



## LIFESTYLE AND IMMUNITY BOOSTING PRACTICES DURING COVID-19 PANDEMIC AMONG THE POPULATION OF RAJSHAHI DISTRICT, BANGLADESH

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### Abstract

Coronavirus disease 2019 (COVID-19) pandemic represents a massive impact on human health, causing sudden lifestyle changes, through social distancing and isolation at home, with social and economic consequences. The aim of the study was to determine both of community and gender-based distribution of perception, attitude, preventive measures, changing lifestyle regarding COVID-19 and to help the Government and policymakers to take indispensable steps. This cross-sectional survey self-administered online-based study was carried out after the declaration of strict initial lockdown enforced in Bangladesh. The study was conducted in Rajshahi district from 30 March 2020 to 31 August 2020, a very critical time of mental suffering and lockdown. A total of 651 respondents from Rajshahi district in Bangladesh participated in the survey, and by a self-administered questionnaire, designed in the language of English. Among the collected responses, 535 were considered for the analysis, which largely belonged to Rajshahi's middle to upper socio-economic status (SES). The data analysis was performed using Microsoft Excel 2019 and SPSS version 25.0 (Chicago, IL, USA). The data were analyzed by using descriptive statistic, chi-square test and z-proportional test. In this empirical study, 278 males and 257 females participated. More than one-tenth of males and 35% of females were not conscious of the type of Coronavirus. A lot of misperception about the incubation period of COVID-19 existed among participants. The research observed that 34.2%, of males and 25.3% of the female study population had no opinion about the treatment of COVID-19 and 27.3% of males and 21.8% of females gave a verdict that COVID-19 had no available treatment. The study discovered more surprisingly that females (67.3%), greater than males (65.5%) did not want to stay at home during the lockdown. Positively 87.8% of males and 70.4% of females washed their hands with soap or used sanitizer after coming back from outside. The consumption of a balanced diet increased by males and females was 13.3% and 6.7% respectively. Z-proportional test showed that regarding COVID-19, there were significant difference between male and female's conception and precaution ( $p < 0.0001$ ). The study has used the first-time data based on the population's lifestyle and eating habits during the COVID-19 lockdown, which will give assistance to the policy makers to develop the situation.

**Key words:** COVID-19, Lifestyle, Immunity boosting activities, Pandemic

### Introduction

COVID-19 pandemic has been changing the world in a frightening condition, leaving it a disaster. In accordance to the World Health Organization (WHO), in March 2020, more than 14, 000 people in the world deceased because of the rapid spreading of the novel Coronavirus, with over 3, 34,000 being infected (WHO 2021). Novel coronavirus disease (COVID-19) was caused by the virus Severe Acute Respiratory Syndrome

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(SARS)-CoV-2, originated in Wuhan, China, and has spread globally, with over 101,700 cases and 3,461 deaths in more than 75 countries. With promptly growing cases and local communal transmission in many countries outside of China, together with the United States, the outburst of coronaviruses has reached a new period, which involves a shift in the primary battle approach from a focus on inhibition in China to worldwide mitigation (Tzu 2020). Comprehending the momentousness of the current pandemic condition, the WHO declared COVID-19 as a public health emergency of global consideration on 30 January and called for collaborative determination and willpower of all the nations to take preventive measures against the rapid spread of COVID-19 (WHO 2020).

The first case of getting infected by COVID-19 on 8 March 2020 in Bangladesh and rates of infection deceptively persisted stably lower until the end of March, but a sharp upsurge in cases instigated in April 2020 with cases getting double in between 2 days (Dhaka Tribune 2020). As of 8 July, the worldwide total affected and deceased people were 11,500,302 and 535,759 respectively, excluding a few remote island states and as of the same date, 168,645 Bangladeshi people were diagnosed with COVID-19 positive, and a total of 2,151 passed away (Government of Bangladesh's office website 2020). Bangladesh has no previous experience with epidemics like SARS or MERS, and clearly, it was observed that Bangladeshi public healthcare systems providers were not instantaneously organized for managing COVID-19 during the first wave period of the pandemic. The enormosity and speedy proliferation of COVID-19 through to some extent symptomatic or asymptomatic infected people in Bangladesh traumas the desire to find out the communicative responses of the population, such as to better identification of behavioral determinants of pandemic control (BBC 2020). The Government of Bangladesh has taken various measures for preventing and hindering the quick spread of COVID-19. Such as the execution of obligatory mask-wearing, instruction for social distancing, safe hygiene practices outside the home, quarantine guidelines, restrictions for going outside (Bangladesh Preparedness and Response Plan for COVID-19, 2020), and for protecting the people, the government declared a "lockdown" throughout the nation from 23 March to 30 May and organized some indispensable steps to spread consciousness to retain this syndrome away from them (Dhaka Tribune, 2020). Official procedures such as the closure of the school and educational institutes, shutdown of offices for a preliminary 30-day period, constraints on leaving home after 6.00 pm, and taking legal actions on individual's departure from their residences after 7.00 pm, along with gathering limitations in mosques and people assembly have rapidly been executed in many regions of the country (Bdnews24 2020; Corona Info, 2020). Day after day, the viciousness of the pandemic has spread over the entire nation and the proportion of the affected population has been aggregating ultimately, Bangladesh is converted into the second most affected country in South Asia next to our neighbor country India (IEDCR 2020). Rajshahi is one of the important divisional cities in Bangladesh. On 19 March 2020, the movement of buses from Dhaka to Rajshahi and Rajshahi to Dhaka had been closed for inhibiting the jab of COVID-19 (Jugantor 2020). Rajshahi reports the first COVID-19 affected case on 12 April 2020 (The Daily Star 2020) and according to 1 October 2020, the total affected rate in COVID-19 was 20,074 (7.4%) (IEDCR 2020). As preserving social distancing is almost required for impeding coronavirus, it is not an easy task for many people, especially those who are already struggling with mental health concerns according to health professionals. Research from during the 2002 SARS pandemic- a dissimilar kind of coronavirus- exposed that quarantine can be the outbreak of considerable post-traumatic stress disorder (PTSD) and other research has disclosed that being isolated socially increases the rate of mortality by 29%. The present study observed that there are a limited number of studies on knowledge, perception, attitudinal behavior, precaution, immunity enhancing activities, and lifestyle changes during epidemics that have been carried out in Bangladesh. However, the necessity of this

