

Nutritional status and dietary habit of COVID-19 patients: A study in a tertiary hospital

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Abstract

Background: Nutritional status has impact on body immune function that is important for controlling disease process and prognosis of the newly emerging Coronavirus Disease 2019 (COVID-19). As no vaccine or specific antiviral treatment is not available for COVID-19, therefore, improvement of nutritional status is important. Adequate and appropriate diet is required for maintaining good nutritional status. There is very few research carried out to evaluate the influence of nutritional status and dietary habit of patients with COVID-19.

Objective: To study the nutritional status and dietary habit of COVID-19 patients admitted in a tertiary hospital of Dhaka, Bangladesh and its impact on the severity of the disease COVID-19.

Methodology: A cross-sectional study was performed on 384 patients in the Corona unit of Holy Family Red Crescent Hospital during 17th May to 31st December 2020. Patients were selected conveniently according to inclusion criteria. COVID-19 patients were categorized as Mild, Moderate and Severe cases according to National Institute of health and latest Public Health Information from Centers for Disease Control (CDC). Direct interviewing of the selected patients with pretested structured questionnaire, data were collected on socio demographic characteristics, nutritional status following Body Mass Index (BMI) grading, daily consumption of different food items in the last 3 months and dietary habits in the last 3 months of these three categories of patients. Written consent of the patient and ethical clearance was obtained prior to data collection. All statistical analyses were performed by using the SPSS software version 21.

Result: A total of 384 patients interviewed. Age distribution was Mean \pm SD, 42.85 \pm 13.82. Male/Female ratio 1.33. Most of them were graduates, 33.1% and 42.9% were Govt. service holders. Monthly family income was Tk 35000 (taka thirty-five thousand) and above in 39.6% cases. Regarding source of infection in these patients, 40.3% and 35.2% from traveling abroad and shopping respectively. Urban dwellers were 75% and 25% from rural area. Nutritional status of COVID-19 patients was calculated according to BMI grading. Among all Underweight COVID-19 patients- 90% were Moderate cases. Among all Normal nutritional status COVID-19 patients we found 37.5%, 41.7% and 20.8% were in mild cases, moderate cases, and severe cases respectively. Regarding Overweight COVID-19 patients we found 46.7% and 32.7% in moderate and in severe cases. Obese 1 were 48.1% in moderate cases and 32.1% in severe cases of COVID-19 patients. On the other hand, all (100%) obese 2 patients were moderate cases. BMI found statistically significant $p = 0.002$. Regarding food items protein showed statistically significant ($p = 0.04$). In severe cases having good sun exposure was found in only 19.5% cases. Regarding dietary habit of COVID-19 patients, most of the variables were found statistically significant, i.e skipping of their meal ($p = 0.016$), number of meal ($p = 0.040$), quality of food ($p = 0.014$), taking food according to daily requirement ($p = 0.021$) and eating extra salt with food ($p = 0.029$).

Conclusion: Considering the result, it can be concluded that COVID-19 patients were mostly middle aged from urban areas with average economic status. Source of infection was from traveling abroad and shopping. Nutritional status of most of Moderate and Severe COVID-19 cases were under weight, obese 1 and obese 2. Concerning diet and dietary habit, protein, skipping of meal, number of meals, variety of food, eating food according to daily requirement and eating extra salt with food significantly associated with the severity of COVID-19. This was a single centered study with a small sample size. A multicenter, larger sample size study recommended for confirming our data and to get an actual view of the nutritional status and dietary habit of COVID-19 patients.

Keywords: Dietary habit, Nutritional status, COVID-19.

DOI: <https://doi.org/10.3329/nimcj.v13i1.73543>

Northern International Medical College Journal Vol. 13 No. 1-2 July 2021-January 2022, Page 574-580

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Introduction

Newly emerging Corona virus Disease 2019 (COVID-19) is caused by a new corona virus called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) also called noble Corona virus 2019-nCoV.¹ The outbreak of the

2019 novel Corona virus disease (COVID-19) first reported in late December 2019 solely in the city of Wuhan, China.² Then it continued to spread throughout the world. By the end of January 2020, WHO declared COVID-19 as a public health emergency of international

concern³ and due to its quick transmission and rapid spread throughout the world, WHO characterized this epidemiological phenomenon as a global pandemic on 11 March 2020.⁴

Since its first identification in Wuhan, China by October 2020, WHO has reported 44,351,506 confirmed cases of COVID-19, including 1,171,255 deaths because the incidence of COVID-19 continues to increase.⁵ SARS-CoV-2 belongs to the same coronavirus group (Beta corona virus) as SARS and MERS viruses because of structural similarity. This highly contagious virus transmitted through respiratory droplets and aerosols, direct contact of mucous membranes and probably the fecal–oral route.⁶

