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University Students' Sociodemographics, Physical Inactivity, and Inadequate and Poor-Quality Sleep Are Associated With Their Overweight/Obesity: Findings From a Case–Control Study in Bangladesh

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ABSTRACT

Background and Aims: Evidence confirms a high prevalence of general and abdominal obesity among university students in Bangladesh. The primary objective of this case–control study was to examine the association between overweight/obesity and sleep patterns (including sleep duration and quality) among university students in Bangladesh. The secondary objective was to identify the sociodemographic and lifestyle-related factors that predict overweight/obesity in the study population.

Methods: The sociodemographics and body mass index (BMI) were gathered from a sample of 330 university students (setting: one public university in Bangladesh). Sleep health was measured by the 19-item Pittsburgh Sleep Quality Index (PSQI) and compared between the cases (BMI $\geq$ 23.0 kg/m^2) and controls (BMI = 18.5–22.9 kg/m^2). Bivariate and multiple stepwise regression analyses were performed.

Results: One hundred and sixty-five overweight/obesity students and 165 control subjects participated in the study. The peak age for overweight/obesity was 22–25 years in the students, and about 67% of the cases were poor-quality sleepers compared to 53% of the students in the control group. Multiple stepwise regression analysis showed that students' overweight/obesity was associated with being female (adjusted odds ratio, aOR = 2.12; 95% confidence interval, CI: 1.25, 3.61), short sleep duration ($\leq$ 7 h/night) (aOR = 1.12, 95% CI: 1.04, 2.66), poor quality of sleep (aOR = 1.82, 95% CI: 1.16, 2.87), and physical inactivity (aOR = 1.89; 95% CI: 1.12, 3.55).

Conclusion: Key factors associated with overweight/obesity among Bangladeshi university students include age (22–25 years), gender (higher prevalence in female students), sleep duration and quality, and physical inactivity. These findings highlight the need for targeted interventions addressing sleep health, physical activity, and healthy lifestyles to mitigate overweight/obesity among university students.

1 | Introduction

The global burden of obesity is on the rise, and overweight/obesity in young adults has become a major health concern in many countries, including Bangladesh. The World Health Organization (WHO) defines overweight as a body mass index (BMI) ≥ 25 and obesity as a BMI ≥ 30. Accordingly, 1.9 billion adults (39% of the global adult population) were identified as overweight in 2016, with more than 650 million (13% of adults) being obese [1]. Bangladesh is no exception; one in every five adults is overweight (generally obese), and two in five are abdominally obese (centralized visceral fat) [2], and the numbers are expected to double by 2030 [3, 4]. General and abdominal obesity predicted metabolic abnormalities, for example, type 2 diabetes, heart disease, hypertension, stroke, certain types of cancer, and pulmonary diseases [5]. Literature is limited on the predictors of the young adults' overweight/obesity in Bangladesh, obesity–sleep link in particular, highlighting the importance of studying this missing aspect in obesity and sleep research.

Weight gain and associated sleep deprivation often commence in the period that marks the onset of adulthood (generally referred to as 18 years) [6]. Between the ages of 18 and 25 years, in Bangladesh, many young adults begin and complete their university degrees [7]. There were 46,90,876 students studying at 153 universities in Bangladesh in 2020, and they accounted for about 10% of the country's young adults [8]. These students experience major changes in their lifestyle: staying in university accommodation (e.g., dormitories), dietary change (e.g., unbalanced diets), and a lack of sleep [9, 10]. Westernized academic culture and dietary patterns, along with academic performance demands and long screen times, may also contribute to sleep debt and weight gain [11–13]. The putative links between sleep and overweight/obesity in Bangladeshi higher education establishments are of growing interest, considering the array of empirical evidence from different parts of the world.

The association between overweight/obesity and sleep health among young adults has been investigated in many parts of the world, producing mixed and conflicting findings. For example, a study conducted among young adults in 26 low-and-middle-income countries reported a significant association between short sleep duration and increased BMI [14]. Studies have also reported a significant association between poor sleep quality and excess weight [15, 16]. On the other hand, a study conducted in Southeastern Texas among women aged 16–40 years found no statistically significant correlation between poor sleep quality and high BMI [17].

