



Research article

Eating habits and lifestyle changes among higher studies students post-lockdown in Bangladesh: A web-based cross-sectional study

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ABSTRACT

Background: The Coronavirus is still exhibiting cases in Bangladesh thus educational institutes are still ceased over one year, it becomes burdens to students at post lockdown period.

Objectives: Identifying the changes in eating habits and lifestyles including, physical activity, sleeping hours, and sleep quality after the cancellation of lockdown than the period of restrictions.

Methods: A quasi-experimental cross-sectional study was conducted among 394 students in Bangladesh using a structured questionnaire from February 3, 2021, to February 13, 2021.

Results: Consuming homemade foods drops by 8.63% at post lockdown than lockdown period. At post lockdown, 26.67% of students gained weight whereas 47.46% of respondents never engaged in any physical works. There has been a significant correlation between weight gain and physical activities ($p = 0.007$). Not continuing the academic activities from home was significantly associated with weight changes (AOR = 1.73; 95% CI: 1.01, 2.95), meals per day (AOR = 3.25; 95% CI: 1.79, 5.92), screen time for entertainment (AOR = 3.08; 95% CI: 1.78, 5.33), sleeping hours (AOR = 2.23; 95% CI: 1.30, 3.83), and sleep quality (AOR = 2.38; 95% CI: 1.35, 4.23) whereas female gender was related to meals per day (AOR = 1.77; 95% CI: 1.06, 2.95) and sleep quality (AOR = 1.76; 95% CI: 1.09, 2.85). However, 43.91% of respondents never felt any sleep disturbances. The rates of students who always experienced mentally tired, resentment, and sadness at post lockdown was lower than lockdown period. All of these changes were significant ($p < 0.000$) in terms of the lockdown situation.

Conclusions: This study shows notable changes in eating habits and lifestyles after lockdown which may indicate the tendency to adopt normal life than restrictions.

1. Introduction

The novel coronavirus disease (COVID-19) pandemic situation has oppressed normal human health, lifestyles, social life, and adversely influenced the local and national economy (Barro et al., 2020). Though it was first identified in December 2019, the World Health Organization (WHO) declared the circumstances as pandemic on March 11, 2020 (Cucinotta & Vanelli, 2020). As of August 20, 2021 there have been 14, 57,194 confirmed cases and 25,143 deaths in Bangladesh (Directorate General of Health Services (DGHS), 2021). The COVID- 19 has become

international public health emergence which affects physical, psychological, mental capabilities, as well as daily activities not only the person, affected but others who are in a lockdown for long period especially the students as Bangladesh government has ceased all operations of educational institutes since March 18, 2020, alongside a lockdown to prevent public gathering (Khan et al., 2020). Though the lockdown situation has been withdrawn, all the educational institutes are still on a vacation declared by the Ministry of Education, Bangladesh which is supposed to reopen on September this year ("Educational Institutions May Reopen in September | Dhaka Tribune," n.d.).

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It is clear that due to this captivity, diet qualities may be and peoples are prone to buy more pleasing, affordable, and possibly unhygienic which can make drawbacks to the immune system (Ismail et al., 2020). Research has shown that people are trending to adopt unhealthy dietary behaviors as they consumed fewer fruits and vegetables, gained weight which may increase the chance to get nutritional burdens, though there may be the opportunity to enhance nutritional behaviors during lockdown (Deschasaux-Tanguy et al., 2020). Traditionally rice is the main staple food in Bangladesh eating with various types of vegetable curries along with mostly fish and legumes whereas fruits are hardly served with daily meals (Islam, 2012). Tendency to involve physical activities is reduced during lockdown (Ammar et al., 2020b; Deschasaux-Tanguy et al., 2020; Lippi et al., 2020). This was responsible to significantly rise the tendency to take sedentary behaviors among Bangladeshi populations during lockdown which may prone to morbidities like hypertension, coronary heart disease, stroke, diabetes, and depression (Rahman et al., 2020).

The initiation of pandemic circumstances creates huge psychological issues, obsessed mental health symptoms among people with anxiety being most common as was shown following the severe acute respiratory syndrome coronavirus (SARS-CoV), and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Hunter, 2020; Wu et al., 2009). A previous study in Bangladesh has shown that 28.50% of students reported mild to extremely severe stress levels, 33.28% reported mild to extremely severe anxiety levels, 46.92% mild to extremely severe depression levels, and 69.31% mild to severe level of psychological impact occurred by the outbreak (Khan et al., 2020). Eventually, these stressful outcomes result in shattered sleeping qualities, insomnia, poor dietary patterns, reduced physical activities, and risen in sedentary behaviors (Holmes et al., 2020; Torales et al., 2020).

This study focused to identify the changes in eating habits and lifestyles including physical activity, sleeping hours, and sleep patterns among higher educational level students of Bangladesh after the cancellation of restrictions.

2. Materials and methods

2.1. Study design and participants

To determine the impacts of the COVID-19 pandemic on eating habits and lifestyle among students who are admitted at least undergraduate level in Bangladesh during and post lockdown period. This survey was operated through an online questionnaire made by Google forms and it was distributed via email and social media platform (Facebook messenger) to get easy access and obtain a large number of participants. A quasi-experimental cross-sectional study was conducted among 394 students in Bangladesh using a structured questionnaire from February 3, 2021, to February 13, 2021. The questionnaire used in this study was piloted in a small sample ($n = 30$) to verify the clarity of the questions and to identify the time requirement. After that, in the main phase, we have sent it to 425 persons initially from which a total number of 397 participants (93.41%) accepted the questionnaire from February 3, 2021, to February 13, 2021, in which only 3 individuals were denied to fill the survey initially as in the first page there was option whether they give consent or not to fill up the entire form. There was no personal data like name, contact number, and living address was collected and there was no financial payoff to participate.

