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Research

Prevalence of risk factors for non-communicable disease: a university-based cross-sectional study after the COVID-19 pandemic in Bangladesh

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Abstract

Background Non-communicable diseases (NCDs) account for major health complications globally as well as in Bangladesh. The current study aimed to evaluate the prevalence of risk factors for NCD among students and faculty/staff of the University of Dhaka after the COVID-19 pandemic.

Methods A cross-sectional study (June 2022-July 2023) was conducted collecting information of sociodemographic factors, sleeping and food habits, family history, smoking, usage of electronic devices, refractive errors, and physical measurements, all of which were linked to risk factors. Subsequent analyses, such as bivariate, univariate, and logistic regression, were conducted on the population to evaluate associations between NCD status and the respective risk factors.

Results The overall mean age, blood sugar, body mass index (BMI), and systolic and diastolic blood pressure were 22.34 years, 5.88 mmol/L, 23.27 kg/m2, 118.47 mm Hg, and 75.69 mm Hg, respectively. The most significant NCD risk factors were obesity (50.37%), followed by high sugar level (hyperglycemic) (13.45%), and hypertension (11.98%).

Conclusions This study showed a significant number of NCD risk factors among University of Dhaka students and staff following COVID-19, underlining the urgent need for focused health interventions, particularly those addressing food and sleep. Addressing these hazards is critical to avoiding growing NCD incidence to ensure an effective healthcare system in Bangladesh.

Keywords Non-communicable diseases (NCDs) · University of Dhaka · COVID-19 · Bangladesh

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1 Introduction

Non-communicable diseases (NCDs) are responsible for causing a significant increase the number of morbidity and mortality cases and healthcare cost all over the world [1, 2]. According to the World Health Organization (WHO), NCDs are responsible for 71% of all global deaths, with approximately 15 million deaths occurring among individuals aged 30–69 years [3].

The prevalence of non-communicable diseases is much higher in developing countries like Bangladesh, India, Indonesia, Thailand, and Vietnam. The findings indicated that over 70% of the predominantly rural populations had three or more risk factors for chronic NCDs. The clustering of these risk factors was linked to older age, male gender, and higher levels of education. Variations in risk factors were observed in different locations within individual country [4]. Previous studies on Bangladeshi individuals, encompassing students, adults, the elderly, children, and residents of both urban and rural areas [5–9], have highlighted a high prevalence of NCDs, for instances, Fottrell et al. [10] specifically mentioned the frequent occurrences of hypertension and diabetes among adults in rural Bangladesh [10]. A study at Jahangirnagar University found 29.2% of respondents were overweight or obese, with two-thirds of them did not engage in any physical activity. Furthermore, personal or family history of NCDs increase the risk of heart disease [11].

Recent studies have reported that adolescents, young people, and even children were experiencing serious NCDs such as diabetes, hypertension, obesity, gastroesophageal reflux disease, asthma, and others [12–14]. According to WHO, unhealthy diets, physical inactivity, tobacco use, harmful use of alcohol, family history, socio-economic factors, and stress are some of the contributors to the development of NCDs [3]. Furthermore, the COVID-19 pandemic has further exacerbated these risk factors, with increased stress levels, reduced physical activity, changes in dietary patterns, and disruptions in healthcare services [15]. A number of studies have highlighted the impact of the COVID-19 pandemic on the prevalence of NCD [16–18]. Various investigation suggested that the prevalence of NCDs such as high blood pressure (HBP), diabetes, respiratory diseases and cardiovascular diseases had been increased with COVID-19 [19], which was reported in Europe, and India [16, 20].

University of Dhaka, the oldest and one of the largest university in Bangladesh has a diverse population of students and staffs, including individuals from different socio-economic backgrounds, age groups, and lifestyles [21]. There is limited investigation based on the prevalence of NCD risk factors among the University of Dhaka community after the pandemic as well as before the COVID-19 pandemic. Understanding the prevalence of NCDs risk factors among the young population and students during the pandemic is essential for developing evidence-based interventions and policies to address the burden of NCDs [22].

STEPwise Surveillance (STEPS) is the WHO's recommended framework for chasing NCDs and their risk factors, designed to help low- and middle-income countries' NCDs pattern. The process involves three stages: first, collecting risk factor data via a questionnaire; second, conducting basic physical measurements; and third, performing more detailed biochemical analyses using urine and blood samples [23]. This study aimed to use the STEPS approach to investigate the prevalence of NCD risk factors among students and staff (both faculty and support personnel) at the University of Dhaka in the wake of the COVID-19 pandemic.

2 Materials and methods

2.1 Study design and participants

This study was conducted from June 2022 to July 2023 as per of STEPSwise approach devised by the WHO recommended core NCD risk indicators [23]. It was a cross-sectional study and the target population for this study was the students and staffs (including faculty members and support personnel) of University of Dhaka who were come from urban and rural areas of Bangladesh.