As described by the Centers for Disease Control (CDC), the most common symptoms of the illness include fever, cough, fatigue, anorexia, dyspnea, sputum production and myalgia, however, a significant number of infected cases (43.8%) do not exhibit fever or radiological abnormalities on the initial presentation. Therefore, human-to-human transmissions are facilitated by unidentified asymptomatic carriers (particularly healthcare providers) during the incubation period (usually 5–7 and as long as 28 days).⁷

As there are no vaccines or specific antiviral treatments for COVID-19 not yet developed. It is very important for patients to improve the immune function for the elimination of SARS-CoV-2 from the respiratory tract and the control of extra pulmonary dissemination. Appropriate nutrition plays a role in the improvement of the immune system and malnutrition resulted in an increased rate of infections. To reduce the incidence and improve the prognosis of COVID-19 a good nutritional status is expected.

Obesity is an expansion of the adipose tissue, which produces cytokines and contributes to a proinflammatory milieu influencing innate and adaptive immune responses. There is an increase in risk of infections from several pathogens such as influenza and corona virus.^{8,9} Expression of angiotensinogen, angiotensin-converting enzyme (ACE-2), IL-6 and TNF- α were significantly elevated in both malnutrition and obesity trigger other diseases that can be avirulence factor for the severity of COVID-19.¹⁰

Several diets with anti-inflammatory characteristics have a prominent role when associated with healthy, nutritionally balanced food choices aimed at maintaining weight, reducing cell stress and the full functionality of the body. These diets support the immune system, preventing, protecting, and combating opportunistic infections and, consequently, may modulate the severity of COVID-19.¹¹ Dietary sources or body stores provide nutrients requirements. A review study highlighted the critical role of diet and relevant nutrients to diminish inflammation and oxidative stress. Subclinical

deficiencies of micro and macronutrients may have a negative effect on body immune responses. A recent review has emphasized on optimum nutrition status as important factor for a well-functioning of immune system against viral infections.¹²

There is scarcity of data regarding the impact or association of nutritional status and dietary habit of patients on the severity of COVID-19 disease. Therefore, the aim of the research is to assess the nutritional status and dietary habit of COVID-19 patients with different level of severity admitted in a tertiary hospital.

Methodology

This cross-sectional study was carried out on 384 patients in the Corona unit of Holy Family Red Crescent Hospital during 17th May to 31st December 2020. Among the admitted patients, those who fulfilled the inclusion criteria were selected conveniently for the study. Direct interviewing of the selected patients with pretested structured questionnaire data was collected. Informed written consent was obtained prior to study participation and ethical clearance was taken from the concerned body of this institution.

Inclusion criteria:

- i) Patients who were RTPCR test positive for Corona Virus
- ii) Patients who were between 16-85 years
- iii) Both male and female patients
- iv) Capable of independent communication

Exclusion criteria:

- i) Under 16 years old of both gender
- ii) Patients who were in Critical illness group
- iii) Not Capable of independent communication

National Institute of health and latest Public Health Information from CDC divided the COVID 19 patients in to following five categories¹³

Asymptomatic or Presymptomatic Infection:

Individuals who are test positive for SARS-CoV-2 using a virology test (i.e., a nucleic acid amplification test [NAAT] or an antigen test) but who have no symptoms that are consistent with COVID-19.

2) Mild Illness

Individuals who have any of the various signs and symptoms of COVID-19 e.g. fever, cough, sore throat, malaise, headache, muscle pain, nausea, vomiting, diarrhea, loss of taste and smell) but who do not have shortness of breath, dyspnea, or abnormal chest imaging.

3) Moderate Illness

Individuals who show evidence of lower respiratory disease

during clinical assessment or imaging and who have an oxygen saturation (SpO₂) <94% on room air at sea level.

4) Severe Illness

Individuals who have SpO₂ <94% on room air at sea level, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO₂/FiO₂) <300 mm Hg, respiratory frequency >30 breaths/min, or lung infiltrates >50%.

5) Critical Illness

Individuals who have respiratory failure, septic shock, and/or multiple organ dysfunction.

For our study, Mild, Moderate and Severe cases were considered. Data were collected on socio demographic characteristics, nutritional status following BMI (Body Mass Index) grading, daily consumption of different food items in the last 3 months and dietary habits in the last 3 months of these 3 categories of COVID 19 cases. (mild, moderate and severe)

For **nutritional status, Body Mass Index (BMI)** was calculated based on the following formula:

Body weight in kilogram divided by height in meter square.