2.2. Survey questionnaire

A multi-sectional, self-mediated online survey was designed through Google forms in Bengali. The study contained questions on dietary habits and lifestyles during and after lockdown situations. However, a questionnaire was developed from a previous study (Ismail et al., 2020) and modified in terms of Bangladesh's people (Ismail et al., 2020), the International Physical Activity Questionnaire Short Form (IPAQ-SF) (Lee

et al., 2011), and the Copenhagen Psychosocial Questionnaire (COPSOQ-II) (Pejtersen et al., 2010). It was then translated and culturally adapted following an internationally accepted methodology (Wild et al., 2005).

The online Google form was separated into 7 sections as following: (1) socio-demographic data (8 questions): age, gender, educational level, changes in weight during and post lockdown, perception on health status during and after lockdown, and whether they were continuing their educational program from home through online; (2) source of information (2 questions): from where do they get information on nutrition and health; (3) eating behaviors (11 questions): types of daily major meals, frequency of daily major meals, eating breakfast, skipping meals, water intake and weekly frequency of specific foods; except the last all the previous was asked twice regarding during and post lockdown period; (4) shopping habits (7 questions): list formation for daily needs, storing food during and post lockdown period, online ordering, reading food labels, sanitizing product during and post lockdown period; (5) physical activity (4 questions): exercising frequency, household chores frequency, computer time for study, screen time for entertainment; (6) stress and irritability (4 questions): physically tired, mentally tired, resentment and sad; (7) sleep (4 questions): sleep duration, sleep quality, sleep disturbances, and energy level. Questions of sections 5, 6, and 7 were asked twice in regards to during and after lockdown times.

2.3. Dietary assessment

A predetermined food frequency questionnaire was constructed, adapted, and modified in terms of the usual intake of Bangladeshi people which contained 9 different food groups (FE & AF, 2008; Tufts University, 2020). Precisely, the form contained food groups of carbohydrates (rice/bread/potato), meat products (meat/fish/chicken), pulse/legumes, vegetables, fruits, sweets and sweetened products, soft drinks, and energy drinks in which replies were included never, 1–4 times per week, once a day, 3–4 times in a day, and more than 4 times in a day.

2.4. Physical activity assessment

To assess the frequency of physical activity among students in both lockdown and post lockdown periods, a modified and adjustable version of the International Physical Activity Questionnaire Short Form (IPAQ-SF) was used (Lee et al., 2011). Each of the people is required to allude their weekly exercise frequency as no training, 1–3 times in a week, and more than 3 times in a week. Students were also asked to reply how many times did they participated in household activities. Moreover, responses on using computer or screen duration for study/working purposes as well as for the sake of relaxing/entertaining on a scale of hours within a day were also collected.

2.5. Stress, irritability, and sleep assessment

A modified version of the Copenhagen Psychosocial Questionnaire (COPSOQ-II) was utilized to obtain the feedback on stress and irritability from the students in which frequency was recorded as never, too little times, sometimes, most of the time, and always regarding the lockdown and post lockdown period where the participants stated following conditions: physically tired, mentally tired, resentment, and sad (Pejtersen et al., 2010). With regards to sleep, students were asked whether they felt very difficult to sleep, wake up frequently, and difficulty to sleep, very early wake up and could not sleep, long continuous sleep, or none of the mentioned conditions. The survey also contained sleeping duration, rating of sleeping quality, and describing energy level. The feedback options for sleep quality and energy level were very good, good and poor, and energized, neutral and lazy respectively. However, all of the answers regarding stress, irritability, and sleep were collected twice as one for during and another for after lockdown period.

2.6. Statistical analysis

Stata: Statistical Software for Data Science (Version 12.0) and Microsoft Excel was used to perform statistical analysis for this study. However, the determination between categorical variables was run through chi-square test whereas a sub-analysis was also conducted for weight and specific behavioral variables' differences between groups. Binary logistic regression was also done to identify the relationship among factors, eating habits, and lifestyle changes. More specifically, data were tabulated by (i) sex, (ii) by age group (18–25 and 26–33 years), and (iii) level of education.

2.7. Ethical approval

This study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Department of Biochemistry and Food Analysis, Faculty of Nutrition and Food Science, Patuakhal Science and Technology University.

2.8. Informed consent statement

Initially, at the survey, participants were asked to respond in regards they agree or disagree to participate and all respondents have been informed that all information will be used for academic purposes only. Besides, the purpose and assurance of confidentiality of data collection were given to the respondents at the beginning of the survey. The informed consent statement for the respondents was as "I do hereby, after reading the research objectives and am participating in the survey sharing my information by answering the questionnaire consciously and willingly." All the students who participated in this study agreed to the aforementioned informed consent statement.

3. Results

3.1. Demographic results

The online survey form was filled up and submitted by 394 participants in which the percentages for male and female were 55.58% and 44.42% respectively among which two age group category was instructed as 18–25 years and 26–33 years. 91.62 percent were from the first group whereas the rest 8.38% were from the second category only. However, among all students, most were studied masters followed by honors 4th year as a rate of 23.60 and 22.34 percent. The least numbers of only 23 were from 2nd year and 76 and 74 counted for 3rd and 1st year respectively. As the educational institutes were ceased, the highest percentages of participants were continuing their academic activities online from home whereas only 18.27% stated they were not doing so. Almost one-fourth of the participants (26.65%) identified that they have gained weight whereas about 17.77% lost after the lockdown. However, more than half (43.65%) controlled their weight and only 11.93% reported they were not concerned about their weight. Moreover, most of the students described their health status as good with a percentage of just below 70% whereas only 11.68 and 4.57 percent outlined as excellent respectively in the post confinement period. Another 13.45% and the least percent of, 1.02% described their health as bad and too bad respectively. All of this data is depicted in the Table 1 statistically.