Evidence indicates that poor sleep duration and quality disrupt the circadian rhythm, leading to metabolic issues and hormonal imbalances that increase obesity risk [18–20]. Sleep deprivation lowers leptin levels and raises ghrelin levels, promoting appetite and weight gain [21, 22]. Additionally, inadequate sleep reduces physical activity, complicating weight management and heightening obesity risk, particularly among students [20, 23].

With the rising incidence of overweight/obesity in Asia, BMI has become an increasingly important disease predictor. The WHO has highlighted that Asians are at a significant risk of type 2 diabetes and cardiovascular disease even at BMI levels below the current global cutoff for overweight ($\geq 25\ kg/m^2$) [24]. As a result, WHO experts recommend a BMI cutoff threshold for Asian people for public health intervention [24]. Accordingly, in Asian countries (such as India, Indonesia, and Bangladesh), the adjusted cutoff for inclusion in the overweight group is $23.0\ kg/m^2$ [25–28]. A 7-year prospective longitudinal study (2007–2014) found that the BMI Asian population cutoff point is appropriate for determining the relationship between BMI and health outcomes in Indonesia as well as other Asian countries [28]. An epidemiological comparative study from India found that the Asian BMI standards are better for predicting hypertension than the WHO criteria [29]. Therefore, our study used population-specific BMI cutoff points (e.g., WHO recommendations for ideal BMI for Asians) rather than the WHO international BMI classification.

The primary research question of this study was: is there an association between overweight/obesity and sleep patterns (i.e., duration and quality) among university students in Bangladesh? The secondary research question was: what sociodemographic and lifestyle-related factors predict overweight/obesity in Bangladeshi university students? Findings from this study could help authorities of the Bangladeshi higher education establishments, Ministry of Health, Bangladesh, and other major stakeholders to design tailored preventive healthcare programs to reduce the burden of overweight/obesity among university students in Bangladesh. Furthermore, this study's findings may fill the gap in the empirical literature available on the subject matter and provide a basis for future research.

2 | Methods

2.1 | Study Location

The study was conducted at the main campus of Patuakhali Science and Technology University (PSTU), which is situated at Dumki Upazila (i.e., subdistrict) under Patuakhali district in Bangladesh. The main campus of this university is positioned around 20 km north from the district center of Patuakhali and 38 km south from Barishal city. Being in a regional area, this higher education establishment provides complete residential accommodations for all its students. On the main campus, there

are currently six residential student halls (i.e., dormitories), four of which are allocated for male students and two for female students. This is one of the fastest expanding and renowned public universities in Bangladesh and students from various sociodemographic and income groups from across the country come to study here, representing the student population of Bangladeshi public universities. The study was conducted from May to September 2022.

2.2 | Study Design, Sample, and Sampling

An observational case–control study design was employed. In this study, cases were defined as students with elevated BMI (i.e., BMI $\geq$ 23.0 kg/m^2 = overweight/obesity), and controls were defined as students with a normal range of BMI (i.e., BMI = 18.5–22.9 kg/m^2) [24, 25]. A purposeful sampling strategy was applied for the selection of cases and controls [30]. The sampling process was previously described in detail elsewhere by Banna et al. [30]. Members of the data collection team entered each room of the dormitories upon students' permission and initially chose the cases and controls through their visual inspection. Subsequently, cases and controls were identified by anthropometric measurement of the primarily predicted participant.

The minimum sample size required for this study was computed using free online software, OpenEpi—Sample Size for Unmatched Case-Control Studies [31]. The calculation was based on the following assumptions: (i) an 80% chance of detection (i.e., study power), (ii) a 95% confidence level, (iii) a case–control ratio of 1:1, and (iv) 40% proportions of controls with exposure. Accordingly, 288 samples were needed to identify at least two odds ratio differences between cases and controls. Initially, approximately 372 participants were screened for the study (through visual inspection), of which 42 participants were excluded based on our study criteria. Specifically, 23 participants did not meet our cases and control criteria during anthropometric evaluations, and the rest of the 19 participants were eliminated for a variety of reasons, such as medical conditions, not residing permanently in the student dormitories, and so forth. Finally, this study recruited 330 participants, including 165 cases and 165 controls.

The student that fulfilled the following criteria was eligible to participate in this study: (i) being aged $\geq$ 18 years, (ii) being a current student, and (iii) residing in residential student dormitories. However, students with serious medical conditions or psychiatric problems who had a BMI below normal body weight were excluded from the study.