Weight of the patient recorded in kilogram and height were measured in centimeter for Anthropometric measurements.

Nutritional status of COVID-19 patients was calculated according to BMI grading- are as follows:

- **Underweight** (BMI <18.5)
- **Normal nutritional status** (BMI - 18.5 – 24.9)
- **Overweight** (BMI-25.0 – 29.9)
- **Obese 1** (BMI -30.0 – 34.9)
- **Obese 2** (BMI-35.0 – 40)

Daily consumption of Different food items in the last 3 months – vegetables, coloured fruits, protein, carbohydrate, fatty food (oil, butter, cheese, ghee), vitamin D containing food (Liver, Orange juice, butter, cheese, milk, egg etc.) were recorded.

Dietary habit in the last 3 months –we recorded, skipped meals, number of meals taken in a day, variety of food, taking meals according to daily requirement. Eating processed food (junk food, tin food, frozen and preserved food), taking soft drinks, taking extra salt (pickles, chips, sauce, Chana Chur, salted biscuits etc.), sweets and sweetened foods and eating in the restaurant frequently.

Result

In this study it was found that 65.3% of the patients aged more than 40 years with 42.85 mean and ±13.82 standard deviation. Among the study patients, 57.1% were male, 85.7% were

Muslim. Most of the patients 81.5% were married and 33.1% patient's education was graduation level. Service holders found 60.6%, business person were 14.8% and only 3.4% were students. About 39.6% of patients' monthly income was 35000 BDT (taka thirty-five thousand) and above. About 75% of patients were from urban areas and 25% from rural areas. On the query about the source of infection 40.3% were found travelled abroad and 35.2% exposed in shopping (Table I).

Table I : Socio demographic information of COVID-19 patients

Variable	Level	Frequency (N)	Percentage (%)
Age Group	≤40 years(16 – 40yrs)	133	34.7
	>40 years (upto 85 yrs)	251	65.3
Age	Mean ±SD	42.85±13.82	
Gender	Male	219	57.1
	Female	165	42.9
Education level	Illiterate	1	0.26
	Primary	9	2.3
	SSC	54	14.1
	HSC	95	24.7
	Graduate	127	33.1
	Graduate and Above	98	25.5
Religion	Muslim	329	85.7
	Hindu	55	14.3
Profession	Labor	5	1.3
	Businessman	57	14.8
	Private service holder	67	17.7
	Government service holder	165	42.9
	Housewife	39	10.2
	Retired	28	7.3
	Student	13	3.4
	Others	10	2.6
	Monthly Family Income	Tk5000-15000	25
Income	Tk16000-Tk25000	85	22.1
	Tk26000-Tk35000	122	31.8
	Tk35000 and above	152	39.6
Marital status	Married	313	81.5
	Unmarried	56	14.6
	Divorced	15	3.9
Residence	Urban	288	75.0
	Rural	96	25.0
	Abroad travel	154	40.3
Source of infection	Shopping	135	35.2
	Mass gathering	49	12.3
	Infected by family member	28	7.5
	Unknown	18	4.7

COVID-19 patients were categorized as Mild, Moderate and Severe cases according National Institute of health and latest Public Health Information from CDC. Among the patients, mild cases were 79 (20.58%), moderate cases were 190(49.48%)

and

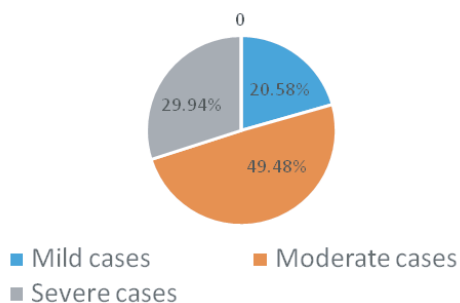


Fig.1 Categories of COVID-19 patients

Nutritional status of COVID-19 patients was calculated according

to BMI grading and the result showed that among all underweight COVID-19 patients- 90% were Moderate cases. Among all normal nutritional status COVID-19 patients we found 37.5%, 41.7% and 20.8% were in mild cases, moderate cases, and severe cases respectively. Regarding Overweight COVID-19 patients we found 46.7% and 32.7% in moderate and in severe cases. Obese 1 were 48.1% in moderate cases and 32.1% in severe cases of COVID-19 patients. On the other hand, all (100%) obese 2 patients were moderate cases . BMI found statistically significant $p = 0.002$. (Table II)

