurrence of depression and being victimized by the community is common among covid-19 affected patients. Diet patterns have a significant impact on persistent symptoms and mental health outcomes.

INTRODUCTION

In December 2019, an unprecedented wave of pneumonia of unspecified etiology unfolded in Wuhan City, Hubei province in China. A novel coronavirus was recognized as the contributing agent and was subsequently labeled COVID-19 by the World Health Organization [1]. COVID-19 is an acute inflammatory process, so critically affected patients have to fight the blow of the emerging inflammatory storm that includes fever, decreased appetite, and weight loss as an inevitable trend [2]. Fatigue, cough, dyspnea, chest pain, altered smell and taste, and cognitive impairment are among the first documented chronic symptoms [3-5]. A research of 43,565 persons conducted in November 2020 discovered that hair loss, often known as alopecia, is connected to severe COVID-19 illness [6]. Only 13% of patients in Italy were utterly rid of COVID-19 symptoms after 60 days, with 55% having at least three persisting symptoms and 32% having one or two [7].These findings raise serious concerns about COVID-19's long-term health consequences.

A combined data incorporating 227,219 confirmed cases and 14,364 deaths show that the male-to-female case fatality ratio is frequently uplifted through all age groups and may even be most evident in middle age [8]. Covid-19 has wreaked havoc on urban areas, primarily megacities. Population density and socializing are considered key attributes of the success of cities [9]. NCD (non-communicable disease) prevention and management are critical during this pandemic since NCDs are a crucial threat to COVID- 19 patients. In Spain, China, and the United States, researchers found a link between COVID-19 severity and NCDs [10]. Tobacco smoke exposure is a risk factor for lung disease [11], and cigarette smoking is a notable risk factor for viral and bacterial infections [12]. The Middle East Respiratory Syndrome Coronavirus (MERS-CoV) had the same clinical symptoms as COVID-19 and showed a link between smoking status and mortality rate [13].

Infectious diseases have plagued humanity for centuries [14], eliciting various psychological responses and altering entire populations' behavior patterns. Research shows that isolation and many other enforced limits exacerbate psychological suffering,

including depression and anxiety symptoms [15]. Female sex, urban living, low or no physical activity, sleep disturbance, self-reported moderate/poor health status, smoking, existing COVID-19 symptoms, and fear of COVID-19 re-infection have all been linked to depression in previous studies [16-20]. COVID-19's prognosis might be worsened by depression [21]. Patients with depression may have a negative attitude toward antiviral therapy, which could make it challenging for them to adhere to their treatment and recover [22]. COVID-19 has been linked to being associated with neurological impairment in recent studies [23]. Depression and other psychiatric illnesses can affect cognitive functioning and occupational performance [24, 25]. During the COVID-19 pandemic in Bangladesh, depression was observed in a variety of populations, including the general public (47.2%) [26], university students (62.9%) [27], medical students (49.9%) [28], and healthcare workers (39.5%) [29]. According to a recent study in Bangladesh, 56.6 percent of 153 COVID- 19 patients reported depression [30].

When an illness is novel and causes severe symptoms or mortality, fear, anxiety, and a lack of understanding of the disease can lead to stereotyping, discrimination, and labeling of people who have it. The stigmatized group may be subjected to discriminatory behaviors such as isolation, refusal to give service, harassment, and bullying. Such behaviors may jeopardize disease-prevention initiatives, leading to a lack of testing and healthy practices such as wearing masks to avoid discrimination [31].

Several medicines have been tried to treat life-threatening COVID-19 infection, but the perfect combination has yet to be discovered. Nutrition and food should be supplied for these patients without scientific proof to control the pandemic [32]. Dietary management should be considered as a measure of strengthening immunity and utilizing the antiviral properties of a few nutrients [33]. Citrus fruit is one of nature's best and most accessible sources of vitamin C, a crucial ingredient for immune system support [34]. Even though practically all fruits benefit human health and immunity, it has been proven that apples, sitaphal, and papaya have antiviral properties against particular viruses [35,36].

Fresh vegetables containing suitable amounts of zinc, iron, and vitamins A, B 12, B6, C, and E are vital for maintaining good health [37]. Adding high biological value proteins (such as those found in eggs, lean meat, fish, and dairy) that contain all essential amino acids may have anti-inflammatory properties. Furthermore, several amino acids, such as arginine and glutamine, are well known for their immune system-modulating properties [38]. On the other hand, polar lipids, such as phospholipids, glycolipids, or sphingolipids (also present in food sources of Omega-3 fatty acids, such as fish and fish oils) can inhibit platelet-activating factor (PAF) and its receptor, resulting in anti-inflammatory actions that may be useful in COVID-19 [39]. Studies have linked a healthy diet and physical activity to improved mental health [17, 40]. These dietary changes may increase the immune system, impacting the host's infection response [18]. In March 2020, the virus was discovered to have spread to Bangladesh. The first three coronavirus cases were reported on March 8. [41]. After India, Bangladesh is the second-most afflicted country in South Asia [42]. Bangladesh confronts considerable challenges in combatting COVID-19 due to its dense population and the housing of millions of stateless Rohingya refugees in sprawling refugee camps that facilitate the spread of diseases [43,44]. The COVID-19 epidemic severely impacts family and individual wages in Bangladesh, with roughly 13% of individuals losing their jobs; lower and middle-income classes have seen significant income drops in recent months. Meanwhile, the Bangladesh Institute of Development Studies (BIDS) claims that national poverty will rise by 25.13 percent [45].