2.3 | Study Protocol and Ethics

Before initiating the survey process, ethical approval was obtained from the Department of Environmental Sanitation, PSTU, Bangladesh (approval number: ENS:11/04/2022:07). All study procedures were carried out in accordance with relevant guidelines and regulations. Moreover, informed consent was obtained from all participants. A face-to-face interview technique was applied to collect data for the study, where male data collectors were employed to gather data from the male respondents and vice versa (it was prohibited for male students in Bangladesh to enter the dorms of female students, and the reverse is also true in the cultural and spiritual context of the region). Data collectors, who were students from nutrition and food science backgrounds, were trained by the study investigators on the study procedures and measures. The data collectors adhered to the following research protocols: first, data collectors explained the study purposes to the students who were staying in their respective rooms of the dormitories during the data collection period; thereafter, they recruited cases and controls by taking anthropometric measurements; and finally, they collected survey data with a structured questionnaire in two sections: sociodemographic characteristics (Block I: nine variables) and sleep quality and behaviors (Block II: eight variables).

2.4 | Study Measures

2.4.1 | Anthropometric Measurement

The procedures outlined by Banna et al. [30] for assessing adults' height and weight were followed by the data collectors. Electronic Personal Scale (Brand: Camry, Model: EB9062) and non-stretchable tape were used to measure participants' weight and height, with accuracy of 0.01 kg and 0.1 cm, respectively. The BMI value was calculated by dividing body weight in kilograms (kg) by height in square meters (m^2). The WHO criteria on appropriate BMI for Asians were used: (i) Normal weight: BMI = 18.5–22.9 kg/m^2, (ii) Overweight: BMI = 23.0 to $<$ 27.5 kg/m^2, and (iii) Obese: $\geq$ 27.5 kg/m^2 [24]. A similar cutoff point was also used in a prior Bangladeshi study to categorize adults' BMI [25].

2.4.2 | Sociodemographic Characteristic

Sociodemographic and lifestyle variables such as participants' gender (male vs. female), age, study level (undergraduation vs. postgraduation), marital status (single vs. married), family income, family history of overweight or obesity (yes vs. no), bedtime social media use (no, $<$ 1 h, or $\geq$ 1 h), smoking status (yes vs. no), and self-reported physical activity (inactive, moderate, or regular activity) were collected.

2.4.3 | Assessment of Sleep Quality (Main Exposure of This Study)

We used a 19-item Pittsburgh Sleep Quality Index (PSQI) to assess participants' sleep quality over the past month [32]. The PSQI is subdivided into the following domains: (i) subjective sleep quality (Very or fairly good vs. Very or fairly bad), (ii) sleep latency, (iii) sleep duration ($>$ 7 h/night or $\leq$ 7 h), (iv) habitual sleep efficiency, (v) sleep disturbance, (vi) use of sleep medication, and (vii) daytime dysfunction. Each domain could get a score between 0 and 3. An

individual's seven domain scores, which range from 0 to 21, are added up to yield a global PSQI score for sleep quality. A score of > 5 on the global PSQI represented a criterion for poor sleep quality. Previous epidemiological investigations used the PSQI as a sleep quality screener among a variety of subpopulations [33], including Bangladeshi students [34–37]. In the current study, a total of eight variables, seven variables from the seven components of the PSQI and overall sleep quality (good vs. poor), were included as participants' sleep quality and lifestyle factors.

2.5 | Statistical Approach

Descriptive statistics, such as frequencies and percentages, were computed to summarize the study variables among case and control groups. χ^2 tests compared the study variables between the two groups. Multiple logistic regression models were fitted to identify the association between cases (overweight/obesity) and exposure (such as sleep health). Analysis was done in two blocks using the forward stepwise method, and all variables of each block (Block I: nine variables and Block II: eight variables) were included separately in the regression models. In the stepwise regression models, inclusion and exclusion criteria for study variables were p values of 0.05 and 0.10, respectively. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 23.0). We set statistical significance values at $p \leq 0.05$ (two-sided).

3 | Results

3.1 | Sociodemographic, Behavioral, and Lifestyle-Related Characteristics and Sleep Quality and Behaviors

Of the 330 samples, more than half (56.4%) of the participants were female and three-quarters (72.7%) of the participants were aged between 22 and 25 years. The peak age for overweight/obesity (case group) was 22–25 years in the samples, with the mean age of the case group being 22.34 (SD: ±1.55) years (see Table 1). Nearly two-thirds of the participants (60.6%) had short sleep duration (≤ 7 h/night). About 65% of the cases slept for ≤ 7 h per night compared to 56.4% of the participants in the control group (normal weight). Overall, 60% of the participants reported poor sleep quality, where around 67% of the cases were poor-quality sleepers compared to 53% of the students in the control group (see Table 2).