type of study is not ignorable at this moment and lessons learned from the other research accompanied abroad in an epidemic condition such as the SARS outbreak in 2003 give information that knowledge and attitudes towards infectious diseases are connected with severe anxiety and other emotional disorders amongst the population, that can further obfuscate attempts to preclude the spread of the infectious disease (Person 2004; Tao 2013).

Worldwide COVID-19 is nearly new to the people who have little or no knowledge about the disease. They gather knowledge and perception about corona from different sources, such as previous experience about similar viral diseases prevalence and consequences, Government information, media exposure, printing media, medical sources, etc. The collected knowledge, perception, and beliefs may create different behavioral patterns and attitudes and make the people perform different activities regarding COVID-19, which may be wrong about the health-related issue that makes a potential risk factor. This research analyzes the gender-wise information about knowledge, perception, precaution pattern, immunity boosting and changing lifestyle-related activities, choosing the foods regarding COVID-19 that help the government about policy-making more effectively than before. Understanding the previous lacking of gender-wise distribution of perception, attitude, precaution measures, immunity boosting activity, behavioral patterns during a pandemic, the study aimed to determine community and gender-based distribution of perception, attitude, preventive measures, changing lifestyle regarding COVID-19 and to help the Government and policymakers to take necessary steps.

## **Materials and Methods**

### **Study design and population**

This cross-sectional survey self-administered using mainly online, in some cases telephone and in person interview (when possible) study was conducted after the declaration of the strict initial lockdown enforced in Bangladesh. The study was conducted in Rajshahi district during the period of 30 March 2020 to August 2020, a very critical time of mental suffering and lockdown. Given the current pandemic situation, a thorough community-based survey was not feasible. For the appropriate survey, a semi-structured questionnaire was designed for the Google survey tool (Google Forms), and the generated link was shared with the public on social media (i.e., Facebook, Messenger, EMO, WhatsApp). That link was also shared individually with taking the verbal consent to their contact list of investigators and research assistants. The investigators' principal researcher's pronouncement to collect the data using online approaches was established on maintaining social distancing at the time of the strict lockdown in Rajshahi, Bangladesh. In the beginning, 651 probable respondents provided informed consent and among them, 535 respondents filled the entire survey form, creating a response rate of 82%. The inclusion criteria to take part in the study were being a resident in Rajshahi, having internet access, and volunteering. However, the study collected the data through telephone, online, or in-person interviews, when possible.

### **Study participants**

A total of 651 respondents from Rajshahi district in Bangladesh participated in the survey, and a self-administered questionnaire was designed in the language of English. Among the collected responses, 535 were considered for the analysis, who largely belonged to Rajshahi's middle to upper socioeconomic status (SES) (who could able to understand and answer in English) because online and telephone facilities were not available to lower socioeconomic status peoples and at that situation it was quite impossible to collect

data from door to door interview. Firstly, the respondents were informed about the circumstantial of involved researchers and also about the motive/objective of the survey. The participation in the survey was entirely voluntary and no kind of intervention of biasedness from the researchers carrying out the study was involved. The respondents were also having an option to skip responding to any question(s) if s/he might wish to. The above criteria were put to maintain the most relevant ethical values such as generosity, non-maleficence, belief within not only the researchers but also the respondents as well as the confidentiality of personal information. For controlling the selection and reply bias at the respondent's level, the survey was floated to various ages of people to get varied information. An easy and smart escape way was opened to the participants as they could exit the survey at any moment at their will. To tackle the duplicity of the response, the option of not being allowed to fill the survey from the same device more than once was enabled. Finally, to remove the bias from the responses, Random or Stratified Sampling was followed. Imperfect forms were identified as exclusion. The study consisted of a total of 535 people in Rajshahi. Among them 278 were male and 257 were female.

#### **Authentication of the questionnaire**

The researchers assessed the auto-prepared Google questionnaire in a pilot study among a few populations (N = 25). Primarily, the researchers discussed with a group of Bangladeshi researchers in the relevant field of epidemiology to independently assess the degree to which the questionnaire is relevant and can measure the population's knowledge, attitude, perception, precaution, and avoidable parameters, and immunity boost-up activities regarding COVID-19 appropriately. After completing the piloting program successfully by using the corresponding questionnaire, the research was administered the updated questionnaire among 651 participants for 30 days. Acquired data were used to evaluate internal consistency and test-retest reliabilities using Cronbach's  $\alpha$  and intra-class correlation analysis. Both assessments indicated satisfactory levels of reliability of the questionnaire (Cronbach's  $\alpha = 0.79$ , intraclass correlation co-efficient = 0.96).