The coronavirus COVID-19 pandemic is the most severe worldwide health epidemic since World War II. This extensive study aimed to discover the persistent symptoms, mental health outcomes, and social consequences after 90 days of being tested positive in patients with covid-19. As well as assess the influence of disease days' diet on persistent Symptoms and mental health outcomes (Tables 1-3).

Table 1: Demographic and Clinical Characteristics and Social Factor Status.

Variable	Categories	Mean ± SD	N, (%)
Gender	Male		139, (69.50)
	Female		61, (30.50)
Residence	Urban		102, (51.0)
	Nearest Urban		50, (25.0)
	Village		48, (24.0)
Occupation	Job		122, (61.0)
	Business		25, (12.5)
Educational status	higher education		115, (57.50)
	SSC and HSC		70, (35.0)
	<SSC		13, (6.5)
Age of the subjects (years)		38.36±10.19	
Monthly income in taka (n=41)		31463 ±19477	
Number of family members		4.7±2.3	
Family members affected		1.7±1.13	
High viral load			29, (14.5)
Frequency of being positive	One time		155, (77.5)
	>One time		45, (22.5)
The period of sickness	≤15 days		88, (44.0)
	16-30 days		78, (39.0)
	>30 days		34, (17.0)
Treatment taking place	home		169, (84.50)
	Hospital		31, (15.50)
Smoking			35, (17.5)
Fear of recontamination			42, (21.0)
Financially Affected			116, (58.0)
Physical Exercise			83, (41.5)
Patients with Non-Communicable Diseases			
Diabetes			33, (16.5)
Hypertension			33, (16.5)
Cardiovascular disease			11, (5.5)
Asthma			12, (6.0)
Kidney			4, (2.0)
Other			47, (23.5)
Social Factor Status	**Severely discriminated**	**Moderately discriminated**	**No discrimination**
	37, (18.5%)	15, (7.50%)	148, (74.0%)

SSC: Secondary School Certificate; **HSC:** Higher Secondary School Certificate

Table 2: Prevalence of Persistent Symptoms and Mental Health Outcomes.

Variables	N (%)	Male, N (%)	Female, N (%)
Fatigue	69.50%	94, (67.6)	45, (73.8)
Dyspnea	40.50%	49, (35.3)	32, (52.5)
Alopecia	35.50%	38, (27.3)	33, (54.1)
Headache	30.0%	29, (20.9)	31, (50.8)
Dry or wet cough	29.0%	40, (28.8)	18, (29.5)
Sore throat	23.50%	27, (19.4)	20, (32.8)
Chest pain	21.50%	31, (22.3)	12, (19.7)
Sweating	7.50%	9, (6.5)	6, (9.8)
Loss of the sense of taste & smell	3.0%	4, (2.9)	2, (3.3)
Difficulty completing the daily activity	13.50%	13, (9.4)	14, (23.0)
Having difficulty in professional life	30.0%	34, (24.5)	26, (42.6)
Other Complication	17.50%	26, (18.7)	9, (14.8)
Mental Health Outcomes			
Depression	71, (35.5)	45, (32.4)	26, (42.6)
Sleeping disturbance	73, (36.50)	41, (29.5)	32, (52.5)
Poor appetite or Over-eating	35, (17.50)	21, (15.1)	14, (23.0)
Memory impairment	97, (48.50)	59, (42.4)	38, (62.3)
Trouble Concentrating on things	69, (34.5)	48, (34.5)	21, (34.4)

Table 3: Patient's Food Intake during Covid-19 Affected Days and Prevalence of Persistent Symptoms according to Different Food Intake.