2.2 Sampling and size determination

The anticipated personnel of University of Dhaka were nearly 41,000, was taken into account for calculating the sample size. As per the RaoSoft, the minimum anticipated number of participants was determined to be 381, ensuring a 95% confidence level (Z = 1.96). The population portion was deemed at 50% while the margin error was considered at 5% [24].

$$n = \frac{z^2pq}{d^2}$$

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{0.05^2}$$

$$n = 384$$

Additionally, a 7% allowance was made for non-responsive participants within the population. Therefore, the total sample size for this study was established at 409. The investigation included students, faculty members, officers, and other professionals from the University of Dhaka, aged 18 and over. Data were collected directly from the population without prioritizing any specific institutes, faculties, or departments. A simple random sampling method was employed to choose participants. The total count of students and staff was determined, and each person was given a unique identifier to prevent repetition. Participants were selected until the desired sample size was reached. The data was then divided into two categories: students and staff/faculty.

2.3 Data collection procedures

The questionnaire was developed by following the STEPS questionnaire to collect the necessary information [23]. The main purpose of the questionnaire was to identify non-communicable disease risk factors. It collected data on sociodemographics, smoking prevalence, food habits (including fruit, vegetable, fast food, street food, water, sugar, and salt consumption), physical activity, phone and computer use, social media use, and family history of NCDs. Additionally, it included questions on age, gender, sleeping habits, daily water intake, smoking habits, social media usage, physical exercise, and personal and family health history (diabetes, cardiovascular disease, chronic respiratory disease, and refractive error). Consent was obtained from all participants.

2.4 Physical measurements

Physical measurements, including height, weight, waist and hip circumference, blood pressure (systolic and diastolic), and blood sugar levels (BSLs), were collected by trained pharmacy students. Body mass index (BMI) (weight divided by height squared) [25] and waist-to-hip ratio (WHR) were enumerated later. All measurements were taken at least three times, with averages used for analysis. Blood pressure readings were taken three times with 30-min intervals, and fasting BSLs were measured three times with 2–5 min intervals. Measurements were conducted over three consecutive days, and the averages were recorded.

2.5 Variables

2.5.1 Dependent variable

HBP was defined using systolic and diastolic BP according to JNC7 guidelines, with systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg considered hypertensive [27, 28]. BMI classifications were underweight/normal (< 25 kg/m^2) and overweight/obese (≥ 25 kg/m^2) based on WHO guidelines [26, 29, 30]. BSLs were considered as hyperglycemic, when ≥ 7 mmol/L based on WHO [29].

2.5.2 Independent variable

WHR was calculated by dividing waist by hip circumference, with categories for women as high (0.86), moderate (0.81–0.85), and low (0.80), and for men as high (1.00), moderate (0.96–1), and low (0.95) [31]. The population was categorized into student, and faculty/staff. Sleeping hours were grouped into ≤ 5 h, > 5 to < 9 h, and ≥ 9 h [32]. Bedtime was categorized as before 11 PM, between 11 PM and 2 AM, and after 2 AM [33]. Fruit and vegetable intake was classified as high (≥ 4 cups daily), moderate (< 4 to ≥ 2 cups), and low (≤ 1 cup) [34]. Consumption of beef, mutton, or foods high in cholesterol was graded as either yes or no. Water intake was divided into high (≥ 2.5 L), moderate (2–2.5 L), and low (≤ 2 L), measured in 250 ml glasses [35]. Sugar intake with tea and coffee was classified as 'high', 'moderate', and 'low'. Additional salt consumption, smoking, social media use, exercise, stress, family history of NCDs, and refractive error were evaluated using a yes/no scale. Refractive error was self-reported in diopters.

Furthermore, in this study no risk factors were established, while those several risk factors were found in prior studies were considered in this study to assess their frequency and associations. According to Center for Disease Control (CDC), WHO and other previous studies, the risk factors of cardiovascular disease, strokes and hypertension are HBP, high BSL, smoking, unhealthy diet, physical inactivity, sleep, additional salt intake, fruits and vegetable intake, family history, age and gender [36–38]. As per the CDC, the risk factors of diabetes include age, gender, BMI, high salt diet, physical inactivity, diet, low intake of fruits and vegetables, family history and stress [39]. Refractive error risk factors include age, phone and computer use, social media use, family history and stress [40].

2.6 Study tools

The research used the following tools: (1) Digital balance and stadiometer for weight and height measurement, (2) Digital blood pressure monitors (Medica Smart), (3) Measuring tapes for abdominal circumference, and (4) Digital glucometers (Glucolab). All instruments were validated: BP monitors against a mercury sphygmomanometer, weight and height machines against standard weights and measuring tapes, and glucometers with standard glucose solutions.