3.2. Source of information

At the time of the global pandemic introduced lockdown period, most of the participants got health and nutrition-related data through the website and social media platforms in which 315 and 318 participants got health and nutritional information respectively from this source during the lockdown. However, the second common source for the information was family members and friends with several 234 for health and 241 for nutrition. The least used source was the local and

Table 1. Socio Demographic data (n = 394).

Characteristics	n	%
Gender		
Male	219	55.58
Female	175	44.42
Age		
18–25	361	91.62
26–33	33	8.38
Educational Status		
Masters	93	23.60
4 th year	88	22.34
3 rd year	76	19.29
2 nd year	23	15.99
1 st year	74	18.78
Continuation of education from home		
Yes	322	81.73
No	72	18.27
Weight change after lockdown		
I do not know	47	11.93
Loss	70	17.77
Weight had/have control	172	43.65
Gained	105	26.65
Perceived health state after Lockdown		
Too bad	4	1.02
Bad	53	13.45
Good	273	69.29
Very Good	46	11.68
Excellent	18	4.57

international agency for the information (health- 82 persons, nutrition- 72 persons). The other two sectors were information from newspapers and health workers/nutritionists/dietitians. However, 159 people read the newspaper for both cases, and 93 and 103 students were consulted/visited by health workers/nutritionists/dietitians for health and nutritional guidelines respectively. As multiple responses were involved, the total number of answers was higher than the total number of participants represents in Table 2.

3.3. Eating habits

The surveyed population was observed both during and post lockdown period and Table 3 describes the data on eating habits of the participants in terms of the relationship between changes in eating habits during and after lockdown. The majority of the students ate homemade foods within a week in both periods (90.36% and 81.73% for during and after lockdown respectively) whereas almost the same number stated

Table 2. Source of information (Percentage) (Multiple responses were collected).

Source of information	Health-Related information n (%)	Nutrition-related information n (%)
Local and International organization	82 (20.81)	72 (18.27)
Health Worker/nutritionist/dietitian	93 (23.60)	103 (26.14)
Newspaper	159 (40.36)	159 (40.36)
Website and social media	315 (79.95)	318 (80.71)
Family members and friends	234 (59.39)	241 (61.17)

Table 3. Relationship between changes in eating habits during and after lockdown.

Variables	During Lockdown n (%)	After Lockdown n (%)	p-Value (Chi-square)
Most consumed meals during the week			
Fast food	1 (0.25)	8 (2.03)	<0.001
Frozen food	2 (0.51)	3 (0.76)	
Healthy food	30 (7.61)	31 (7.87)	
Homemade food	356 (90.36)	322 (81.73)	
Restaurant's food	5 (1.27)	30 (7.61)	
Number of major meals per day			
1–2 meals	62 (15.74)	100 (25.38)	<0.001
3–4 meals	315 (79.95)	286 (72.59)	
≥5 meals	17 (4.31)	8 (2.03)	
Eating breakfast on most days			
Yes	275 (69.80)	267 (67.77)	<0.001
No	119 (30.20)	127 (32.23)	
Skipping meals			
Yes	69 (17.51)	68 (17.26)	<0.001
No	325 (82.49)	326 (82.74)	
Amount of water consumed per day			
1–4 Glasses	120 (30.46)	129 (32.74)	<0.001
5–7 glasses	205 (52.03)	200 (50.76)	
More than 8 glasses	69 (17.51)	65 (16.50)	

they consumed healthy foods (7.61% and 7.87% for during and after lockdown respectively). However, a significant increase in taking restaurant's food has been observed in which only 1.27% were during lockdown which later raised to 7.61% after lockdown. Though the rates of participants taking 1–2 major meals daily significantly increased to 25.38% after lockdown from 15.74% of during lockdown, percentages in terms of 3–4 meals and 5 or more than 5 times in day slightly lowered down after canceling lockdown than continuing lockdown. There were no visible significant changes in regards to eating breakfast daily, skipping meals, and the consumption of water in both given periods.

During lockdown due to COVID-19 pandemic, the frequency of food consumption of particular food groups is represented in Table 4. Most of the participants (53.81%) ate carbohydrates (Bread/rice/potato) 3–4 times daily whereas just below 30% consumed meat/fish/chicken once a day and only 4.06% more than 4 times per day. A significant number of the population never accessed milk and dairy products (22.08%). However, higher numbers got fruits 1–4 times per week. Like this, 32.74% of students reported they have taken vegetables. Almost fifty percent of people have consumed pulse/legumes 1–4 times/week and 26.14% at least once daily. However, a noticeable percentage of students just below 13% consumed sweet and sweetened foods once per day whereas most of the students denied energy drinks, and just above 40% of participants consumed soft drinks 1–4 times every seven days.

Table 4. The frequency of consumption of particular foods during a lockdown of COVID-19 pandemic (n = 394).