Variables	Regular, N (%)	Irregular, N (%)	Never, N (%)	X2/P-Value
Citrus fruits Intake	196, (98.0)	4, (2.0)	-	-
Other fruits Intake	137, (68.5)	50, (25.0)	13, (6.5)	-
Vegetable Intake	175, (87.5)	21, (10.5)	4, (2.0)	-
Fish Intake	142, (71.0)	37, (18.5)	21, (10.5)	-
Meat Intake	107, (53.5)	79, (39.5)	14, (7.0)	-
Milk Intake	105, (52.5)	29, (14.5)	66, (33.0)	-
Egg Intake	153, (76.5)	35, (17.5)	12, (6.0)	-
Vegetable Intake				
Chest distress	32, (18.3)	8, (38.1)	3, (75.0)	11.281 /0.004
Cough	50, (28.6)	5, (23.8)	3, (75.0)	4.401 /0.111
Dyspnea	66, (37.7)	11, (52.4)	4, (100.0)	7.670 /0.022
Other symptoms suffering now	27, (15.4)	5, (23.8)	3, (75.0)	10.259 /0.006
Having difficulty in professional life	47, (26.9)	11, (52.4)	2, (50.0)	6.594/0.037
Other Fruits Intake				
Depression	42, (30.7)	21, (42.0)	8, (61.5)	6.175 /0.046
Fatigue	97, (70.8)	29, (58.0)	13, (100.0)	8.934 /0.011
Dry/Wet cough	35, (25.5)	15, (30.0)	8, (61.5)	7.502 /0.023
Did not suffer from any symptoms	23, (62.2)	14, (37.8)	0, (0.0)	6.210 /0.045
Did not return to regular activity	12, (8.8)	12, (24.0)	3, (23.1)	8.378/0.015
Egg Intake				
Sleeping disturbance	56, (36.6)	9, (25.7)	8, (66.7)	6.468/0.039
Milk Intake				
Chest distress	16, (15.2)	6, (20.7)	21, (31.8)	6.614 /0.037

OTHER FRUITS: Available Seasonal Fruits, Excluding Citrus fruits.

SUBJECTS AND METHODOLOGY

Study design and Participants

This research was conducted by the Jashore University of Science and Technology's (JUST) Department of Nutrition and Food Technology. The research ethics committee of the university approved the study protocol. The JUST Genome Center provided the patients' basic information and contact information. The research is a cross-sectional survey between December 2, 2020, and January 12, 2021. For this study, a total of 411 patients were contacted. Among them, 203 patients verbally agreed to participate in the trial. Three samples were eliminated during the screening process due to missing data. The participants in this study ranged in age from 20 to 60 years old and had tested positive for COVID-19 at the JUST Genome Center. The participants tested positive between August 20, 2020, to October 13, 2020. They tested positive by using real-time PCR machines. COVID-19 patients in Bangladesh were required to be quarantined for 14 days or more after testing positive and later tested negative, according to treatment standards. Thus, it was ensured that the time since testing positive for the covid-19 for all subjects was more than three months. The patients are from Jashore, Shatkhira, Jhenaidah, and Chuadanga. The data were collected from December 2, 2020, to January 12, 2021.

Questionnaire development

The data was collected from the respondents using a closed-ended questionnaire. A pre-tested, semi- structured English questionnaire (translated into Bangla during the interview) was used to collect information from the participant. The questionnaire was pre-tested on ten people in a group similar to the target population to check that the material was appropriate and understandable and that the questions flowed well. The questionnaire had seven parts:

i) Patient demographics: age, gender, religion, monthly income, living area, profession, degree of education, present condition, recovery timeframes, number of family members, and number of family members infected.

ii) Patient's cigarette smoking/tobacco use, difficulty with daily tasks, return to work, financial impact/loss, maintaining physical exercise at least three times per week, memory impairment, and patient fear about re-contamination.

iii) Patient's chronic disease status: Diabetes mellitus, Hypertension, Cardiovascular disease, Asthma, Kidney disease, and others.

iv) Persistent symptoms: Fatigue, Chest pain, Cough, Dyspnea, Sweating, Sore throat, Alopecia, Anosmia/Ageusia, Headache, and Others.

v) Mental health outcomes: A validated Bangla version of the PHQ-9 [46] was used to determine the severity of depressive symptoms [47, 48]. The PHQ-9 is a nine-item

questionnaire that asks about sleep, tiredness, changes in appetite, concentration problems, and suicidal thoughts in the last two weeks. "Do you have difficulties falling or staying asleep, or do you sleep too much?" [49] Is an example question with a four-point Likert scale ranging from 0 ("Not at all") to 3 ("Nearly every day"). The total score was determined by adding the raw scores of each item, which ranged from 0 to 27, with a higher score indicating greater depression severity. The reliability coefficient Cronbach's α of the PHQ-9 scale was 0.83 for this study.

vi) Social factor: For the current study with COVID-19 patients, we used a 5-item perceived discrimination scale based on comparable scales previously used to assess HIV patients' discrimination. "My family refuses to live with me," "I am rejected by my neighbors and community," "my family members are rejected by relatives and neighbors," "relatives and friends are terrified of me," and "I am subjected to verbal abuse" are the inquiries. "None of the time" (score 0), "a little" (score 1), "moderate" (score 2), "severe" (score 3), and "extremely serious" (scoring 4) were among the items replies (score 4). A higher score suggests more discrimination is being experienced [50].