#### **Measures**

A semi-structured and self-administered standard questionnaire with informed consent, questions regarding socio-demographic data, gender-wise perception about COVID-19, questions related to knowledge of symptoms of corona diseases, questions about attitude regarding the disease, questions about knowledge regarding coronavirus transmission, questions about what should be avoided in a pandemic situation, questions linked to precaution for hindering the rapid spread of COVID-19, questions about immunity enhancement activities, questions about food source, questions about things which should be avoided during COVID-19 pandemic, questions about lifestyle changing activities of individuals was administered for collecting data.

#### **Socio-demographic measures**

The first part of the questionnaire included socio-demographic information, which covered gender, age, level of education, occupation, residential address, monthly income (Ranging from Tk. 2000/ to 56000/-), and disease prevalence.

## **Other parameters**

### **Knowledge and perception regarding COVID-19**

The knowledge and perception part of the questionnaire includes ten questions. Most of the questions responded as “Yes”, “No” and “Maybe”.

### **Attitude linked to COVID-19**

This part included 38 questions, by answering “Yes”, “No” and “Maybe” for most of the questions.

### **Lifestyle changing activities considering pandemic situation**

This part covered 24 items (following the five point Likert Scale) by responding as “Significantly decreased”, “Slightly decreased”, “Same as before”, “Slightly increased”, and “Significantly increased”.

### **Immunity Enhancing Doings for preventing COVID-19**

This important part of the questionnaire encompassed eight questions, which provided information about immune boost activities and the awareness level of the people.

### **Precaution outset regarding preventing**

This section incorporated 8 different variables, which aid gender-wise consciousness level for keeping away themselves COVID-19.

## **Statistical analysis**

The data analysis was performed using Microsoft Excel 2019 and SPSS version 25.0 (Chicago, IL, USA). Microsoft Excel was used for editing, sorting, and coding. The excel file was then imported into SPSS software. Descriptive statistics was used to identify frequencies and percentages of male and female population and z-proportional test were performed to determine the significance difference between two groups of sample population. Cronbach’s alpha and intraclass correlation coefficient (ICC) were used for measuring of internal consistency of data.

**Ethical considerations:** This study was approved by ethical research committee of Institutional Animal, Medical Ethics, Biosafety and Biosecurity Committee (IAMEBBC) for Experimentations on Animal, Human, Microbs and Living Natural Sources at the Institute of Biological Sciences, University of Rajshahi, Bangladesh.

## **Results**

### **Socio-economic background of the respondents**

Table 1 exposed that 278 males and 257 females participated in this study. The study observed that the maximum of participants was coming from the age range 15-29 years (41% male and 54% from female) and a lower quantity of participants from the age range 50-65years (9% male and 9.3% female). Interestingly perceived that 1.9% of females took part in this study who was >65 years old. More than half (52.9% vs. 52%) of males and females belonged to urban and rural areas respectively. More than three fourth (61.5%) of males were job holders and students, who are considered the most active population in a country, whereas, 54% of female respondents were students and housewives. Regarding the educational background

in this study, the literacy rate of males (illiterate 6.8%) was comparatively better than females (illiterate 30%). More than one-fourth of males (26%) and 13% of females were graduates. Almost three-tenths percent (28%) of males and more than four tenth (42.8%) had no income.

**Table 1:** Socio-demographic characteristics of the respondents in Rajshahi District, Bangladesh (n = 535).

Characteristics	Levels	Gender		Total, n (%)
		Male, n (%)	Female, n (%)	
Age (in years)	<15	62 (22.3)	45 (17.5)	107 (20)
	15 – 29 years	114 (41)	139 (54.1)	253 (47.4)
	30 – 49 years	77 (27.7)	44 (17)	121 (22.6)
	50 – 65 years	25 (9)	29 (11.2)	54 (10)
Residence	Urban	147 (52.9)	123 (47.9)	270 (50.46)
	Rural	131 (47.1)	134 (52.1)	265 (49.53)
Educational background	Illiterate	19 (6.8)	77 (30)	96 (18)
	Primary	66 (23.7)	46 (17.9)	112 (21)
	SSC	28 (10)	32 (12.5)	60 (11.2)
	HSC	43 (15.5)	41 (16)	84 (15.7)
	Graduate	73 (26.3)	34 (13.2)	107 (20)
	Post Graduate	49 (17.5)	27 (10.5)	76 (14.2)
Occupation	Student	82 (29.1)	72 (28.0)	154 (28.8)
	Housewife	-	67 (26.1)	67 (12.5)
	Job seeker	4 (1.4)	4 (1.6)	8 (1.5)
	Job	90 (32.4)	47 (18.3)	137 (25.6)
	Farmer	25 (9)	1 (0.4)	26 (4.8)
	Business	32 (11.5)	4 (1.6)	36 (6.7)
	Health professional	14 (5)	5 (1.9)	19 (3.6)
	Daily labor	31 (11.2)	56 (21.8)	87 (16.3)
Monthly income	No income	79 (28.4)	110 (42.8)	189 (35.3)
	Tk. 2,000-10,000/-	33 (11.9)	100 (38.9)	133 (24.8)
	Tk. 11,000-20,000/-	66 (23.7)	24 (9.3)	90 (16.8)
	Tk. 21,000-35,000/-	39 (14.0)	17 (6.6)	31 (5.8)
	Tk. 36,000-55,000/-	08 (2.9)	3 (1.2)	11 (2)
	Tk. >56,000/-	53 (19)	3 (1.2)	56 (10.4)

#### Distribution of participant's knowledge regarding COVID-19

The research showed that almost all of the sample population heard about Coronavirus.