2.7 Statistical analysis

The information was gathered and recorded on an individual basis. All of the content was manually input into Microsoft Excel 2016 (USA). The entirety of the data was subjected to analysis, while Microsoft Excel was employed for the initial phase of data analysis. Univariate and bivariate (chi-square test) analyses were conducted to check the association between the dependent and explanatory variables. After reviewing the association between the explanatory and dependent variable, this study has gone through a multilevel binary logistic model to determine the effects of different factors on HBP, overweight/obesity, and high BSL. The statistical data analysis was conducted using STATA 17 (StataCrop LLC, Texas, USA).

2.8 Ethical clearance

Notably, the study did not involve any harm to either group and was not part of a clinical trial. Prior to data collection, explicit verbal and/or written consent was obtained from each participant. The collection of data was solely for research purposes, and stringent measures were implemented to uphold privacy. Before initiating the investigation, the protocol was approved by the Faculty of Pharmacy Ethical Committee [(Ref.No.Fa.Ph.E/001/22) date- 15/06/2022] in accordance with the Helsinki Declaration of the World Medical Association (WMA) [41]. After the full explanation of the procedure involved, written and informed consent was obtained from the attendees.

3 Results

3.1 Gender and current role prevalence in relation to sample characteristics

Most participants were male (64.79%) and students (91.69%). Urban participants make up 65.76%, while rural participants were 34.24%. The prevalence of underweight/normal (49.63%) versus overweight/obesity (50.37%) was nearly equal, with overweight/obesity more common among males (69.42%) (Table 1). 11.98% of participants had HBP, which was more

Table 1 The prevalence of gender and current role by sample characteristics

Variable	Overall (N, %) n = 409 (100%)	Sex		Current Role	
		Male (n, %) 265 (64.79%)	Female (n, %) 144 (35.21%)	Student (n, %) 375 (91.69%)	Staff (n, %) 34 (8.31%)
Area					
Rural	140 (34.24)	101 (72.14)	39 (27.86)	132 (94.3)	8 (5.7)
Urban	269 (65.76)	164 (60.97)	105 (39.03)	243 (90.3)	26 (9.7)
Body mass index					
Underweight or Normal	203 (49.63)	122 (60.1)	81 (39.9)	196 (96.6)	7 (3.4)
Overweight or Obesity	206 (50.37)	143 (69.42)	63 (30.58)	179 (86.9)	27 (13.1)
HBP					
Yes	49 (11.98)	32 (65.31)	17 (34.69)	42 (85.7)	7 (14.3)
No	360 (88.02)	233 (64.72)	127 (35.28)	333 (92.5)	27 (7.5)
BSL					
Hyperglycemic	55 (13.45)	39 (14.72)	16 (11.11)	45 (12.0)	10 (29.41)
Normal	354 (86.55)	226 (85.28)	128 (88.89)	330 (88.0)	24 (70.59)
Sleeping hours (daily)					
≤ 5 h	51 (12.47)	30 (58.82)	21 (41.18)	49 (96.08)	2 (3.92)
5 h–9 h	306 (74.82)	201 (65.69)	105 (34.31)	279 (91.18)	27 (8.82)
≥ 9 h	52 (12.71)	34 (65.38)	18 (34.62)	47 (90.38)	5 (9.62)
Bedtime					
Before 11 pm	89 (21.76)	61 (68.54)	28 (31.46)	69 (77.53)	20 (22.47)
1 pm-2 am	273 (66.75)	170 (62.27)	103 (37.73)	261 (95.60)	12 (4.40)
Later than 2 am	47 (11.49)	34 (72.34)	13 (27.66)	45 (95.74)	2 (4.26)
Amounts of fruits and vegetables consumption					
Low	237 (57.95)	158 (66.67)	79 (33.33)	81 (92.05)	7 (7.95)
Moderate	17 (4.16)	9 (52.94)	8 (47.06)	15 (88.24)	2 (11.76)
High	155 (37.90)	98 (63.23)	57 (36.77)	141 (90.97)	14 (9.03)
Beef, mutton, cholesterol consumption					
Yes	121 (29.58)	75 (61.98)	46 (38.02)	109 (90.08)	12(9.92)
No	288 (70.42)	190 (65.97)	98 (34.03)	266 (92.36)	22 (7.64)
Water intake					
Low	44 (10.76)	21 (47.73)	23 (52.27)	41 (93.18)	3 (6.82)
Moderate	77 (18.83)	58 (75.32)	19 (24.68)	67 (87.01)	10 (12.99)
High	288 (70.42)	186 (64.58)	102 (35.42)	267 (92.71)	21 (7.29)
Process Food consumption					
Low	129 (31.54)	90 (69.77)	39 (30.23)	108 (83.72)	21 (16.28)
Moderate	246 (60.15)	155 (63.0)	91 (37.0)	233 (94.71)	13 (5.29)
High	34 (8.31)	20 (58.82)	14 (41.18)	34 (100)	0 (0)
Soft drinks consumption					
2 or more a day	32 (7.82)	16 (50.00)	16 (50.00)	28 (87.50)	4 (12.50)
Once a day	98 (23.96)	71 (72.45)	27 (27.55)	94 (95.92)	4 (4.08)
Once a week	126 (30.81)	89 (70.63)	37 (29.37)	111 (88.10)	15 (11.90)
Rarely	153 (37.41)	89 (58.17)	64 (41.83)	142 (92.81)	11 (7.19)
WHR					
Low	305 (74.57)	238 (78.03)	67 (21.97)	281 (92.13)	24 (88.57)
Moderate	69 (16.87)	20 (28.99)	49 (71.01)	63 (91.30)	6 (8.70)
High	35 (8.56)	7 (20.00)	28 (80.00)	31 (88.57)	4 (11.43)
Salt intake					
Yes	89 (21.76)	62 (69.66)	27 (30.34)	79 (88.76)	10 (11.24)
No	320 (78.24)	203 (63.44)	117 (36.56)	296 (92.50)	24 (7.50)