Participants' sociodemographic, behavioral, and lifestyle-related characteristics and sleep quality and behaviors by case and control groups are presented in Table 1 and Table 2, respectively. The bivariate analysis found the following variables were significantly associated with case and control groups: gender ($p < 0.001$), age ($p < 0.001$), study level ($p < 0.001$), marital status ($p < 0.001$), family history of overweight/obesity ($p < 0.001$), smoking status ($p = 0.002$), physical activity ($p < 0.001$), sleep duration ($p = 0.012$), habitual sleep efficiency ($p = 0.047$), and sleep quality ($p = 0.007$).

3.2 | Factors Associated With Overweight/Obesity Among the Study Participants

Table 3 shows the factors associated with overweight/obesity among the study participants. In Block I, multiple logistic regression analysis demonstrated that being female (adjusted odds ratio [aOR] = 2.12; 95% CI: 1.25, 3.61), aged between 22 and 25 years (aOR = 2.05; 95% CI: 1.11, 3.76), undergraduate (aOR = 0.28; 95% CI: 0.15, 0.54), married (aOR = 5.49; 95% CI: 1.96, 15.40), having a family history of overweight/obesity (aOR = 2.74; 95% CI: 1.59, 4.73), and involving no physical activity (i.e., inactive; aOR = 1.89; 95% CI: 1.12, 3.55) were significantly associated with overweight/obesity. In the final block, the higher odds of developing overweight/obesity were associated with short sleep duration (≤ 7 h/night; aOR = 1.12, 95% CI: 1.04, 2.66) and poor quality of sleep (aOR = 1.82, 95% CI: 1.16, 2.87). In addition, using unmarried samples ($n = 287$), blockwise multivariable logistic regression analysis (Forward: LR) shows that sleep disturbances such as short sleep duration and poor sleep quality are independent predictors of overweight/obesity (Table S1).

4 | Discussion

4.1 | Main Finding of This Study

Our case–control study documented the association between overweight/obesity and sleep health, including quality and duration for a Bangladeshi university sample. We found that the peak age for overweight/obesity was 22–25 years, especially in female students who had a family history of obesity and were involved in no physical activity. The overall sleep quality was rated by most of the students as poor, whereas the cases were poor-quality sleepers more than the controls. We also showed that the students who slept shorter than normal hours (≤ 7 h/night) and had poor quality of sleep were almost twice at risk of being overweight/obese. We did not find a clear association of the students' overweight/obesity with their sleep efficiency and daytime dysfunction.

4.2 | What Is Already Known on This Topic

The prevalence of overweight/obesity in university students in Bangladesh has increased significantly over the past decades [38]. Our finding of the association between overweight/obesity and sleep quality corroborates with a report from a cross-sectional study conducted among young adults in 24 low- and middle-income countries [39]. Other studies have also reported a significant correlation between poor sleep quality and overweight/obesity [15, 16]. Contrary to this finding however, a study conducted in the United States among 927 women aged 16–40 years found no statistically significant correlation between poor sleep quality and overweight/obesity [17]. The disparity in findings could plausibly be a result of differences in the methods employed in each study and the sociodemographic characteristics of respondents.

Sociodemographic and lifestyle factors have been found to largely influence sleep quality and overweight/obesity [2, 30, 40].

TABLE 1 | Sociodemographic, behavioral, and lifestyle-related characteristics by two study groups.