Conversely, they are confused about the type of mentioned virus. More than one-tenth of males and 35% of females were not aware (of) the type of Coronavirus. There was also a lot of misperception about the incubation period of COVID-19. Z-proportional test showed that very nearly belief of 70% of male about COVID-19 is contagious whereas, 52.5% of female agreed with that verdict. The percentages of male about this perception were higher than female which was significantly different ( $p < 0.00001$ ). Most of them (Male 74% and female 67.3%) answered that the Incubation period of COVID-19 was 2 – 5 Days. Seven-tenth of

males and very nearly half of the females delivered that people, affected by Corona will have symptoms of fever. More than one-fifth (21.6%) of males and less than one-fifth (18.3%) of females responded that people suffering from COVID-19 will not have any cough symptoms. Approximately seven-tenths (68.3%) of males and 46.3% of females had an idea that people, suffering from COVID-19 must have sore throats. Patients, agonized by COVID-19 must have pain in the whole body- this was the conception of 178 male and 107 female respondents. Male (56.5%) and female (40%) respondents alleged that COVID-19 affected patients would be suffering from either diarrhea or constipation symptoms. Higher than two-fifth (41.6%) of females and 61% of males supposed that patients with COVID-19 would have headaches. Actually Z- proportional test result showed that about COVID-19 the thought of males were significantly dissimilar between males and females in every circumstance ( $p < 0.00001$ ) (Table 2).

**Table 2:** Gender-wise distribution of respondent's knowledge concerning COVID-19 (n = 535).

Characteristics	Levels	Gender		Total, n (%)	P-value
		Male, n (%)	Female, n (%)		
Heard about COVID-19	Yes	278 (100)	255 (99.2)	553 (99.7)	P<0.00001
	Maybe	-	2 (0.8)	2 (0.3)	
	No	44 (15.8)	31(12.2)	75(14)	
Is it a contagious disease?	Maybe	40 (14.4)	91 (35.4)	131 (24.5)	
	Yes	194 (69.8)	135 (52.5)	329 (61.4)	
	Others	14 (5)	7 (2.7%)	21 (3.9)	
Causes of COVID-19	Virus	263 (95)	248 (96.5)	511 (95.5)	
Incubation period of COVID-19	0 days	69 (24.8)	79 (30.7)	148 (27.7)	
	2-5 day	206 (74)	173 (67.3)	379 (70.8)	
	3-13 day	01 (0.4)	03 (1.2)	4 (0.7)	
	14-21 day	02 (0.7)	02 (0.8)	4 (0.7)	
Fever	No	54 (19.4)	41 (16)	95 (17.8)	
	Maybe	28 (10.1)	88 (34.2)	116 (21.7)	
	Yes	196 (70.5)	128 (49.8)	324 (60.5)	
Cough	No	60 (21.6)	47 (18.3)	107 (19.9)	
	Maybe	27(9.7)	93(36.2)	120(22.4)	
	Yes	191(68.7)	117(45.5)	308(57.6)	
Sore throat	No	61(21.9)	59(23)	120(22.4)	
	Maybe	27 (9.7)	79 (30.7)	106 (19.8)	
	Yes	190 (68.3)	119 (46.3)	309 (57.7)	
Body pain	No	64 (23)	66 (25.7)	130 (24.2)	
	Maybe	36 (12.9)	84 (32.7)	120 (22.4)	
	Yes	178 (64)	107 (41.6)	285 (53.2)	
Diarrhoea or constipation	No	85 (30.6)	59 (23)	144 (27)	
	Maybe	36 (12.9)	95 (37)	131 (24.5)	
	Yes	157 (56.5)	103 (40.1)	260 (48.6)	
Headache	No	76 (27.3)	51 (19.8)	127 (23.8)	
	Maybe	32 (11.5)	99 (38.5)	131 (24.5)	
	Yes	170 (61.2)	107 (41.6)	277 (51.8)	

### Distribution of participant's attitudes regarding COVID-19

The research observed that 34.2% of male and 25.3% of the female respondents had no opinion about the treatment of COVID-19 and 27.3% of males and 21.8% of females gave a verdict that COVID-19 had no available treatment, whereas, 1.1% of study population assumed that the treatment of corona was symptomatic. Nearly four-fifth of males and three fourth of females supposed that COVID-19 was precarious for ages above 65 years. Half of the male and 36.6% of female respondents measured fever suspecting infection. More than half (55%) of males and 38.1% of females visited health professionals when they were suspected of infections. Unpredictably 55.3% of female respondents didn't visit health consultants when they were supposed to affect COVID-19.

**Table 3:** Gender-wise distribution of respondent's attitudes regarding COVID-19 (n = 535).

Characteristics	Levels	Gender		Total, n (%)
		Male, n (%)	Female, n (%)	
Treatment of COVID-19	No response	48 (17.3)	77 (30)	125 (23.36)
	Others	57 (20.5)	58 (22.6)	115 (21.5)
	No opinion	95 (34.2)	65 (25.3)	160 (29.9)
	No treatment	76 (27.3)	56 (21.8)	132 (24.67)
	Symptomatic	2 (0.7)	1 (0.4)	3 (0.5)
	Others	25 (9)	19 (7.4)	44 (8.2)
High-risk group	Any age	32 (11.5)	46 (17.9)	78 (14.58)
	> 65 years	221 (79.5)	192 (74.8)	413 (77.2)
Measure fever suspecting infection	No	113 (40.6)	143 (55.6)	256 (47.8)
	Maybe	26 (9.4)	20 (7.8)	46 (8.6)
	Yes	139 (50)	94 (36.6)	233 (43.5)
Visit consultant at the time of suspecting infection	No	99 (35.6)	142 (55.3)	241 (45)
	Maybe	26 (9.4)	17 (6.6)	43 (8.03)
	Yes	153 (55)	98 (38)	251 (47)
Hand washing with soap and water	No	25 (9)	11 (4.3)	36 (6.7)
	Maybe	31 (11.2)	57 (22.2)	88 (16.4)
	Yes	222 (79.9)	189 (73.5)	411 (76.8)