Vii) Patient's dietary pattern during disease days: Taking citrus fruit, other fruits, Vegetables, Fish, Meat, Milk, and Egg (Regularly, Irregularly, Never) when they were positive for covid-19 were recorded. Taking a specific food group at least once a day was considered regular, whereas at least three times a week was considered irregular.

Data collection and analysis

"Data" was collected over the phone in the presence of a qualified supervisor. The "JUST" Genome Center's electronic medical record system provided demographic information such as age, gender, and religion. The data was entered and analyzed using Statistical Package for Social Sciences (SPSS v16 for Windows). Descriptive statistics (e.g., frequencies, percentages, means, and standard deviations) and some first-order analyses (e.g., Chi-square tests and independent t-tests) were performed. A P-value of <0.05 was considered significant in all the analyses.

RESULTS

One hundred thirty-nine men (69.50 %) and 61 women (30.50 %) were among the participants. The majority of the subject's residents are Urban (51 %). In terms of occupation, the majority of the participants were job holders (61 %). The participant responded about their educational background, which could affect their understanding of Covid-19 and health awareness. A total of 115 people (57.50%) have completed higher education. Around 35 % of participants have SSC and HSC degrees, while 13 (6.5%) participants do not have an SSC degree. The Mean ±SD age was 38.36±10.18 years old. The Mean ±SD monthly income was 31463 ±19477 taka (n= 41). Besides this, the mean ±SD Number of family members was 4.7±2.3, and 1.7±1.13 (Mean ±SD) numbers of family members affected by Covid-19. Concerning the non-communicable disease history, a large number of participants have diabetes (33), cardiovascular disease (11), hypertension (33), and other (46) chronic diseases. Around 78% of the participants tested positive for covid-19 once, while 22.50% tested positive more than once. Moreover, 14.50% of patients had a high viral load during their real-time PCR tests. In addition, 17% of participants were covid-19 positive for more than 30 days. Only 15.50 % of the patient admitted to the hospital. There were no female patients who smoked. Only 25 % of the male participants smoke cigarettes or use other tobacco products. Approximately 41.5 % of individuals exercise at least three times per week. Because of the covid-19 pandemic, 58% of participants claimed they had been financially affected. On top of that, 18.50% had experienced horrible treatment in their community for being affected by Covid-19.

The common persistent symptoms among the participants are fatigue (69.50%), dyspnea (40.50%), alopecia (35.5%), headache (30.0%), cough (30.0%), and Chest pain (21.50%). Among the female Samples, those suffering from fatigue (73.8%), dyspnea (52.5%), alopecia (54.1%), and headache (50.8%) are significantly high, while fatigue (67.6%) and dyspnea (35.3%) are more common among the male patients. Female individuals get twice as many headaches and alopecia as male participants. Compared to male participants (9.4 %), the percentage of female participants (23.0%) who have difficulty completing daily activities is more than double. Furthermore, female participants (42.6%) face more professional challenges than male participants (24.5%). According to the findings, 71 patients (35.5%) had moderate or severe depression. While 48.50 % of the patients have memory impairment, 34.50% have difficulty concentrating. Furthermore, 17.50% of people have eating disorders, and 36.50% have sleep disturbances. Female participants (42.6%) are more depressed than male participants (32.4%). Sleep disturbances and eating disorders are also more common among women than men.

In this study, participants were questioned about their diets while infected with covid-19. The majority of participants (98%) took citrus fruits regularly. Regular intake of Other fruits with citrus fruits was typical among the participants (68.50%). Besides, 87.50% of participants took vegetables regularly. Among the protein-rich food, egg intake (76.50%) was higher. Respectively, 71%, 53.50%, and 52.50% of patients regularly took fish, meat, and milk. However, some participants never consumed milk (33%), fish (10.5%), and meat (7%) when they were affected by Covid-19.

In addition, 61.5% of patients with depression never ate other fruits. Participants who did not take Other fruits regularly are suffering from fatigue (100%), cough (61.5%), and also having difficulty completing their daily tasks (23.1%). Participants who abstained from Other fruits were significantly more likely to report fatigue (P=0.011), cough ((P=0.023), and difficulty completing the daily task (P=0.015). Participants who had vegetables regularly;

most of them are free from cough (71.4%), dyspnea (62.3%), chest distress (81.7%), and other symptoms (15.45%). Besides, 73.1% did not have difficulty in their professional life. Regular vegetable consumers were significantly less likely to report dyspnea ((P=0.022), chest distress (P=0.004), other symptoms (P=0.006), and difficulty in professional life (P=0.022). Sleeping disruption (66.7%) and chest distress (48.8 %) were frequent among those who had never had eggs or milk. Regular egg and milk consumers were significantly less likely to report sleeping disturbance (P=0.039) and chest distress (P=0.037).