Food Items	More than 4 times/day n (%)	3-4 times/day	Once/Day	1-4 times/Week	Never
Bread/rice/potato	23 (5.34)	212 (53.81)	83 (21.07)	68 (17.26)	8 (2.03)
Meat/fish/chicken	16 (4.06)	98 (24.87)	109 (27.66)	166 (42.13)	5 (1.27)
Pulse/legumes	11 (6.09)	65 (16.50)	103 (26.14)	191 (48.48)	24 (6.09)
Milk and dairy products	5 (1.27)	16 (4.06)	102 (25.89)	184 (46.70)	87 (22.08)
Vegetables	18 (4.57)	106 (26.90)	134 (34.01)	129 (32.74)	7 (1.78)
Fruits	7 (1.78)	26 (6.60)	87 (22.08)	246 (62.44)	28 (7.11)
Sweet and sweetened foods	2 (0.51)	14 (3.55)	51 (12.94)	251 (63.71)	76 (19.29)
Soft Drinks	9 (2.28)	17 (4.31)	41 (10.41)	165 (41.88)	162 (41.12)
Energy drinks	1 (0.25)	9 (2.28)	18 (4.57)	106 (26.90)	260 (65.99)

3.4. Shopping practices

There have been noticed trends to prepare a shopping list (Table 5) during lockdown among more than half of the participants. Though the tendency to store foods during lockdown was about 43.15%, it is later significantly decreased after lockdown to a percent of only 14.72 than the previous 43.15%. However, the majority of the population reported they are not stocking up on foods in both of the time frames. Almost 70% of students used to buy grocery products online at the time of lockdown. Moreover, 89.59 percent of participants read food labels during the lockdown. But the number of students sanitizing products before use after buying has significantly outnumbered after lockdown as 82.49% sanitized during lockdown which then lowered to only 46.45% in the later time.

3.5. Physical activity

Table 6 represents the relationship between changes in daily activities in terms of during and after lockdown. Almost 26% of participants did household activities during lockdown which then lowered to 19.04% when the restriction was withdrawn. However, 29.44% of students reported they never contributed to home activities after lockdown which is much higher than the time of lockdown of a rate of 19.04% ($p < 0.001$). In terms of 1–3 times within a week, the percentages remained almost the same in both periods whereas 14.72 and 12.18 percent give a hand to works respectively during and after lockdown. As the confinement has ceased, using the computer for study purposes decreased to 22.59% from the rate of 26.40% during the lockdown in terms of more than 5 h daily ($p < 0.001$). Unlike this, in regards to 1–2 h per day, screening time has increased almost 6% percent when a restriction has been terminated whereas using 3–5 h per day was nearly the same in both periods. Additionally, rates of populations never engaged to screen were 21.57 and 19.04 percent respectively for during and after lockdown. In terms of sitting in front of the screen to get refreshment, the almost same number of participants spent 3–5 h in a day. Only a small amount of students get accessed less than half an hour daily where numbers were 14 and 31 respectively for during and post lockdown situations. However, significantly higher rates of 44.67 and 30.71 percent respectively for first and later period used to screen more than five hours within a day for entertainment whereas rates for post lockdown time has increased to a relatively higher rate of 31.73% than the previous 23.10% of restricted period ($p < 0.001$). Table 6 contains all the frequencies of these data.

Figure 1 (a) depicts the frequency of physical activities among the participants in both of the mentioned periods in which it describes that significantly higher numbers of students never engaged in any exercises which counts more than 40% in both timeframes whereas only a little percentages of people, with the rates of 18.78 and 16.24 percent took more than 3 times within a week respectively for lockdown and post-lockdown situation ($p < 0.001$). However, in terms of taking 1–3 times per week, the rates almost remained the same for both times.

Table 5. Shopping practices.

Variable (s)	n (%)	n (%)
	During Lockdown	After Lockdown
Prepare shopping list		
Yes	236 (59.90)	*
No	158 (40.10)	*
Start stocking up on foods		
Yes	170 (43.15)	58 (14.72)
No	224 (56.85)	336 (85.28)
Online grocery shopping		
Yes	264 (67.01)	*
No	130 (32.99)	*
Reading food labels		
Yes	353 (89.59)	*
No	41 (10.41)	*
Sanitizing/cleaning groceries		
Yes	325 (82.49)	183 (46.45)
No	69 (17.51)	211 (53.55)

* Data were not collected in those responses regards to after lockdown.

Table 6. Relationship between changes of daily activities in terms of during and after lockdown.

Variables	During Lockdown n (%)	After Lockdown n (%)	p-Value (Chi-square)
Doing household chores			
Never	75 (19.04)	116 (29.44)	<0.001
1–3 times/week	159 (40.36)	155 (39.34)	
4–5 times/week	58 (14.72)	48 (12.18)	
Everyday	102 (25.89)	75 (19.04)	
Screen time for study or work			
None	85 (21.57)	75 (19.04)	<0.001
1–2 h/day	118 (29.95)	142 (36.04)	
3–5 h/day	87 (22.08)	88 (22.34)	
>5 h/day	104 (26.40)	89 (22.59)	
Screen time for entertainment			
Less than 30 min/day	14 (3.55)	31 (7.87)	<0.001
1–2 h/day	91 (23.10)	125 (31.73)	
3–5 h/day	113 (28.68)	117 (29.70)	
>5 h/day	176 (44.67)	121 (30.71)	

Figure 1 (b) represents the significant interrelation between physical activity and weight changes after the lockdown period ($p = 0.007$). The bar graph shows that the highest percent (51.56%) participants maintained weight who has done more than 3 h exercise within a week whereas the almost same number of students maintained their weight who did 1–3 h per week which was significantly higher than who never engaged to activities (35.29%). Moreover, there is a significant rate of students described gained weight (33.16%) due to no training whereas only little amount reported so who did extensive works (12.50%).