### Distribution of participant's precautions regarding COVID-19

The study discovered more surprisingly that females (67.3%), greater than males (65.5%) didn't want to stay at home during the lockdown. Positively 87.8% of males and 70.4% of females washed their hands with soap or use sanitizer after coming back from outside and more than half of males (52.2%) and 44.7% of females took bath & washed clothes after returning home. Higher than three-fifth (61.5%) of males and 40.9% of females habituated to using face masks outside. Approximately three fourth (73.2%) of females and 64.4% of males didn't concern to maintain physical distancing outside. However, males (32.7%) were more apprehensive to follow the social distancing guidelines compared to females (23.7%). Males (65.5) and



females (63.8%) were almost in the same position in washing their hands frequently. Nearly three-fifths (59.7%) of males and 64.2% of females had attention to personal hygiene maintenance (Table 4).

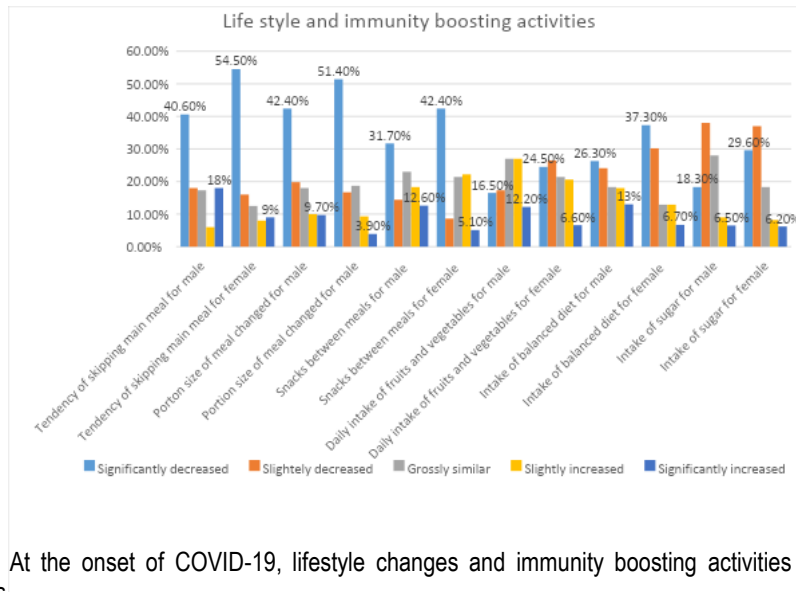
**Table 4:** Gender-wise distribution of respondent's precautions regarding COVID-19 (n = 535).

Characteristics	Levels	Gender		Total, n (%)	P value
		Male, n (%)	Female, n (%)		
Presence at home during lockdown	No	182 (65.5)	173 (67.3)	355 (66.35)	P<0.0001
	Yes	96 (34.5)	84 (32.7)	180 (33.6)	
Wash hands with soap or use sanitizer after coming back from outside	No	7 (2.5)	17 (6.6)	24 (4.5)	
	May be	27 (9.7)	59 (23)	86 (16)	
	Yes	244 (87.8)	181 (70.4)	425 (79.4)	
Bath & wash clothes after returning home	No	81 (29.1)	70 (27.2)	151 (28)	
	May be	52 (18.7)	72 (28)	124 (23)	
	Yes	145 (52.2)	115 (44.7)	260 (48.5)	
Using face mask at outside	No	89 (32)	132 (51.4)	221 (41.3)	
	May be	18 (6.5)	20 (7.8)	38 (7)	
	Yes	171 (61.5)	105 (40.9)	276 (51.5)	
Physical distancing at outside	No	179 (64.4)	188 (73.2)	367 (68.5)	
	May be	8 (2.9)	8 (3)	16 (3)	
	Yes	91 (32.7)	61 (23.7)	152 (28.4)	
Frequently hand washing	No	54 (19.4)	37 (14.4)	91 (17)	
	May be	42 (15.1)	56 (21.8)	98 (18.3)	
	Yes	182 (65.5)	164 (63.8)	346 (64.6)	
Attention on personal hygiene	No	38 (13.7)	27 (10.5)	65 (12)	
	May be	74 (26.6)	65 (25.3)	139 (26)	
	Yes	166 (59.7)	165 (64.2)	331 (61.8)	