DISCUSSION

Among the 200 participants, 15.50 % of the participants were hospitalized. This finding is close to a recent study in which 21% were reported being hospitalized with COVID-19 [51]. Twenty-five percent of the male participants smoke cigarettes or use other tobacco products. Tobacco smoke exposure is a risk factor for lung disease [11], and cigarette smoking is a notable risk factor for viral and bacterial infections [12]. Because of the covid-19 pandemic, 58% of participants claimed they had been financially affected. This figure is lower than Vietnam's (66.9%) but higher than India's (45.6%) [52, 53]. On top of that, 18.50% of the participants were severely abused by their community because of being positive for Covid-19. Such behaviors may jeopardize disease-prevention initiatives, leading to a lack of testing and healthy practices such as wearing masks to avoid discrimination [31].

According to this study, the common persistent symptoms among the participants are fatigue (69.50%), dyspnea (40.50%), alopecia (35.5%), headache (30.0%), cough (30.0%), and Chest pain (21.50%). Fatigue, cough, dyspnea, chest pain, altered smell and taste, and cognitive impairment are among the first documented chronic symptoms [3, 4, 5]. A research of 43,565 persons conducted in November 2020 discovered that hair loss, often known as alopecia, is connected to severe COVID-19 illness [6]. According to a recent study, the post-COVID-19 syndrome is characterized by several symptoms, the most common of which are fatigue and sleep disturbances [54]. Some prevalent symptoms are dyspnea, joint pains, anxiety, low mood, cognitive dysfunction, chest pain, thromboembolism, hair loss, and chronic kidney disease [54].

COVID-19 has been linked to being associated with neurological impairment in recent studies [23]. While 48.50 % of the patients have memory impairment, 34.50% have difficulty concentrating. Furthermore, 17.50% of people have eating disorders, and 36.50% have sleep disturbances. Another recent study found that 37.3 % of people had memory problems, 35.1 % had sleep disturbance, and 25.4

% had trouble concentrating [55]**.** The COVID-19 pandemic has resulted in poor sleep quality and insomnia, according to studies in the general population and COVID-19 patients [56, 57]. Our findings showed that 71 patients (35.5%) had moderate or severe depression. A study in Bangladesh conducted in a similar setting with a similar age range, education level, and resident areas finds that 47.2% of participants had depression four months after the COVID-19 outbreak. Among the female participants, those suffering from fatigue (73.8%), dyspnea (52.5%), alopecia (54.1%), and headache (50.8%) are higher, while Fatigue (67.6%) and Dyspnea (35.3%) are more common among the male patients. Female participants are twice likely to suffer from headaches and alopecia than male participants. Difficulty completing daily activities and facing professional challenges is also double among the female participants. More female participants (42.6%) have depression than male participants (32.4%). Previous research has found that females are more likely than males to be depressed [58, 59]. Sleep disturbances and eating disorders are also more common among women than men. Females may be more emotionally vulnerable and more susceptible to pressures associated with negative psychological impacts, such as the death of friends or family members. These aspects may be relevant during a pandemic [59, 60].

At the start of the COVID-19 pandemic, the focus was on controlling the virus's transmission and preventing infection. The health of COVID-19 survivors should be a priority now. [61]. Nutrition and food should be supplied for these patients without scientific proof to control the pandemic [32]. In this study, participants were questioned about their diets while infected with covid-19. The majority of participants (98%) took citrus fruits regularly. Citrus fruit is one of nature's best and most accessible sources of vitamin C, a crucial ingredient for immune system support [34]. The participants regularly consumed other fruits with citrus fruits every day (68.50%). Even though practically all fruits benefit human health and immunity, it has been proven that apples, sitaphal, and papaya have antiviral properties against particular viruses [35,36].

Besides this, 87.50% of participants took vegetables regularly. Fresh vegetables containing suitable amounts of zinc, iron, and vitamins A, B 12, B6, C, and E are vital for maintaining good health [37]. Among the protein-rich food, egg intake (76.50%) was higher. Respectively, 71%, 53.50%, and 52.50% of patients regularly took fish, meat, and milk. However, some participants never consumed milk (33%), fish (10.5%), and meat (7%) when they were affected by Covid-19. It has been suggested that adding high-biological value proteins (such as those found in eggs, lean meat, fish, and dairy) that contain all of the essential amino acids may have anti-inflammatory properties [38].

In addition, 61.5% of patients with depression never ate other fruits. Epidemiological studies have reported a lower risk of depression linked to high fruit and vegetable consumption [62]. Participants who did not take other fruits regularly are suffering from fatigue (100%), Cough (61.5%), and also having difficulty completing their daily tasks (23.1%). Participants who abstained from Other fruits were significantly more likely to report Fatigue (P=0.011), Cough ((P=0.023), and Difficulty completing the daily task (P=0.015). Participants who had vegetables regularly; most of them are free from cough (71.4%), dyspnea (62.3%), Chest distress (81.7%), and other symptoms (15.45%). Besides, 73.1% did not have difficulty in their professional life. Regular vegetable

consumers were significantly less likely to report dyspnea ((P=0.022), Chest distress (P=0.004), other symptoms (P=0.006), and difficulty in professional life (P=0.022). According to a study, patients with poor nutrition are more likely to develop Post-COVID-19 syndrome [63].