Variable (Block I)	Total; *n* (%)	Case; *n* (%)	Control; *n* (%)	*p* value
Gender				**< 0.001**
Male	144 (43.6)	51 (30.9)	93 (56.4)	
Female	186 (56.4)	114 (69.1)	72 (43.6)	
Age (in years)				**< 0.001**
18–21	90 (27.3)	30 (18.2)	60 (36.4)	
22–25	240 (72.7)	135 (81.8)	105 (63.6)	
Study level				**< 0.001**
Undergraduation	245 (74.2)	145 (87.9)	100 (60.6)	
Postgraduation	85 (25.8)	20 (12.1)	65 (39.4)	
Marital status				**< 0.001**
Single	287 (87.0)	129 (78.2)	158 (95.8)	
Married	43 (13.0)	36 (21.8)	7 (4.2)	
Family income (BDT/month)				0.925
< 20,000	124 (37.6)	61 (37.0)	63 (38.2)	
20,000–40,000	129 (39.1)	64 (38.8)	65 (39.4)	
> 40,000	77 (23.3)	40 (24.2)	37 (22.4)	
Family history of overweight/obesity				**< 0.001**
Yes	125 (37.9)	86 (52.1)	39 (23.6)	
No	205 (62.1)	79 (47.9)	126 (76.4)	
Bedtime social media use				0.060
No	32 (9.7)	10 (6.1)	22 (13.3)	
< 1 h	120 (36.4)	59 (35.8)	61 (37.0)	
≥ 1 h	178 (53.9)	96 (58.2)	82 (49.7)	
Smoking status				**0.002**
Yes	85 (25.8)	30 (18.2)	55 (33.3)	
No	245 (74.2)	135 (81.8)	110 (66.7)	
Physical activity				**< 0.001**
Inactive	137 (41.5)	93 (56.4)	44 (26.4)	
Moderate activity	108 (32.7)	32 (19.4)	76 (46.1)	
Regular activity	85 (25.8)	40 (24.2)	45 (27.3)	

Notes: Bolded values indicate statistically significant values ($p \leq 0.05$). *p* values were determined by χ^2 test. Cases were defined as participants with elevated Body Mass Index (BMI; i.e., BMI ≥ 23.0 kg/m^2 = overweight/obesity), and controls were defined as participants with a normal range of BMI (i.e., BMI = 18.5–22.9 kg/m^2).
Abbreviation: BDT = Bangladeshi taka (currency).

Specifically, it was found that age differences between university students had a significant influence on their poor sleep quality and short sleep duration, which were associated with overweight/obesity. Yeboah et al. (2022) confirm that the young adult age group in university was perceived as having poor sleeping quality and short sleeping duration due to the time spent learning [41].

Consistent with previous studies [42, 43], the study also showed that married students were more likely to be obese compared to those who were single. The probable reason is that married students were compelled to eat anytime they came to the house to appease their spouses. When students arrive home late from lectures and eat, the rate at which they sit for the food to digest before falling asleep is high. In support, Alafif and Alruwaili (2023) and Ramírez-Contreras et al. (2022) asserted that the nutrient effect of late eating is associated with overweight/obesity, which results in poor sleep quality and short sleep duration [44, 45].

The study also showed that family history has a significant effect on overweight/obesity of students. However, an individual gene can expose a person to experience insomnia, causing poor sleep quality and short sleep duration [40]. However, when parents have the trait of being overweight and obese, there is a likelihood of their children being overweight/obese [40, 46]. In support, Banna et al. (2020) posit that genetic factors are essential determinants of overweight/obesity of descendants [30].

From the results, it was apparent that a lack of physical activity was associated with overweight/obesity. The researchers believe

TABLE 2 | Sleep quality and behaviors by two study groups.

Variable (Block II)	Total; *n* (%)	Case; *n* (%)	Control; *n* (%)	*p* value
Subjective sleep quality				0.630
Very or fairly good	285 (86.4)	144 (87.3)	141 (85.5)	
Very or fairly bad	45 (13.6)	21 (12.7)	24 (14.5)	
Sleep latency (score)				0.567
0–1	211 (63.9)	103 (62.4)	108 (65.5)	
2–3	119 (36.1)	62 (37.6)	57 (34.5)	
Sleep duration (per night)				**0.012**
> 7 h	130 (39.4)	72 (43.6)	58 (35.2)	
≤ 7 h	200 (60.6)	107 (64.8)	93 (56.4)	
Habitual sleep efficiency				**0.047**
> 85% efficient	248 (75.2)	115 (69.7)	133 (80.6)	
≤ 85% efficient	82 (24.8)	50 (30.3)	32 (19.4)	
Sleep disturbance				0.082
Not during the past month	117 (35.5)	69(41.8)	48 (29.1)	
Less than one a week	93 (28.2)	44 (26.7)	49 (29.7)	
Once or twice a week	67 (20.3)	31 (18.8)	36 (21.8)	
Three or more times a week	53 (16.1)	21 (12.7)	32 (19.4)	
Sleep medication use				1.000
Not during the past month	248 (75.2)	124 (75.2)	124 (75.2)	
Less than one a week	50 (15.2)	25 (15.2)	25 (15.2)	
Once or twice a week	32 (9.7)	16 (9.7)	16 (9.7)	
Daytime dysfunction				0.871
Not during the past month	188 (57.0)	93 (56.4)	95 (57.6)	
Less than one a week	100 (30.3)	52 (31.5)	48 (29.1)	
Once or twice a week	42 (12.7)	20 (12.1)	22 (13.3)	
Overall sleep quality				**0.007**
Good	132 (40.0)	54 (32.7)	78 (47.3)	
Poor	198 (60.0)	111 (67.3)	87 (52.7)	