Table 1 (continued)

Variable	Overall (N, %) n = 409 (100%)	Sex		Current Role	
		Male (n, %) 265 (64.79%)	Female (n, %) 144 (35.21%)	Student (n, %) 375 (91.69%)	Staff (n, %) 34 (8.31%)
Physical exercise					
Yes	187 (45.72)	140 (74.87)	47 (25.13)	168 (89.84)	19 (10.16)
No	222 (54.28)	125 (56.31)	97 (43.69)	207 (93.24)	15 (6.760
Family history of NCD					
Yes	267 (65.28)	101 (71.13)	41 (28.87)	122(85.92)	20 (14.08)
No	142 (34.72)	164 (61.42)	103 (38.58)	253(94.76)	14 (5.24)
Smoking status					
Yes	28 (6.85)	25 (89.29)	3 (10.71)	23 (82.14)	5 (17.86)
No	381 (93.15)	240 (63.00)	141 (37.00)	352 (92.39)	29 (7.61)

frequent in males (65.31%). Most participants have normal BSLs (86.55%), though hyperglycemia was more common in females (29.41%). Most participants slept for 5 to 9 h (74.82%) and went to bed between 1 pm and 2 am (66.75%) (Table 1). Many have low fruit and vegetable intake (57.95%) but avoid high-cholesterol foods (70.42%), when male participants were prominant here (61.98%). High water intake was common (70.42%), while processed food consumption was moderate (60.15%) and soft drink consumption was low (37.41%). Most had a low WHR (74.57%) and consume little salt (78.24%). Nearly half engaged in physical exercise (45.72%), and most had a family history of NCDs (65.28%). Only a small percentage smoke (6.85%), predominantly males (89.29%) (Table 1).

3.2 Characteristics of university students and staff by gender

The average age of the participants was 22.34 years (Table 2). The average age of the male staff was higher (37.7 years) compared to female staff (29.5 years), and male students (21.27 years) were also higher compared to female students (20.68 years). The average height of male students, male staff, female students, and female staffs was 170.76 cm, 166.29 cm, 159 cm, and 164.12 cm, respectively. The overall average BSL was 5.88 mmol/L but was observed to be the highest among male staff (6.78 mmol/L) (Table 2). The mean systolic BP and diastolic BP were 118.47 mmHg and 75.69 mmHg, respectively. Both male students and staff had higher systolic BP compared to their corresponding counterparts. The mean WHR was 0.858, indicating a moderate WHR. The average mean BMI was 23.27, which belongs to the normal range. Male students had a higher BMI of 23.22, compared to their female counterparts (22.70) and it belongs to the normal range (Table 2).

3.3 The prevalence of HBP, overweight/obesity, and hyperglycemic sugar level by sample characteristics

It was witnessed that the prevalence of HBP (12.08%), overweight/obesity (53.96%), and hyperglycemic sugar level (14.72%) was higher among males compared to females (Fig. 1).

Participants whoraised in urban areas had higher rates of HBP (13.75% vs. 8.57%) and overweight/obesity (55.39% vs. 40.71%) compared to the rural areas' participants rural areas (Table 3). Hypertension, overweight/obesity, and high BSL were prevalent in respondents those show sleep ≤ 5 h in a day (13.73%, 56.86% & 17.65% respectively) than those who sleep 5 to 9 h (12.75%, 50.65% & 13.40% respectively) and ≥ 9 h (5.77%, 42.31% & 9.62% respectively) (Fig. 2).