3.6. Stress

Figure 2 depicts the percentages of participants feeling in terms of physically tiredness (a), mental tiredness (b), resentment (c), and sadness (d) in both of the mentioned periods. However, outputs indicated that all types of stress categories except physical tiredness, numbers of students who reported always has decreased as the lockdown withdrawn than the confinement situation. Though a significant number counted just above 50% admitted they have experienced physically tired sometimes in both period, in regards to always was just below 5% in both situation. The p values describe the statistical significance level of the chi-square test ($p < 0.000$).

3.7. Sleep quality

Below Table 7 shows the relationship between changes in sleeping patterns in terms of lockdown and post lockdown periods. As the confinement situation has ended, rates of students having good quality sleep have risen by almost 10% than the period of lockdown (63.17%). However, people getting very good sleep slightly lowered to 21.83% in post lockdown than lockdown (29.19%). Moreover, results have shown that more than 50% of students slept 7–9 h per night whereas there was a significant increase who slept less than 7 h only, the percentages counts 25.63 and 38.83 respectively for during and after lockdown. Additionally, significantly higher numbers (43.91%) never felt any disturbances during sleep as the lockdown ceased than imprisoned situation (27.41%). Due to the cancellation of restriction being home, 17.26% reported feeling energized whereas only 12.18 reported so in lockdown. 21.83% enquired population felt lazy after lockdown which was almost half than who experienced laziness during confinement (40.36%). The Chi-square test shows the statistical significance ($p < 0.000$).

Below Table 8 describes the relationship between socio-demographic factors and lifestyle changes after lockdown by the adjusted model.

Table 8 illustrates that odds were 1.73 times higher in terms of changes in weight among those who did not continue their educational

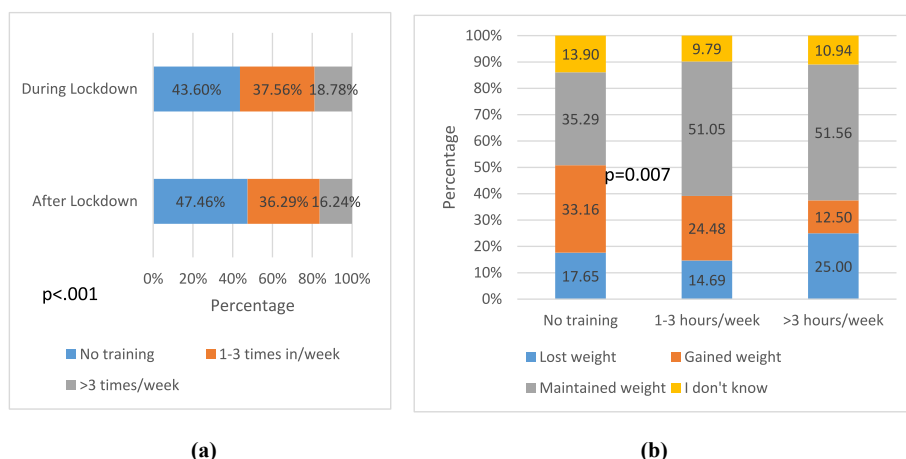


Figure 1. (a) Frequency of physical activity during and post lockdown; Figure 1 (b) Association between physical activity and weight changes among students.