Notes: Bolded values indicate statistically significant values (i.e., $p \leq 0.05$). χ^2 test was applied to determine p values.

that a lack of physical activity is one of the leading risk factors for health challenges and that the root causes of these health challenges result in poor sleep quality and short sleep duration. In the same vein, poor sleep quality and short sleep duration come as a result of imbalances such as too many calories in and too few calories burned [47]. In support, Bao et al. (2020) suggested that a lack of "leisure-time physical activity" or "recreational physical activity" was associated with overweight/obesity [48]. It is, therefore, important to encourage students to engage in more physical activity to help reduce overweight/obesity.

However, it was discovered that sedentary lifestyle factors, such as going to nightclubs, sitting for long periods of time while watching television, or using the computer, contribute to overweight or obesity, resulting in poor sleep quality and short sleep duration. In support, Rich et al. (2020) and Yang et al. (2017) suggested that sedentary life among students affects their sleep [49, 50]. Yang et al. (2017) further asserted that the amount of time spent by students eating while in night clubs or watching television increases their risk of being overweight or obese, resulting in poor sleep quality and short sleep duration [50].

While a lack of regular physical exercise could adversely affect sleep quality, eating late as a lifestyle or dietary pattern also affects how the body absorbs and digests food, which then leads to an increased risk of overweight/obesity [44]. Poor sleep quality could also contribute to changes in appetite regulation, which is known to have a significant influence on food choice and calorie intake [51–53]. Food choice, dietary pattern, and calorie intake are well-established determinants of overweight/obesity.

Findings from this study also report a significant association between the sleep duration of Bangladeshi students and overweight/obesity. In agreement with previous studies in Bangladesh [8], low- and middle-income countries including

TABLE 3 | Blockwise multivariable logistic regression analysis showing the factors associated with overweight and obesity (case) among study participants.

Variable[†]	Odds ratio	95% CI for odds ratio		*p* value
		Lower	Upper	
Block I:				
Gender				
Male	Reference			
Female	2.12	1.25	3.61	**0.005**
Age (in years)				
18–21	Reference			
22–25	2.05	1.11	3.76	**0.022**
Study level				
Undergraduation	0.28	0.15	0.54	**< 0.001**
Postgraduation	Reference			
Marital status				
Single	Reference			
Married	5.49	1.96	15.40	**0.001**
Family history of overweight/obesity				
Yes	2.74	1.59	4.73	**< 0.001**
No	Reference			
Physical activity				
Inactive	1.89	1.12	3.55	**0.032**
Moderate activity	0.47	0.24	0.91	**0.025**
Regular activity	Reference			
Block II:				
Sleep duration				
> 7 h	Reference			
≤ 7 h	1.12	1.04	2.66	**0.034**
Overall sleep quality				
Good	Reference			
Poor	1.82	1.16	2.87	**0.010**

Abbreviation: CI = confidence interval.
[†]Only statistically significant ($p \leq 0.05$) variables were presented in the table.

Bangladesh [39], and among the United States and South Korea college students [16]; Bangladeshi university students who slept ≤ 7 h a night were at higher risk of overweight/obesity compared to their colleagues who slept more than 7 h a night. This finding is further corroborated by findings from a systematic review that found that individuals who regularly slept less than 7 h per night were more likely to have higher average BMIs and develop obesity than those who slept more than 7 h [23]. Previous studies have established that higher leptin levels in individuals are correlated with decreased sleep time [54, 55].