Table II : Nutritional status of COVID-19 patients

Nutritional status		total no	COVID -19 patients						X ² Value	P-value
			Mild		Moderate		Severe			
			Frequency	%	Frequency	%	Frequency	%		
BMI	<18.5 (Underweight)	10	1	10	9	90	0	0	24.641	0.002
	18.5-24.9 (Normal)	24	9	37.5	10	41.7	5	20.8		
	25.0-29.9 (Overweight)	257	53	20.6	120	46.7	84	32.7		
	30.0-34.9 (Obese-1)	81	16	19.8	39	48.1	26	32.1		
	35.0-40.0 (Obese-2)	12	0	0	12	100	0	0		

It was evident from the result that among the COVID-19 patients only 19.6% of severe cases consume protein and 33% did not, on the other hand in moderate and mild cases protein consumption was 54% and 26.4% and no consumption of protein was 18.9% and 48.1% respectively. It showed statistically significant $p = 0.04$. Regarding other food items,

severe cases consumed carbohydrate and fatty food higher (32.1% and 31.6% respectively), than the others. While moderate cases consumed more vitamin D containing foods 54.3%, coloured fruits 51.8% and vegetables 50.9%. Mild cases consumed vegetables and fatty foods more (20.7% and 21.4% respectively) than other cases (Table III).

Table III: Daily consumption of Food items of COVID-19 patients in the last 3 months

Daily Intake of Food items		COVID -19 patients						X ² Value	P-value
		Mild		Moderate		Severe			
		Frequency	%	Frequency	%	Frequency	%		
Vegetables	Yes	24	20.7	59	50.9	33	28.4	3.190	0.909
	No	55	20.5	131	48.9	82	30.6		
Colorful fruits	Yes	28	19.5	87	51.8	53	28.7	2.792	0.248
	No	51	21.1	103	47.4	62	31.5		
Protein	Yes	23	26.4	47	54	17	19.6	6.418	0.040
	No	56	18.9	143	48.1	99	33		
Carbohydrate	Yes	63	19.6	155	48.3	103	32.1	4.405	0.111
	No	16	25.4	35	55.6	12	19		
Fatty food (oil, butter, cheese, ghee)	Yes	57	21.4	125	47	84	31.6	2.159	0.340
	No	22	18.6	65	55.1	31	26.3		
Vitamin D containing food (Liver, Orange juice, butter, cheese, milk, egg etc.)	Yes	26	18.6	76	54.3	38	27.1	2.894	0.114
	No	53	21.7	114	46.7	77	31.6		

Regarding dietary habit of COVID-19 patients moderate and severe cases were used to skip their meals in 48.1% and 29.9% respectively. But only 17.5% of mild cases did not skip their meals; it was statistically significant $p=0.016$. The number of meals taken by COVID-19 patients showed that 5 meals per day were taken by 53.3% severe cases that was higher than mild and moderate cases (20% and 26.7% respectively). Results also showed that 2 meals (49.3%), 3 meals (49.3%) and 4 meals (51.6%) were higher in number in moderate cases. The number of meals was statistically significant $p=0.040$.

moderate and 30.3% severe cases did not take food according to daily requirements and that was also statistically significant $p=0.021$.

In this study moderate and severe cases found to take extra salt in 47.1% and 35.4% respectively and it was significant $p=0.029$.

Eating processed food, taking soft drink, sweets and sweetened foods, and eating in the restaurant frequently found not statistically significant. (Table IV)

Table IV : Dietary habit of COVID-19 patients in the last 3 months

Dietary habits		COVID -19 patients						χ ² value	p-value
		Mild		Moderate		Severe			
		Frequency	%	Frequency	%	Frequency	%		
Skipped meals	Yes	58	22	127	48.1	79	29.9	5.126	0.016
	No	21	17.5	63	52.5	36	30		
Having number of meals per day	2 Meals	47	22.1	105	49.3	61	28.6	4.201	0.040
	3 Meals	4	14.3	15	53.6	9	32.1		
	4 Meals	25	19.5	66	51.6	37	28.9		
	5 Meals	3	20.0	4	26.7	8	53.3		
Character of food	Fried	9	37.5	10	41.7	5	20.8	5.984	0.014
	Boiled	8	26.7	15	50	7	23.3		
	Extra spicy	48	19.7	120	49.2	76	31.1		
	Mild spicy	23	21.3	54	50	31	28.7		
Taking meals according to daily requirement	Yes	27	23.9	53	46.9	33	29.2	5.038	0.021
	No	52	19.2	137	50.5	82	30.3		
Eating processed food	Yes	47	20	112	49.1	69	30.3	2.587	0.386
	No	32	20.5	78	50.0	46	29.6		
Taking soft drinks frequently	Yes	53	21.7	114	46.7	77	31.6	2.037	0.361
	No	26	18.6	76	54.3	38	27.1		
Taking extra salt in food	Yes	36	17.5	97	47.1	73	35.4	7.057	0.029
	No	43	24.2	93	52.2	42	23.6		
sweets and sweetened foods frequently	Yes	41	19	114	52.8	61	28.2	2.174	0.337
	No	38	22.6	76	45.2	54	32.1		
Eat in the restaurant frequently	Yes	47	21.3	111	50.2	63	28.5	4.542	0.763
	No	32	19.6	79	48.5	52	31.9		