The prevalence of HBP, overweight/obesity and high BSL were observed greater who had high WHR (31.43%, 65.71%, & 28.57% respectively) in comparison to people with moderate WHR (14.49%, 50.72% & 10.14%, respectively) and low WHR (9.18%, 48.52% & 12.46%, respectively), was higher in participants who consumed moderate amounts of fruits and vegetables (35.29%, 70.59% & 23.53%, respectively) compared to those who consumed low or high amounts (13.55%, 52.26% & 9.03%, respectively), People who consumed moderate amounts of processed food (12.60%, 51.22% & 14.23% respectively) were more prevalent than those who consumed low amounts (11.63%, 49.61% & 12.40% respectively) and high amounts (8.82%, 47.06% & 11.76% respectively) and lastly smokers (14.29%, 64.29% &17.86%) had higher rates than non-smokers (11.81%, 49.34% & 13.12%) (Table 3).

Table 2 Characteristics of University Students and Staff by Gender

Variables	Overall Mean (95% CI)	Male		Female	
		Student Mean (95% CI)	Staff Mean (95% CI)	Student Mean (95% CI)	Staff Mean (95% CI)
Age of the participants (year)	22.34 (21.78, 22.93)	21.27 (21.04, 21.50)	37.7 (32.87, 42.52)	20.68 (20.41, 20.95)	29.5 (12.93, 46.06)
Height (cm)	166.34 (165.52, 167.17)	170.76 (169.89, 171.64)	166.29 (163.44, 169.14)	159.00 (158.01, 159.99)	164.12 (153.72, 174.52)
BSL (mmol/L)	5.88 (5.76, 6.01)	5.72 (5.58, 5.86)	6.78 (5.97, 7.59)	5.94 (5.74, 6.14)	6.37 (5.03, 7.71)
Systolic blood pressure (mm Hg)	118.47 (117.29, 119.64)	120.20 (118.71, 121.68)	122.1 (116.90, 127.29)	114.72(112.81, 116.63)	120.25 (85.71, 154.78)
Diastolic blood pressure (mm Hg)	75.69 (74.78, 76.61)	75.57 (74.36, 76.78)	78.26 (75.20, 81.33)	75.26 (73.71, 76.81)	78.75 (47.28, 110.21)
WHR	0.858 (0.850, 0.865)	0.87 (0.86, 0.88)	0.93 (0.91, 0.96)	0.81 (0.80, 0.82)	0.85 (0.79, 0.92)
Mean BMI	23.27 (22.86, 23.68)	23.22 (22.68, 23.77)	26.69 (25.24, 28.14)	22.70 (22.04, 23.35)	20.54 (15.90, 25.19)