Sleeping disruption (66.7%) and chest distress (48.8 %) were frequent among those who had never had eggs or milk. Regular egg and milk consumers were significantly less likely to report Sleeping disturbance (P=0.039) and Chest distress (P=0.037). An overall healthy diet rich in fruits and vegetables, as well as bioactive compound constituents like omega-3 fatty acids, combined with a low intake of trans- fats and refined carbohydrates, has been found to improve psychological well-being and may thus play a role in recovery from the post-COVID-19 syndrome [64].

CONCLUSION

- Survivors of COVID-19 experience fatigue, shortness of breath, and alopecia more often.
- The occurrence of depression and short-term memory loss is significantly high, especially among women.
- A substantial number of COVID-19 patients have faced harassment from their community.
- Diet pattern influences persistent symptoms and mental health outcomes.

LIMITATIONS

- Because telephone follow-up differs from face-to-face communication, the obtained data's dependability may be compromised.
- The study sample size was small.
- Mental health outcomes were the sum score of diagnostic criteria and cut-off based; may lead to bias.

RECOMMENDATION

- Proper care of persistent symptoms should take seriously.
- Mental health should promote as a critical component of overall health.
- Maintaining an adequate diet and regular physical exercise is necessary to fight against Covid-19.
- Further studies on the individual topic need to conduct to know more about Covid-19 etiology.

REFERENCES

1. World Health Organization. Coronavirus disease 2019 (COVID-19) situation report–51. Geneva, Switzerland: World Health Organization; 2020.
2. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020; 395: 507-513.
3. Carfì A, Bernabei R, Landi F. Persistent symptoms in patients after acute COVID-19. JAMA. 2020; 324: 603-605.
4. Carvalho-Schneider C, Laurent E, Lemaignen A, Beaufils E, Bourbao-Tournois C, Laribi S, et al. Follow-up of adults with noncritical COVID-19 two months after symptom onset. Clin Microbiol Infect. 2021; 27: 258-263.
5. Fjaeldstad AW. Prolonged complaints of chemosensory loss after COVID-19. Dan Med J. 2020; 67: A05200340.
6. CDC (2020). https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/ symptoms.html
7. Islam MS, Potenza MN, van Os J. Posttraumatic stress disorder during the COVID-19 pandemic: upcoming challenges in Bangladesh and preventive strategies. Int J Soc Psychiatry. 2021; 67: 205-206.
8. Gebhard C, Regitz-Zagrosek V, Neuhauser HK, Morgan R, Klein SL. Impact of sex and gender on COVID-19 outcomes in Europe. Biol Sex Differ. 2020; 11: 29.
9. Duranton G, Puga D. The economics of urban density. JEP. 2020; 34: 3-26.
10. Jordan RE, Adab P, Cheng KK. Covid-19: risk factors for severe disease and death. BMJ. 2020; 368.
11. Strzelak A, Ratajczak A, Adamiec A, Feleszko W. Tobacco smoke induces and alters immune responses in the lung triggering inflammation, allergy, asthma and other lung diseases: a mechanistic review. Int J Environ Health Res. 2018; 15: 1033.
12. Arcavi L, Benowitz NL. Cigarette smoking and infection. Arch Intern Med. 2004; 164: 2206-2216.
13. Vickers NJ. Animal communication: when i'm calling you, will you answer too?. Curr Biol. 2017; 27: R713-R715.
14. Zürcher K, Zwahlen M, Ballif M, Rieder HL, Egger M, Fenner L. Influenza pandemics and tuberculosis mortality in 1889 and 1918: analysis of historical data from Switzerland. PLoS One. 2016; 11: e0162575.
15. Rajkumar RP. COVID-19 and mental health: A review of the existing literature. Asian J Psychiatr. 2020; 52: 102066.
16. Lee Y, Rosenblat JD, Lee J, Carmona NE, Subramaniapillai M, Shekotikhina M, et al. Efficacy of antidepressants on measures of workplace functioning in major depressive disorder: A systematic review. J Affect Disord. 2018; 227: 406-415.
17. Gomez-Pinilla F. The influences of diet and exercise on mental health through hormesis. Ageing Res Rev. 2008; 7: 49-62.
18. Iddir M, Brito A, Dingeo G, Fernandez Del Campo SS, Samouda H, La Frano MR, eta al. Strengthening the immune system and reducing inflammation and oxidative stress through diet and nutrition: considerations during the COVID-19 crisis. Nutrients. 2020; 12: 1562.
19. Al Saleh Y, Beshyah SA, Hussein W, Almadani A, Hassoun A, Al Mamari A, et al. Diagnosis and management of vitamin D deficiency in the Gulf Cooperative Council (GCC) countries: An expert consensus summary statement from the GCC vitamin D advisory board. Arch Osteoporos. 2020; 15: 35.
20. Hughes DA, Norton R. Vitamin D and respiratory health. Clin Exp Immunol. 2009; 158: 20-25.
21. Leonard BE. The immune system, depression and the action of anti depressants. Prog Neuropsychopharmacol Biol Psychiatry. 2001; 25: 767-780.