Frequently (having that food item 3 times or more per week)

Regarding character of food, moderate cases were found to take meals with more fried (41.7%), boiled (50%), extra spicy (49.2%) and mild spicy (50%) and character of food also significant $p=0.014$. The result also showed that 50.5%

Discussion

In the present study, we aimed to determine the nutritional status and dietary habit of COVID-19 patients and 384 patients with COVID-19 attending corona unit of Holy Family Red Crescent Hospital were interviewed.

Regarding sociodemographic characteristic of the patients, we found that age, Mean±SD 42.85±13.82, male 57.1% and female 42.9%. This result was different from the study done by H. Mohseni et al where mean age was 35.88 and female was 70.7%.¹ The study result showed 33.1% patient's education were at graduation level or higher, 39.6% patient's monthly income was 35000 BDT or above and 60.6% were service holder. These results indicate that most of the COVID-19 patients were educated service holders and from solvent families. Bangladesh is Muslim majority country; therefore, most of the patients, 85.7% were Muslim. The study done in a hospital situated in Dhaka, capital city of Bangladesh therefore majority patients (75%) was from urban area.

COVID-19 first identified in Wuhan city of China from there it transmitted to the whole world and finally declared as pandemic.² In our study, the source of infection was found mainly (40.3%) from travelling aboard. As it is a new disease people are unaware to wear mask and maintain social distance for prevention of transmission, 35.2% found infected from shopping.

Regarding nutritional status our study result showed underweight, overweight, obese 1 and obese 2 were found more in Moderate and Severe cases. Nutritional status was significant $p=0.002$. In a recent study showed majority severe cases were malnourished.¹⁴ Vegetables and colorful fruits are important food items that contains vitamin and minerals essential for improving immune system. Our result was consistent with a study which showed severe cases of COVID-19 had less intake of these 2 food items.¹⁵ Among the macronutrients (Protein, Carbohydrate, Fat) protein is directly involved in body immunity and our study result also showed significant association of protein consumption and COVID-19. In this study, we found that severe cases were less protein consumer. Similar results were also found by Aman F in his study.¹⁶

Goncalves and co-workers found vitamin D deficiency might be an important factor in Corona virus infection.¹⁷ Vitamin D deficiencies also found in COVID-19 infected patients admitted to a tertiary hospital in Italy.¹⁸ In our study we found that vitamin D containing foods were consumed less by moderate and severe cases.

Regarding dietary habit our study result showed that skipping of meal, number of meals, quality of food, taking food according to daily requirement and eating extra salt with food significantly associated with COVID-19. Leila Cheikh Ismail et al found similar results in their study.¹⁹ Eating processed food, taking soft drinks, sweets and sweetened foods more frequently, eat in the

restaurant frequently were found not significant in our study.

Conclusion

We conclude that the majority of the COVID-19 patients were of middle aged, educated, service holder from solvent family resided in urban area and they were mainly infected from travelling abroad and shopping. Nutritional status – malnutrition (underweight, overweight, obese 1 and obese 2) might have an association with the severity of COVID-19 as we found that the majority of moderate and severe cases were malnourished. Concerning diet and dietary habits, protein was significantly associated with COVID-19. Severe cases were found less consumer of protein, also less consumer of vegetables, colour fruits, vitamin D containing foods. Skipping meals, number of meals per day, quality of food, taking food according to daily requirement and eating extra salt with food significantly associated with COVID-19.

This was a single centered study with a small sample size. A multicenter, larger sample size study recommended confirming our data and to get actual view of association of the nutritional status and dietary habit of COVID-19 patients with the disease as well as severity of it.

Limitations

COVID-19 is a new illness therefore limited studies exist at the time when our work was started. As COVID-19 is a viral disease, it was not possible to talk with patients with longer time as there was a chance of contamination. The sample size of this study was small. It did not include critical patients due to the requirement of emergency management. Therefore, our findings could not be generalized in the context of Bangladesh.

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