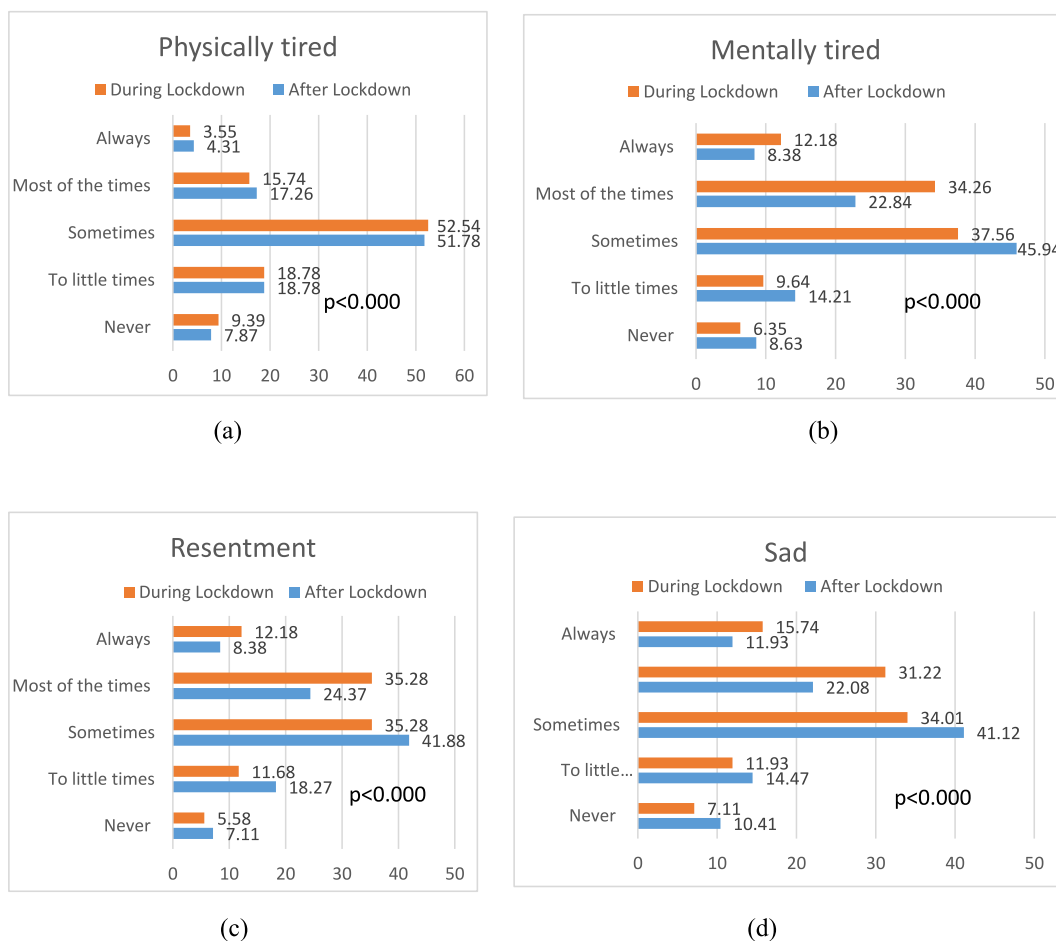


Figure 2. 2 (a) Percentages of respondents feeling physical tiredness in both lockdown and post-lockdown periods; 2 (b) Percentages of respondents feeling mental tiredness in both lockdown and post-lockdown periods; 2 (c) Percentages of respondents feeling resentment in both lockdown and post-lockdown periods; 2 (d) Percentages of respondents feeling sadness in both lockdown and post-lockdown periods.

Table 7. Relationship between changes in sleeping patterns in terms of lockdown and post lockdown periods.

Variables	During Lockdown n (%)	After Lockdown n (%)	p-Value (Chi-square)
Hours of sleep per night			
Less than 7 h	101 (25.63)	153 (38.83)	<0.001
7-9 Hours	211 (53.55)	199 (50.51)	
More than 9 h	82 (20.81)	42 (10.66)	
How would you rate your sleep quality			
Very good	115 (29.19)	86 (21.83)	<0.001
Good	212 (53.81)	251 (63.71)	
Poor	67 (17.01)	57 (14.47)	
Did you experience any of the following			
None	108 (27.41)	173 (43.91)	<0.001
Very difficult to sleep	37 (9.39)	30 (7.61)	
Wake up frequently and have difficulty to sleep	57 (14.47)	47 (11.93)	
Very early wake up and could not sleep	21 (5.33)	23 (5.84)	
Long continuous sleep	171 (43.40)	121 (30.71)	
Describe your energy level			
Energized	48 (12.18)	68 (17.26)	<0.001
Neutral	187 (47.46)	240 (60.91)	
Lazy	159 (40.36)	86 (21.83)	

activities (AOR = 1.73; 95% CI: 1.01, 2.95) after the lockdown period compared to who continued their academic works from home.

Factors associated with meals per day also shows in Table 8. The sex of the respondents, self-perceived health status, and continuation of education from home were significantly related. The odds were 1.77 times higher among females (AOR = 1.77; 95% CI: 1.06, 2.95) than male participants. However, odds were 0.08 times lower for both who stated their health status bad (AOR = 0.08; 95% CI: .01, .87) and good (AOR = 0.08; 95% CI: .01, .87) than who claimed too bad. But odds were 3.25 times higher among those who did not continue their educational activities (AOR = 3.25; 95% CI: 1.79, 5.92) compared to their counterparts.

Our analysis revealed that the continuation of education is significantly associated to screen time for entertainment purposes. 3.08 times odds were found among those who did not continue their educational activities (AOR = 3.08; 95% CI: 1.78, 5.33) compared to their counterparts.

Perceived health status and continuation of education are also significantly associated with the sleeping hour (Table 8). Odds were 0.7 times lower in terms of changes sleeping hour found among who explained their health state excellent (AOR = 0.7; 95% CI: .01, .98) than their counterparts. However, 2.23 times the odds were identified among those who did not continue their education from home (AOR = 2.23; 95% CI: 1.30, 3.83) after lockdown.

Gender and continuation of education from home were significantly related to changes in sleeping quality (Table 8). Odds were 1.76 times higher among women (AOR = 1.76; 95% CI: 1.09, 2.85) than male

Table 8. Association between factors and lifestyle changes after lockdown.

Variables	Changes in weight AOR (95% CI)	Meals per day AOR (95% CI)	Physical Activity AOR (95% CI)	Screen time (Entertainment) AOR (95% CI)	Sleeping Hour AOR (95% CI)	Sleep quality AOR (95% CI)
Age						
18–25	Ref	Ref	Ref	Ref	Ref	Ref
26–33	.78 (.34, 1.78)	1.28 (.44, 3.73)	.84 (.34, 2.05)	1.14 (.49, 2.67)	.78 (.32, 1.88)	.51 (.19, 1.38)
Education						
Hons.	Ref	Ref	Ref	Ref	Ref	Ref
Masters	.84 (.49, 1.46)	.52 (.25, 1.07)	.63 (.35, 1.12)	.99 (.55, 1.75)	1.17 (.66, 2.09)	1.70 (.94, 3.10)
Gender						
Male	Ref	Ref	Ref	Ref	Ref	Ref
Female	.75 (.50, 1.14)	1.77 (1.06, 2.95)**	1.08 (.71, 1.66)	.70 (.44, 1.10)	.88 (.56, 1.38)	1.76 (1.09, 2.85)**
Perceived health state after Lockdown						
Too bad	Ref	Ref	Ref	Ref	Ref	Ref
Bad	.45 (.04, 4.74)	.08 (.01, .87)**	.27 (.03, 2.75)	1.35 (.37, 4.87)	.14 (.01, 1.47)	1.17 (.35, 3.92)
Good	.26 (.03, 2.61)	.08 (.01, .84)**	.22 (.02, 2.19)	1.63 (.51, 5.22)	.18 (.02, 1.81)	.83 (.28, 2.48)
Very Good	.29 (.03, 3.09)	.16 (.01, 1.72)	.13 (.01, 1.39)	1.64 (.45, 5.98)	.11 (.01, 1.19)	.60 (.16, 2.19)
Excellent	.64 (.05, 7.72)	.17 (.01, 2.16)	.16 (.01, 1.94)	- ^a	.07 (.01, .98)**	- ^a
Continuation of education from home						
Yes	Ref	Ref	Ref	Ref	Ref	Ref
No	1.73 (1.01, 2.95)**	3.25 (1.79, 5.92)***	1.32 (.77, 2.29)	3.08 (1.78, 5.33)***	2.23 (1.30, 3.83)***	2.38 (1.35, 4.23)***