22. Wu KK, Chan SK, Ma TM. Posttraumatic stress, anxiety, and depression in survivors of severe acute respiratory syndrome (SARS). J Trauma Stress. 2005; 18: 39-42.

23. Wu Y, Xu X, Chen Z, Duan J, Hashimoto K, Yang L, et al. Nervous system involvement after infection with COVID-19 and other coronaviruses. Brain Behav Immun. 2020; 87: 18-22.

24. Husain SF, Tang TB, Yu R, Tam WW, Tran B, Quek TT, et al. Cortical haemodynamic response measured by functional near infrared spectroscopy during a verbal fluency task in patients with major depression and borderline personality disorder. EBioMedicine. 2020; 51: 102586.

25. Subramaniapillai M, Mansur RB, Zuckerman H, Park C, Lee Y, Iacobucci M, et al. Association between cognitive function and performance on effort based decision making in patients with major depressive disorder treated with Vortioxetine. Compr Psychiatry. 2019; 94:152113.

26. Al Zubayer A, Rahman ME, Islam MB, Babu SZD, Rahman QM, Bhuiyan MRAM, et al. Psychological states of Bangladeshi people four months after the COVID-19 pandemic: an online survey. Heliyon. 2020; 6: e05057.

27. Islam MS, Sujan MSH, Tasnim R, Sikder MT, Potenza MN, Van Os J. Psychological responses during the COVID-19 outbreak among university students in Bangladesh. PloS one. 2020; 15: e0245083.

28. Safa F, Anjum A, Hossain S, Trisa TI, Alam SF, Rafi MA, et al. Immediate psychological responses during the initial period of the COVID-19 pandemic among Bangladeshi medical students. Child Youth Serv Rev. 2021; 122: 105912.

29. Tasnim R, Sujan M, Hossain S, Islam M, Ritu AH, Siddique M, et al. Prevalence and correlates of anxiety and depression in frontline healthcare workers treating people with COVID-19 in Bangladesh. BMC psychiatry. 2021; 21: 271.

30. Mina FB, Billah M, Karmakar S, Das S, Rahman MS, Hasan MF, et al. An online observational study assessing clinical characteristics and impacts of the COVID-19 pandemic on mental health: a perspective study from Bangladesh. Z Gesundh Wiss. 2021; 1-9.

31. Turner-Musa J, Ajayi O, Kemp L. Examining social determinants of health, stigma, and COVID-19 disparities. In Healthcare. 2020; 8: 168.

32. Adhikari SP, Meng S, Wu YJ, Mao YP, Ye RX, Wang QZ, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. Infect Dis Poverty. 2020; 9: 29.

33. Davison G, Kehaya C, Wyn Jones A. Nutritional and physical activity interventions to improve immunity. Am J Lifestyle Med. 2016; 10: 152-169.

34. Lv X, Zhao S, Ning Z, Zeng H, Shu Y, Tao O, et al. Citrus fruits as a treasure trove of active natural metabolites that potentially provide benefits for human health. Chem Cent J. 2015; 9: 68.

35. Suchitra MR, Parthasarathy S. International Journal Of Research in Pharmaceutical Sciences.2020.

36. Konowalchuk J, Speirs JI. Antiviral effect of apple beverages. Appl Environ Microbiol. 1978; 36: 798-801.

37. Aman F, Masood S. How Nutrition can help to fight against COVID-19 Pandemic. Pak J Med Sci. 2020; 36: 121-123.

38. Iddir M, Brito A, Dingeo G, Fernandez Del Campo SS, Samouda H, La Frano MR, et al. Strengthening the immune system and reducing inflammation and oxidative stress through diet and nutrition: considerations during the COVID-19 crisis. Nutrients. 2020; 12: 1562.

39. Lordan R, Tsoupras A, Zabetakis I. Platelet activation and prothrombotic mediators at the nexus of inflammation and atherosclerosis: Potential role of antiplatelet agents. Blood Rev. 2021; 45: 100694.

40. Matsuoka Y, Hamazaki K. Considering mental health from the viewpoint of diet: the role and possibilities of nutritional psychiatry. Seishin Shinkeigaku Zasshi. 2016; 118: 880-894.

41. Paul R. "Bangladesh confirms its first three cases of coronavirus". Reuters. 2020.

42. (IEDCR), Institute of Epidemiology, Disease Control and Research. Y TNT \NYNT. corona.gov.bd (in Bengali). Archived from the original on 22 March 2020. Retrieved 3 May 2020.