#### Lifestyle and immunity enhancing activities

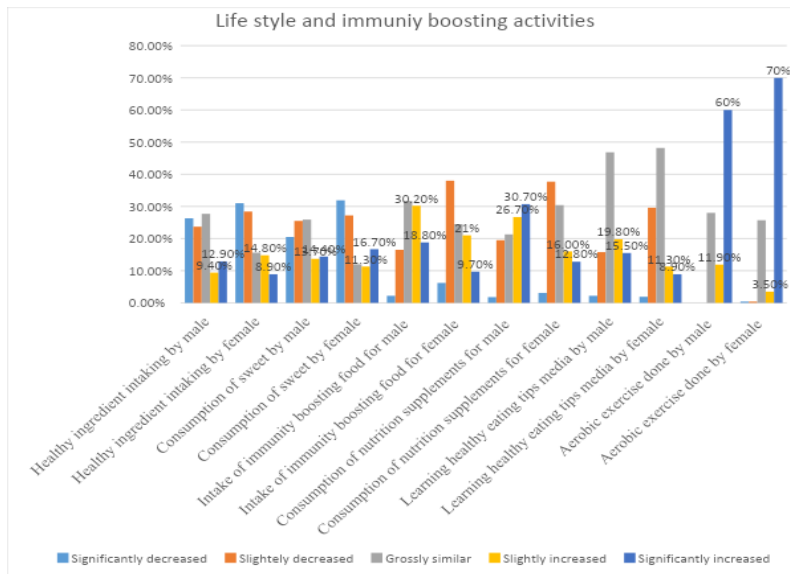
The study observed that tendency of skipping the main meal is comparatively lower among females than males. The percentage of skipping main meal was significantly decreased among male (40.2%), whereas this mentioned percentage was higher (54.5%) among female. Skipping the main meals is harmful to maintaining good health. Corona pandemic influenced the study population to lead a routine life including taking meals. Though the study observed that the tendency of skipping the main meal was decreased among both male and female respondents, the quantity of taking meals and snacks was more declined among females (51.4%) than males (42.4%). Midmorning, midday and midafternoon snacks have a prominent role in enhancing immunity. Only 12.6% of males had significantly increased their taking snacks between meals, while only one-twelfth of females did that. Fruits and vegetables are enriched with essential vitamins and minerals. More than one-tenth (12.2%) of males improved their daily intake of fruits and vegetables, however, 6% (almost half of males) of women had done so, which was frustrating output. The consumption

of a balanced diet increased by males and females was 13.3% and 6.7% respectively. Intake of excess sugar had been increased in the same manner among males (15.5%) and females (14.5) (Fig. 1).



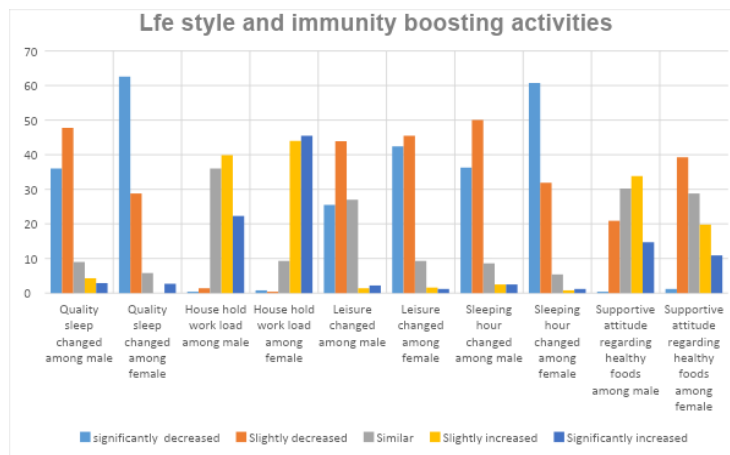
**Fig. 1:** At the onset of COVID-19, lifestyle changes and immunity boosting activities among males and females.

The research explored that consumption of healthy food ingredients was significantly increased among females (31.5%) than male respondents (26.3%). Though the study observed in fig 1 that the intake of sugar consumption was decreased among the study participants. However, in the case of sweet ingestion instead of sugar, the inclination of taking sweets was nearly the same among the participants (male 28.1% and female 28.3%). The propensity of consuming immunity boosting foods was hugely perceived among males (slightly increased 30.4% and grossly increased 18.8%) in comparison to females (slightly increased 21% and grossly increased 9.8%). Remarkably the study also uncovered that ingestion of healthy nutrition supplements among male (57.4%) was more commonly noticed than females (28.8%). At the beginning of COVID-19, the media promulgated healthy eating tips among the population which was followed more keenly by men (35.3%) in comparison to women (20.2%), The study perceived that a long lockdown stimulated the respondents to participate in aerobic exercise (male 72% and female 73.5%) for improving immunity level (Fig. 2).



**Fig. 2:** At the onset of COVID-19, lifestyle changes and immunity boosting activities among male and female  
**Lifestyle and immunity boosting activities among the study population in Rajshahi district**

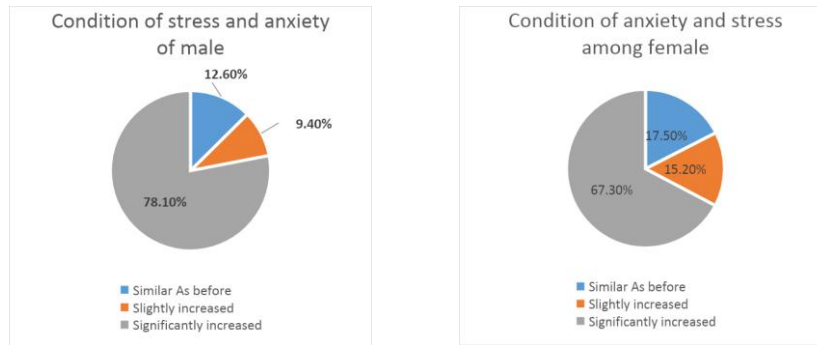
The authors determined that sleep quality was slightly and severely deteriorated among 47.8% and 36% of males respectively, while, sound sleep was slightly and severely decreased amongst 28.8% and 62.6% of females correspondingly. The respondents assumed that household and other works load was increased among 62.2% of males and 89.5% of females. One-fourth of males and 42.4% of females informed that their leisure time was decreased relentlessly. The sleeping hour was ominously diminished among 36.3% of male and 60.7% of females (Fig. 3).