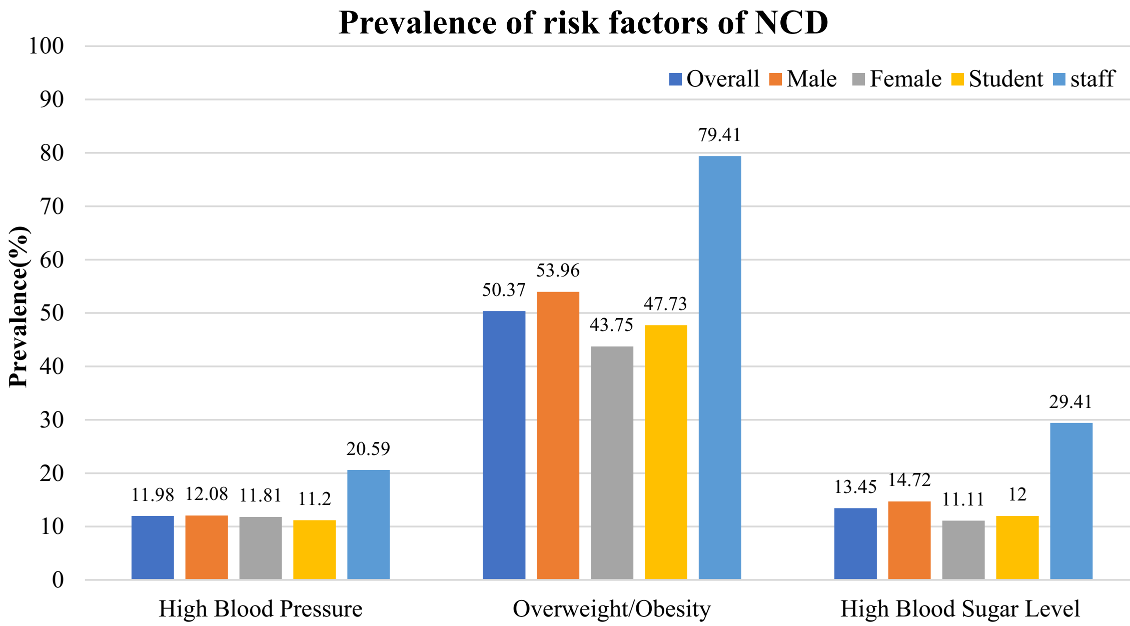

Fig. 1 Prevalence of NCD risk factors

To estimate the multivariable analysis, this study used only variables significant at the 10% level in bivariate analysis (Table 4). For HBP, each additional year of age increased the odds by 1.007 times. High WHR raised the odds by 3.656 times (95% CI 1.508, 8.863) compared to participants with low WHR, while moderate fruit and vegetable consumption increased the odds by 4.214 times compared to participants with low consumption (AOR: 4.214, 95% CI 1.251, 14.195). Overweight or obese individuals had 4.285 times higher odds of HBP than those with normal BMI (AOR: 4.28; 95% CI 0.73, 3.81). Women had 29.8% lower odds of being overweight/obese compared to men (AOR: 0.702, 95% CI 0.452, 1.089). Urban residents had 1.676 times higher odds of being overweight/obese than rural residents (AOR: 1.676, 95% CI 1.08, 2.601). Those with HBP had 4.681 times higher odds of being overweight/obese (AOR: 4.68, 95% CI 2.179, 10.055). Faculty/staff had 56.2% higher risk of high BSL compared to students (AOR: 1.562, 95% CI 0.385, 6.337) (Table 4). High WHR increased high blood sugar odds by 2.435 times (AOR: 2.435, 95% CI 0.996, 5.952), while moderate WHR showed 0.877 times the odds compared to low WHR (AOR: 0.877, 95% CI 0.365, 2.109). High fruit and vegetable consumption reduced hyperglycemia odds to 0.464 times compare to low consumption (AOR: 0.464, 95% CI 0.236, 0.911). No significant differences were found in age or occupation regarding overweight/obesity or between age and hyperglycemia (Table 4).

4 Discussion

The current study elucidates the behavioral and physical changes experienced by students and staff at the University of Dhaka after the COVID-19 pandemic, highlighting an increased risk of NCDs due to various lifestyle factors. Our findings underscore the complex interplay between sleep patterns, dietary habits, water intake, smoking, social media and computer use, as well as personal and family medical histories, in contributing to the elevated risk of NCDs.

Our study identified a notable difference in the likelihood of overweight/obesity between genders, with females exhibiting lower odds compared to males. This observation aligns with previous research indicating a lower prevalence of overweight and obesity among women relative to men [42]. Additionally, the higher prevalence of overweight/obesity among urban respondents compared to their rural counterparts corroborates findings from other studies [43], suggesting that urban environments may contribute to lifestyle factors that promote weight gain.

Consistent with the literature, our study reveals that individuals who reported sleeping less than 5 h daily had a higher prevalence of HBP, overweight/obesity, and hyperglycemia. This finding is consistent with the CDC's assertion that insufficient sleep, defined as less than 7 h per night, is associated with an increased risk of various NCDs, including cardiovascular diseases, hypertension, type 2 diabetes, and obesity [44].

Table 3 The prevalence of HBP, overweight/obesity, and high sugar level by sample characteristics

Variables (n)	HBP 49 (11.98%) n (%)	Overweight/obesity 206 (50.37%) n (%)	BSL 55 (13.45%) n (%)
Gender			
Male (265)	32 (12.08)	143 (53.96)	39 (14.72)
Female (144)	17 (11.81)	63 (43.75)	16 (11.11)
P-value	> 0.5	< 0.05	> 0.1
Current role			
Student (375)	42 (11.20)	179 (47.73)	45 (12.00)
Faculty/Staff (34)	7 (20.59)	27 (79.41)	10 (29.41)
P-value	> 0.1	< 0.0001	< 0.01
Area			
Rural (140)	12 (8.57)	57 (40.71)	19 (13.57)
Urban (269)	37 (13.75)	149 (55.39)	36 (13.38)
P-value	< 0.2	< 0.01	< 1.0
Sleeping hours			
≤ 5 h (51)	7 (13.73)	29 (56.86)	9 (17.65)
5 to 9 (306)	39 (12.75)	155 (50.65)	41 (13.40)
≥ 9 (52)	3 (5.77)	22 (42.31)	5 (9.62)
P-value	> 0.1	> 0.1	> 0.1
WHR			
Low (305)	28 (9.18)	148 (48.52)	38 (12.46)
Moderate (69)	10 (14.49)	35 (50.72)	7 (10.14)
High (35)	11 (31.43)	23 (65.71)	10 (28.57)
P-value	< 0.001	> 0.1	< 0.05
Amounts of fruits and vegetables consumption			
Low (237)	22 (9.28)	113 (47.68)	37 (15.61)
Moderate (17)	6 (35.29)	12 (70.59)	4 (23.53)
High (155)	21 (13.55)	81 (52.26)	14 (9.03)
P-value	< 0.005	> 0.1	> 0.05
Process food consumption			
Low (129)	15 (11.63)	64 (49.61)	16 (12.40)
Moderate (246)	31 (12.60)	126 (51.22)	35 (14.23)
High (34)	3 (8.82)	16 (47.06)	4 (11.76)
P-value	> 0.5	> 0.5	> 0.5
Smoking status			
Yes (28)	4 (14.29)	18 (64.29)	5 (17.86)
No (381)	45 (11.81)	188 (49.34)	50 (13.12)
P-value	> 0.5	> 0.1	> 0.1
Physical exercise			
Yes (187)	23 (12.30)	102 (54.55)	31 (16.58)
No (222)	26 (11.71)	104 (46.85)	24 (10.81)
P-value	> 0.5	> 0.1	> 0.05
Family history of NCDs			
Yes (267)	20 (7.49)	74 (27.71)	18 (6.74)
No (142)	29 (20.43)	132 (92.96)	37 (26.05)
P-value	> 0.1	> 0.5	> 0.5