43. Nooruddin I, Shahid R. Defusing Bangladesh's COVID-19 time bomb. Atlantic Council. 2020; 30.

44. 10 ICU beds for 1.2 million: COVID-19 catastrophe looms in Cox's Bazar. Reliefweb, 2020.

45. Y TNT T\ T : ℓ T ¢ TYR RT?YR ⍰RℓY. Prothom Alo (in Bengali). Archived from the original on 30 March 2020. Retrieved 30 March 2020.

46. Chowdhury AN, Ghosh S, Sanyal D. Bengali adaptation of brief patient health questionnaire for screening depression at primary care. J Indian Med Assoc. 2004; 102: 544-547.

47. Moonajilin MS, Rahman ME, Islam MS. Relationship between overweight/obesity and mental health disorders among Bangladeshi adolescents: a cross-sectional survey. Obes Med. 2020; 18:100216.

48. Islam S, Akter R, Sikder T, Griffiths MD. Prevalence and factors associated with depression and anxiety among first-year university students in Bangladesh: a cross-sectional study. Int J Ment Health Addict. 2020; 1-14.

49. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care Evaluation of Mental Disorders. Patient Health Questionnaire. Jama. 1999; 282: 1737-1744.

50. Liu D, Baumeister RF, Veilleux JC, Chen C, Liu W, Yue Y, et al. Risk factors associated with mental illness in hospital discharged patients infected with COVID-19 in Wuhan, China. Psychiatry Res. 2020; 292: 113297.

51. Islam M, Ferdous M, Islam US, Mosaddek ASM, Potenza MN, Pardhan S. Treatment, persistent symptoms, and depression in people infected with COVID-19 in Bangladesh. Int J Environ Res Public Health. 2021; 18: 1453.

52. Tran BX, Nguyen HT, Le HT, Latkin CA, Pham HQ, Vu LG, et al. Impact of COVID-19 on economic well-being and quality of life of the Vietnamese during the national social distancing. Front Psychol. 2020; 11: 565153.

53. Keelery S. Impact on household income due to the coronavirus (COVID-19) in India from February to April 2020. 2020.

54. Iqbal F M, Lam K, Sounderajah V, Clarke JM, Ashrafian H, Darzi A. Characteristics and predictors of acute and chronic post-COVID syndrome: A systematic review and meta-analysis. EClinicalMedicine. 2021; 36: 100899.

55. Sykes DL, Holdsworth L, Jawad N, Gunasekera P, Morice AH, Crooks MG. Post-COVID-19 symptom burden: what is long-COVID and how should we manage it?. Lung. 2021; 199: 113- 119.

56. Barrea L, Pugliese G, Framondi L, Di Matteo R, Laudisio D, Savastano S, et al. Does Sars-Cov-2 threaten our dreams? Effect of quarantine on sleep quality and body mass index. J Transl Med. 2020; 18: 318.

57. Krishnamoorthy Y, Nagarajan R, Saya GK, Menon V. Prevalence of psychological morbidities among general population, healthcare workers and COVID-19 patients amidst the COVID-19 pandemic: A systematic review and meta-analysis. Psychiatry Research. 2020; 293, 113382.

58. Hossain S, Anjum A, Uddin ME, Rahman MA, Hossain MF. Impacts of socio- cultural environment and lifestyle factors on the psychological health of university students in Bangladesh: a longitudinal study. J Affect Disord. 2019; 256: 393-403.

59. Van Droogenbroeck F, Spruyt B, Keppens G. Gender differences in mental health problems among adolescents and the role of social support: results from the Belgian health interview surveys 2008 and 2013. BMC Psychiatry. 2018; 18: 6.

60. Matheson FI, Smith KL, Moineddin R, Dunn JR, Glazier RH. Mental health status and gender as risk factors for onset of physical illness over 10 years. J Epidemiol Community Health. 2014; 68: 64-70.

61. Klok FA, Boon GJ, Barco S, Endres M, Geelhoed JM, Knauss S, et al. The Post-COVID-19 Functional Status scale: a tool to measure functional status over time after COVID-19. Eur Respir J. 2020; 56: 2001494

62. Lassale C, Batty GD, Baghdadli A, Jacka F, Sánchez-Villegas A, Kivimäki M, et al. Healthy dietary indices and risk of depressive outcomes: a systematic review and meta-analysis of observational studies. Mol Psychiatry. 2019; 24: 965-986.

63. Butler MJ, Barrientos RM. The impact of nutrition on COVID-19 susceptibility and long-term consequences. Brain Behav Immun. 2020; 87: 53-54.

64. Barrea L, Grant WB, Frias-Toral E, Vetrani C, Verde L, de Alteriis G, et al. Dietary recommendations for post-COVID-19 syndrome. Nutrients. 2022; 14: 1305.