**Fig. 3:** Lifestyle and immunity enhancing activities among respondents in Rajshahi district.

### Stress and anxiety among study participants during the lockdown in Rajshahi district

The study exposed that during the continuous lockdown, offices, working places, shopping malls, educational institutes were closed for impeding the spread of COVID-19. At that time, it had been detected that stress and anxiety among all participants were prominently increased. The rate of significantly increased and slightly increased males by stress and anxiety were 78% and 9.4% consequently, while affected by severe stress was 67.3% among females (Fig. 4).



**Fig. 4:** Gender-wise presentation of condition of mental health among respondents throughout COVID-19.

### Discussion

The spread of the COVID-19 pandemic has indisputably transformed the life routine and caused unimagined alterations, which made a negative outbreak of severe psychological trauma and mental strength catastrophe (Anand et al., 2021). Bangladesh has a higher than 165 million populations (Shammi et al. 2020), and a household containing 4.4 persons on an average (Khan and Prodhan 2020; Rahman et al. 2021), was not habituated to conserving the non-therapeutic happenings, i.e. avoiding and limit social get-together, marginal movement, maintaining hygiene by washing hands with alcohol-based hand rub or wash, wearing a face mask. Taking immunity boosting food, practice some precautions (WHO 2020) to hinder the COVID-19 outburst. There is a long history of recurrent natural threats and infectious diseases in Bangladesh (Mutsuddy et al. 2019; Anwar et al. 2020). Because of the geological reason, repeated natural disasters frequently attack this country and Bangladesh has continuously struggled with the climate change-induced problems as well (Haque 1995; Banu et al. 2014). Bangladesh has converted into one of the hardest-hit countries in the tremendous COVID-19 pandemic likewise other South Asian countries like India and Pakistan (Johns Hopkins Coronavirus Resource Center 2020; Shammi et al. 2020; WHO 2020a; Khan et al. 2022). This overpopulated developing nation together with other calamities has been fighting to control this pandemic and it has been carried out by several experimental activities of numerous strategies such as full lockdown, partial lockdown, maintaining social distancing, and documentation of zone depending on the number of COVID-19 cases to control the pandemic. Still, not all of these taken strategies were entirely successful and sometimes faced failure to effectively control the COVID-19 spread (Shammi et al. 2020). Bangladesh also experienced challenging conditions to apply the social distancing, bulk COVID-19 testing conveniences, and travel restrictions to lower the COVID-19 outbreak (Anwar et al. 2020; Shammi et al. 2020). As of 4 October 2020, registered COVID-19 cases were 368,690 in Bangladesh (Johns Hopkins Coronavirus Resource Center 2020). This empirical study revealed that more than one-tenth of males and 35% of females in Rajshahi were not aware of the type of Coronavirus. The study agreed with the study

performed by Zegarra et al. (2020). They exposed that 48.3% of participants had more accurate knowledge, 62.3% had more positive attitudes, and 55.1% had more frequent practices for COVID-19 prevention (Zegarra et al. 2020). In this research, study participants had some conception of COVID-19 symptoms. They thought that seven-tenth of males and very nearly half of the females delivered that people, affected by coronavirus will have symptoms of fever. More than one-fifth (21.6%) of males and less than one fifth (18.3%) of females responded that people suffering from COVID-19 will not have any cough symptoms and patients, agonized by COVID-19 must have pain in the whole body- this was the commencement of 178 of male and 107 of female respondents. Male (56.5%) and female (40%) respondents alleged that Corona affected patients would be suffering from either diarrhea or constipation symptoms. Higher than two-fifth (41.6%) of females and 61% of males supposed that patients with COVID-19 would have headaches. Zegarra et al. (2020) and Srichan et al. (2020) reported almost the same outputs. They showed that most of the study participants (99.35%) described some symptoms are documented as COVID-19 related: fever, dry cough, breathing difficulty, but, this has not been established as part of the diagnosis and respondents also revealed other important symptoms such as sore throat and blocked nose (51.16%), followed by headache, and diarrhea and a very few 8 (0.3%) respondents did not know the symptoms which were 56.7% (Srichan et al. 2020; Zegarra et al. 2020). In this research, more than 17% of males and 30% of females didn't even have any idea about the treatment of COVID-19. It signposts that all-encompassing efforts and consciousness proclamation are required to deliver messages to the population, specially women, who may have complications retrieving the most auspicious sources of COVID-19-related symptoms and treatment procedures. General awareness to keep away them from suffering from COVID-19, both males and females were habituated to washing hands with soap or sanitizers and washing clothes after returning home from outside, the study agreed with Anwar et al. (2021). They demonstrated that participants in their research exposed a sort of good personal preparation in response to COVID-19 as well as obeyed the value of recurrent hand washing for a protracted time, avoiding touching eyes, nose, and mouth, and lower contact with others (Anwar et al. 2021). This study revealed that more than four-tenth of women used face masks when they were outside. Another study entirely agreed with this study. They showed that almost 40% of women were using a mask on their face or a KN95 mask or a respirator (Anwar et al. 2021). The proportion of practicing the use of masks by participants was adjacent to the reports from Egypt (Abdelhafiz et al. 2020), but definitely not in China, because almost all participants in China covered their faces by wearing face masks at the time of going out (Zhong et al. 2020). Less than one-fourth (23.7%) of females and 32.7% of males considered social distancing when they were outside in this study. It indicates that there was an enough lacking attentiveness amongst respondents about the gruesomeness of COVID-19 in the primary stage of the epidemic. Another study performed on Bangladeshi internet users showed entirely different outcomes than this study. According to their study, more than 95% of respondents practiced social distancing. It is vital need to develop guidelines locally for mask use in Bangladesh by the health experts and Government bodies. Redundant use of masks needs to prevent while confirming that the health risk is not hindered during this unprecedented time. Similar strategies are also required for the use of soaps, hand sanitizers, and disinfectants, as abuse of these chemical substances may harm the dermatological characteristics of human beings.