AOR = Adjusted Odds Ratio.

CI = Confidence Interval.

** Implies p-value significance at 5% level.

*** Implies p-value significance at 1% level.

- Data were not found in those cases.

students. Furthermore, odds were 2.38 times higher among those who did not continue their educational activities (AOR = 2.38; 95% CI: 1.35, 4.23) compared to their counterparts.

4. Discussion

As far as our knowledge, this is one of the initial studies to assess eating habits and lifestyle changes among students after the cancellation of lockdown. Though home confinement has been imposed to prevent the spread of coronavirus cases, it might be possible to adopt alteration of normal daily life during the pandemic than previous times and again trying to get rid of restricted life at post lockdown period.

Prevalence of taking restaurant's foods increased after lockdown period than home staying whereas eating homemade foods has lowered after lockdown than previous home confinement. However, the previous study has suggested that consuming rate of fast food and outside foods has significantly dropped during lockdown (Husain and Ashkanani, 2020). Another study from Italy shows an increased in eating homemade foods during lockdown due to sufficient time to cook (López-Moreno et al., 2020; Pellegrini et al., 2020). The possible reasons behind the visible changes at the time of post lockdown in our findings may be the restaurants, street foods vendors and other outside markets are open now. However, in terms of the frequency of daily major meals, skipping meals and eating breakfast has not changed significantly at a later period than earlier. In agreement with our research, a Polish study shows that most prevalence of meal frequency was three and four times within a day during lockdown whereas our observation declared it was about 79.95% and 72.59% who consumed 3–4 times main foods respectively for during and after lockdown (Sidor and Rzymiski, 2020). Not switching the patterns at post lockdown than lockdown may be the closure of educational institutes as students are still forced to follow family patterns.

This particular study has shown that about one-fourth of the participants gained weight as well as only 5.33% reported an increase in meals per day after lockdown. These changes might have happened as the students could frequently go outside home than the lockdown period. In contrast to our study, previous researches have shown that a higher

number of respondents gain weight during pandemic confinement (Ismail et al., 2020; López-Moreno et al., 2020; Pellegrini et al., 2020) and others represent increment in calorie intake and subsequent increase in weight at that situation (Bhutani and Cooper, 2020; Deschaux-Tanguy et al., 2020; Di Renzo et al., 2020; Husain and Ashkanani, 2020). Though the genuine weight could not be possible to measure, respondents stated their condition in terms of this asking. Weight gain during lockdown may be occurred due to the prohibition to go outside the home, unavailability of products as limited time to open shops (Mattioli et al., 2020). However, our study represents lesser numbers of respondents who gained may be due to the availability to move outside as the lockdown was postponed.

Just below 50% of respondents did not involve any physical activities in both periods which causes sedentary behaviors but gradually lowered the number of students who never accessed after lockdown. A Bangladeshi study shows that higher sedentary behavior was found among 20.9% of people (Rahman et al., 2020). In comparison to other studies, it is almost similar pictures at the time of lockdown (Abbas et al., 2020; Ammar et al., 2020a; Burtscher et al., 2020; Grant et al., 2021; Ismail et al., 2020; Rahman et al., 2020; Yang et al., 2021). However, the small increase in taking physical exercises may happen as restrictions have withdrawn and it may be one of the possible reasons for weight loss among respondents.

Moreover, in this research, screen time for refreshing and entertainment purposes has decreased significantly among those who used to spend over 5 h per day after lockdown which was more prevalent to sit in front of the television, computer, or handphone, and these were possible risks associated with poor health during lockdown along with physical inactivity and extra care and attention should be taken to prevent this bad habits as soon as possible as lockdown has ceased now (Burtscher et al., 2020; D. et al., 2020).

It has been experienced in previous studies that there are significantly higher levels of stress, irritability, anxiety, and depression among individuals due to COVID- 19 pandemic (Cullen et al., 2020; Shigemura et al., 2020; Zandifar and Badrfam, 2020). Some researches among university students in Bangladesh has shown the increasing level of

depression and anxiety during the pandemic outbreak as the institutes are closed for a longer period which is a major concern about their future academic and professional life (Akhtarul Islam et al., 2020; M. S. Islam et al., 2020). For instance, an observation which was conducted in 2015 represents medical colleges students suffer from depression and anxiety at a rate of 54.3 and 64.8 percent respectively whereas another study suggested that 52.2% of university students were depressed and 58.1% were anxious (Alim et al., 2017; Mamun et al., 2019). In comparison to these study's outcomes, though the lockdown has been postponed in Bangladesh, physical tiredness, mental tiredness, resentment, and sadness are still exhibited among the participants which are possibly due to the cancellation of all types of academic activities like class lessons, examinations. Moreover, according to our results sleep disturbances were more prevalent among female students and sleeping hours per night have also decreased than males respondents which are possible causes of weight gain, depression, anxiety, and stress among the surveyed populations. Also, World Health Organization (WHO) advised it can cause depression and anxiety situations by receiving information from non-realistic sources (WHO, 2020). This research shows that around 80% of students got health and nutrition-related data from social media which can contain a false and misleading context.