Furthermore, the findings revealed that frequent consumption of beef, mutton, and cholesterol-rich foods, drink moderate amounts of water, added salt to their food, or tea and coffee with sugar are linked to a higher prevalence of HBP. Moderate consumption of processed foods was associated with a higher risk of HBP, overweight/obesity, and elevated BSLs. In contrast, moderate and low intake of fruits and vegetables also responsible for HBP, overweight/

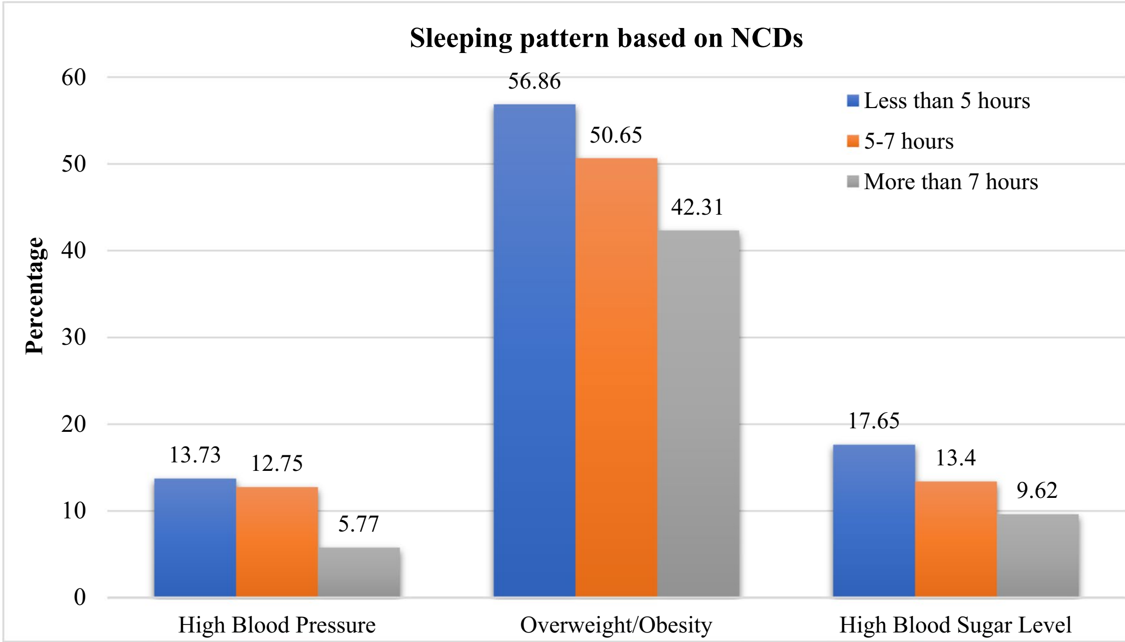

Fig. 2 Sleeping pattern based on NCDs

obesity, and hyperglycemia, while high fruit intake reduced the risk of high BSL. The ultimate findings said that NCDs patterns among the people of University of Dhaka is directly depend on their lifestyle. Same findings patterns also reported in previous study, where NCDs cases were associated with sleep duration, and eating behaviors [45].

The outcome is consistent with existing literature that links high consumption of red meat and processed foods to increased cardiovascular risk and hypertension [46]. Overall, current findings emphasize the need to get enough sleep, eat healthy, and exercise to reduce the prevalence of NCDs. Understanding the links between sleep duration, eating habits, and NCDs allows for the development of treatments and initiatives to promote healthier lives and reduce the risks associated with these diseases.

Notably, our study found that staff members exhibited a higher prevalence of hyperglycemia compared to students, a finding consistent with research conducted in middle- and lower-income countries [47]. Furthermore, staff members had higher WHR compared to students. Elevated WHR values were associated with a greater prevalence of hypertension, reinforcing the association between abdominal obesity and increased hypertension risk [48]. Similarly, participants with a higher BMI were more likely to have hypertension, corroborating previous findings that link elevated BMI with an increased risk of hypertension and other obesity-related conditions [49].