This new different situation may compromise maintaining a healthy, balanced, and varied diet, along with the regular physical activity. For example, inadequate entrance to regular grocery shopping may reduce the intake of fresh foods, especially fruit, vegetables, and fish, in favor of highly processed foods, such as convenience foods, junk foods, snacks, and ready-to-eat cereals, there are high in fats, sugars, and salt. Additionally, psychological and emotional retorts to the outbreak of COVID-19 may proliferate the hazard of developing dysfunctional eating behaviors (Montemurro 2020; Wang et al. 2020). It is well known that the involvement in negative emotions can lead to overeating, the so-called "emotional eating" (Van Strien 2018;,

Evers 2018). This study revealed that the percentage of skipping main meal was significantly decreased among male (40.2%), whereas this mentioned percentage was higher (54.5%) among female. The propensity of consuming immunity boosting foods was hugely perceived among males (slightly increased 30.4% and grossly increased 18.8%) in comparison to females (slightly increased 21% and grossly increased 9.8%). Remarkably the study also exposed that absorption of healthy nutrition supplements among male (57.4%) were more commonly noticed than females (28.8%). The study also perceived that a long lockdown stimulated the respondents to participate in aerobic exercise (male 72% and female 73.5%) for developing immunity levels. A current analysis underlines that complete nutrition, that can help in improving immunity, is necessary for hindrance and management of infectious diseases, caused by viruses, and considering that COVID-19 has no effective preventive measures and pharmacological therapies available, proper and healthy habits of consuming foods are crucial and elective micronutrient supplementations (e.g. vitamins, trace elements, nutraceuticals, prebiotics, and probiotics) may be advantageous for all population, especially for vulnerable populations, such as the aged (Jayawardena et al. 2020). Di Renzo et al. (2020) showed that at the time of the COVID-19 lockdown, the sense of hunger and satiety reformed for more than half of the population: 17.8% of respondents had less appetite, while 34.4% of responders increased appetite (Di Renzo et al. 2020). To mitigate the spreading of the pandemic coronavirus infection (COVID-19), worldwide governments have implemented "lockdowns" which have restrained many individuals to their homes. This interrupts the routine life, elements of which are important day-to-day cues. The pandemic is also allied with new stressors, transformed roles, and qualms about health and economic safety, which are likely to disturb sleep (Gupta et al. 2020). In this research, the quality of sleep was slightly and severely declined among 47.8% and 36% males respectively, while, sound sleep was slightly and severely decreased amongst 28.8% and 62.6% of female correspondingly as well as sleeping duration was worryingly reduced among 36.3% of male and 60.7% of females. Gupta et al. (2020) conducted a research among 958 valid respondents and compared with the pre-lockdown period, there was a shift to a later time for bed and waking time, with a decreased sleep at night time and an increase in day-time napping. These habits effected visible across job-related groups, but severely affected working individuals except health professionals and thus sleep quality depreciated across groups (Gupta et al. 2020).

This research had some of methodological limitations that were inherent to Internet-based surveys. In this study, all needed criteria for inclusion and exclusion were assessed based on self-evaluation, and consequently some responders who were unconscious of their present status (e.g., for memory problems or pregnancy) may have been included. Besides, cross-sectional data collection had a recall biased, especially for patterns of sleep and food habits assessed for the period of pre-lockdown. As responses were begged across social media platforms by a snowballing approach, the respondents engaged may belong to groups that belong to similar strata of society, besides being more likely to be identified to each other. Internet access, responding motivation, and comfort with self-reporting emotional and behavioral symptoms, may all have predisposed both participation rates, and the responses provoked. Finally, it is challenging to determine how many individuals received the survey link but did not participate, and thus a response rate could not be ascertained.

## **Conclusion**

The novel coronavirus disease (COVID-19) pandemic situation has beleaguered normal human health, lifestyles, the reality of life, and unpleasantly influenced both the local and national economies. This study was an online-based cross-sectional study, performed at the time of first lockdown. This study tried to assess gender-wise distribution of individual's knowledge, attitude, lifestyle and food patterns considering COVID-19. The study revealed that awareness of the new virus was not adequate among both the groups. Lifestyle,

food habits, quality of sleep etc. were changed drastically. New normal in life such as, using face masks, washing hands with soap and water, maintaining social distancing, etc. were observed to be neglected among the study responders. Sleeping hour was significantly decreased among female (more than 60%) which seemed that lowering sleeping hour will make change the physical and mental health in future. Due to COVID-19, the normal life of people is altered drastically which create a prominent influence among the study participant's mental health. The study observed that the rate of significantly increased and slightly increased males by stress and anxiety were 78% and 9.4% consequently, while affected by severe stress was 67.3% among females. Initiative and necessary directives of the government, health professionals, and media help the population to keep away themselves from COVID-19.

**Conflict of interest:** The authors hereby declare no conflict of interest regarding the publication of this article.

**Contribution:** Authors contributed equally in the research and writing of this article.

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(Manuscript received on 09 March 2022; Revised on 12 April 2022)