Furthermore, these physical and mental exhaustive conditions could severely hamper sleeping quality at night as well as daytime energy status. Previous studies have suggested that sleeping quality was worse during lockdown among students (Romero-Blanco et al., 2020) whereas another finding stated that sleeping disturbances were more common among middle-aged Bangladeshi people (Ara et al., 2020). Moreover, sleep duration increased during lockdown among participants (Dragun et al., 2021; Galali, 2021; Luciano et al., 2020; Yang et al., 2021). However, our study shows that there was a gradual decrease in sleep disturbances during the post lockdown period. Also, it indicates that only 17.26% of people stated their energy level as energized whereas 14.47% rated their sleep as poor quality after the cancellation of lockdown. Though these percentages have slightly decreased than lockdown's period that does not mean the situation has improved entirely. These changes happened may be due to the frequent movement outside, meeting friends and families, and withdrawal of restrictions. A previous observation has revealed that it is beneficial to meet up telepsychiatry as it found a significantly adverse correlation between anxiety and sleep quality (Xiao et al., 2020).

The regression model reveals that changes in sleep quality were higher among female students after lockdown. However, research shows that during lockdown sleep quality was not different between sexes (Bigalke et al., 2020). The result of our study may be male students could go outside and do not participates in household works than females.

Output from logistic regression also shows that not continuing educational activities after the lockdown was significantly positively associated with weight changes which maybe occurs as the lockdown has withdrawn, but the closure of academic institutes which may enable either physical activities or not. More studies may be needed to find out the possible reason behind this.

Not continuing educational activities after the lockdown was significantly positively associated also with meals per day. This might have happened as students have still stayed at home or they can go outside for eating as the home confinement has been postponed.

Not continuing educational activities after the lockdown was significantly positively associated with screen time for entertainment. The plausible reason behind this may be participants get enough time other than educational purposes. A study from the USA shows that screen time increased during homestay (Cullen et al., 2020).

Sleeping length and timing significantly altered during homestay than normal life (Roitblat et al., 2020). Our findings show that sleeping hours and sleep quality were also associated with not continuing academic activities from home which may be occurred as students have not had educational activities which enable more sleeping time. However, we

may suggest more advanced researches should be conducted to find out the underlying causes behind these changes.

5. Conclusions

This study was the pioneer study to assess the eating habits and lifestyle changes among Bangladeshi higher studies students.

The results show that the prevalence of taking homemade foods decreased after lockdown. Meal frequency also lowered at this time. Tendency to stock extra foods and sanitizing products bought were significantly decreased after the cancellation of home confinement. Participating in household activities regularly also falls into the lockdown period. Screen time in terms of longer period (>5 h) significantly decreased after lockdown which was significantly associated with those who did not continue their academic purposes. Changes in weight, meal per day, sleeping quality, and sleeping hours were also significantly related to this factor. Moreover, perceived health state was related to meal per day and sleeping hours. However, the gender of the respondents was significantly associated with meals per day and sleep quality. Though weight gain percent was decreased involvement to any physical activities were almost remain same in both periods. The results also show that physical tiredness, mental tiredness, resentment, and sadness are still exhibited among the participants which are possibly due to the cancellation of all types of academic activities like class lessons, examinations.

5.1. Limitations and future scopes

This particular study has limitations as it was conducted through a self-administrated questionnaire, non-probability convenience sampling method, and cross-sectional study design. As the study was cross-sectional, we cannot conclude causality between any variables studied. Moreover, the data related to lockdown was collected after the cancellation of lockdown which may cause biases due to memory recall. We also could not take into account some important factors like smoking habits, consumption of alcohol and energy drinks, waist diameter, weight, and height. In terms of Bangladeshi culture, drinking alcohol is not so relatable thus we did not ask about it to respondents. Furthermore, weight changes could not detect directly as it is not possible online. However, as the data was collected during the pandemic situations, it was impossible to conduct face-to-face interviews. So, we did not take self-administered waist diameter, weight, and height. Previous studies also show that self-reported physical exercises, sedentary behavior, and sleep practices are less feasible than device-oriented measurements (Lauderdale et al., 2008; Prince et al., 2020). Major changes in food habits were not also possible to count as questionnaire regard to this was only during lockdown period. Most importantly, our targeted population was students who were admitted to at least bachelor's level. This does not represent all the people, not even all the students. It was not also possible to reach all of the higher educational institute's pupils. However, this study could be used for reference further upcoming studies in terms of all students from all institutes as well as all age populations.

Declarations

Author contribution statement

Md Mahbul Alam Shaun, Shahnaz Munny: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Md Wahidur Rahman Nizum: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Fahmida Fayeza: Performed the experiments; Analyzed and interpreted the data.

Sujan Kanti Mali: Contributed reagents, materials, analysis tools or data; Wrote the paper.

Mohammad Tazrian Abid, Al-Riaj Hasan: Performed the experiments; Contributed reagents, materials, analysis tools or data.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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