5 Limitations of the study

The limitations of this research include its cross-sectional design, which restricts the ability to establish causality between risk factors and NCD prevalence. The reliance on self-reported data may introduce biases, such as underreporting or over reporting of behaviors and conditions. Additionally, the sample was limited to students and faculty/staff of a single university, potentially affecting the generalizability of the findings to the broader population. The data collection period, confined to June 2022-July 2023, may not capture long-term trends or seasonal variations in risk factors. Moreover, potential confounding variables, such as stress levels, genetic predispositions, and environmental influences, were not accounted for. The timing of the study post-COVID-19 pandemic may also introduce unique health behaviors and stressors that differ from pre-pandemic conditions.

Table 4 Estimates of regression coefficients along with their 95% CI and p values obtain from the logistics regression model (n = 409)

Variable	HBP		Overweight/obesity		BSL	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Age	1.007	(0.94, 1.08)	1.06	(0.984, 1.143)	1.036	(0.97, 1.107)
Current role						
Student	1		1		1	
Faculty/Staff	1.112	(0.24, 4.962)	1.704	(0.513, 5.658)	1.562*	(0.385, 6.337)
Gender						
Male			1			
Female			0.702	(0.452, 1.089)		
Area						
Rural			1			
Urban			1.676**	(1.08, 2.601)		
WHR						
Low	1				1	
Moderate	1.556	(.682, 3.549)			0.877	(0.365, 2.109)
High	3.65***	(1.508, 8.863)			2.435*	(0.996, 5.952)
Fruits						
Low	1				1	
Moderate	4.214**	(1.251, 14.195)			1.136	(0.295, 4.378)
High	1.453	(0.744, 2.838)			0.464**	(0.236, 0.911)
Physical exercise						
Yes					1	
No					0.621	(0.34, 1.135)
Hypertension						
No			1		1	
Yes			4.68***	(2.179, 10.055)	1.93	(0.867, 4.297)
BSL						
Normal	1		1			
Hyperglycemic	1.655	(1.98, 9.30)	1.18	(0.63, 2.23)		
BMI						
Normal	1					
Overweight/obesity	4.285***	(0.73, 3.81)				

AOR Adjusted Odds Ratio

***p < .01, **p < .05, *p < .1

6 Conclusion

This study evaluated the prevalence NCDs risk factors among the students and staff of the University of Dhaka post-COVID-19 pandemic. The implications of the study are significant. High levels of NCD risk factors among university students and faculty indicate an urgent need for targeted health treatments and lifestyle changes, with a particular emphasis on diet and sleep patterns. The increased risks among specific demographics such as male and staff indicate that public health interventions should be tailored to these groups' specific needs. If these risk factors are not addressed, the prevalence of NCDs may rise, resulting in increased demand for healthcare services and lower productivity. This situation recommends immediate public health efforts to improve lifestyle choices and prevent future health problems. This study highlights the need for awareness programs in Bangladesh, particularly in urban areas, to promote healthy lifestyles and reduce NCDs Prevalence. Failure to address these factors may lead to a significant increase in the prevalence of NCDs in the future. The previously mentioned scenario is expected to lead to increased pressure on healthcare services and reduced productivity among educational staff and the general population of Bangladesh.

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Author contributions Al Amin: Conceptualization; data collection; methodology; validation, Formal analysis; software; validation; writing—original draft Md. Momin Islam: Data curation; formal analysis; investigation; methodology; software and statistical analysis; writing—original draft; writing—review and editing. Md Abdus Samadd: writing—original draft; writing—review and editing Rajib Das: data collection; Investigation; visualization; writing—original draft. Md Raihan Sarkar: Conceptualization; supervision; writing—review and editing Mariam Wahed: data collection; Investigation; visualization; writing—original draft Abu Sufian Md Ashikur Rahman: data collection; Investigation; visualization; writing—original draft Tanvir Mahtab Uddin: data collection; Investigation; visualization; writing—original draft Anamika Haque: data collection; Investigation; visualization; writing—original draft All authors read, critically reviewed, and approved the final version of the paper.

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Data availability The datasets used and/or analysed analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate The study was approved by the Institutional Ethical Committee of the faculty of Pharmacy, University of Dhaka, Bangladesh, under the ethical permission number: (Ref.No.Fa.Ph.E/001/22) date- 15/06/2022. After the full explanation of the procedure involved, written and informed consent was obtained from the attendees. Participants were reassured that the data collected would be confidential and would be used for research purposes only.

Consent for publication Not applicable.

Competing interests The authors have declared that no competing interests exist.

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