4.3 | What This Study Adds

Tailored public health interventions, including screening and monitoring of sleep patterns, should be considered to improve the students' quality of sleep, which would reduce the risk of being overweight/obese. The preventative healthcare frameworks including primary, secondary, and tertiary preventative measures employing the health beliefs model, transtheoretical model, and the model of planned behavior could have a positive impact on improving sleep and dietary patterns that are clearly linked to overweight/obesity. In fact, the nonpharmacological interventions such as sleep education [56], behavioral change methods [57], relaxation techniques [58], physical exercise [59], and mind–body exercise [60] were found effective for adults. The interventions that influence an individual's beliefs and behaviors were more effective than changes in health policy.

In addition, we contextualized the students' obesity–sleep link in terms of sociodemographic context. The study, therefore, recommends authorities of Bangladeshi universities, especially those in PSTU, to introduce preventative healthcare programs in an effort to sensitize and educate students on the need for

quality sleep and the importance of sleeping more than 7 h a day. We recommend that, along with eating habits and sociodemographic factors, proper sleep hygiene (i.e., sleep quality, duration, efficacy, etc.) is important for students to reduce the risk of overweight/obesity. The university authorities are encouraged to work with the health ministry and education ministry of Bangladesh to develop and implement policies and programs that will enhance sleep quality and duration among the students. We also recommend that proper sleep hygiene should be introduced to students during their first-year orientation program and in all higher education establishments across the country.

5 | Strengths and Limitations

The study has several strengths, such as a rigorous methodology and a clear presentation of results. Although rigorous procedures were followed to execute the study, there are some inherent limitations that are worth acknowledging. Some of the variables were self-reported; therefore, it is possible that social desirability biases were introduced. The case–control study design employed also makes it impossible to establish causal relationships. A longitudinal design would help to establish the causal direction and the long-term consequences of sleep duration on overweight/obesity. We assessed associations among the key variables of interest. This study did not also include other important variables including food choices, dietary patterns, and calorie intake. Although 13% ($n = 43$) of the participants (male = 15 and female = 28) were married, we did not collect any information on the usage of oral contraceptive pills (OCPs) from the female married participants. Future studies should incorporate such information to explore the role of OCP use on overweight/obesity. Finally, though the sample size was statistically adequate, further studies should incorporate large and country-representative samples.

6 | Conclusions

In conclusion, we identified key factors associated with overweight/obesity among Bangladeshi university students, particularly those aged 22–25 years, with a higher prevalence observed in female students. The findings indicate that sleep duration and quality are significant predictors of overweight/obesity among university students, with both short sleep duration (≤ 7 h) and poor sleep quality independently associated with higher odds of developing overweight/obesity. Additionally, sociodemographic and lifestyle-related factors such as marital status, family history of obesity, physical inactivity, and education level were also found to contribute to the risk of overweight/obesity. These results emphasize the need for targeted nonpharmacological, public health interventions addressing sleep health, along with promoting physical activity and healthy lifestyles, to mitigate the risk of overweight/obesity in university students. Further research is warranted to explore the underlying mechanisms and to develop tailored interventions to improve both sleep quality and overall health in this population.

Author Contributions

Md. Hasan Al Banna: conceptualization, methodology, software, formal analysis, project administration, writing – original draft. **Mohammad Hamiduzzaman:** validation, visualization, writing – review and editing. **Shammy Akter:** writing – review and editing, visualization, validation. **Abdul-Aziz Seidu:** writing – original draft, writing – review and editing, validation, visualization. **Ayesha Begum:** writing – review and editing, validation, visualization. **Nilufa Yeasmin:** visualization, validation, writing – review and editing. **Satyajit Kundu:** visualization, validation, writing – review and editing, writing – original draft. **Mst. Umme Hafsa Begum:** Validation, visualization, writing – review and editing. **Mst Sadia Sultana:** validation, writing – original draft, writing – review and editing. **Bernard Kissi-Abrokwah:** writing – original draft, visualization, validation. **Najim Z Alshahrani:** visualization, validation, writing – review and editing. **Md. Shafiqul Islam Khan:** writing – review and editing, visualization, validation, supervision, conceptualization, project administration. **Md. Nazmul Hassan:** conceptualization, validation, visualization, writing – review and editing, project administration, supervision.

Conflicts of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data will be shared upon reasonable request to the corresponding author. All authors have read and approved the final version of the manuscript. Md. Hasan Al Banna had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

Transparency Statement

The lead author Md. Hasan Al Banna affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.