

ASSESSMENT OF OVERWEIGHT AND OBESITY AMONG SCHOOL AND COLLEGE GOING ADOLESCENT'S STUDENTS OF LAKSHMIPUR DISTRICT, BANGLADESH

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ABSTRACT

WHO defines overweight and obesity as abnormal or excessive fat accumulation that poses a risk to health. It is a multifactorial disease, defined as a state of imbalance between calories ingested versus calories expended would lead to excessive or abnormal fat accumulation. Globally, overweight and obesity among adolescents are considered a major public health issue because of their contribution to the development of chronic non-communicable diseases (NCDs) in adulthood. WHO (2013) considers childhood obesity as “one of the most serious public health challenges of 21st century”. A descriptive type of cross-sectional study was conducted in Lakshmipur district of Bangladesh from January 2024 to April 2024. The study population was students at respected school and colleges of Lakshmipur district. Data was collected based on GSHS Questionnaire. However, there is a relationship between physical inactivity with obesity and overweight. ($p=0.048$). Age is also associated with obesity and overweight. ($P=0.019$).

There is also association between loneliness and obesity ($P=0.045$). Association also found in between age and obesity ($P=0.019$). Father education is also associated obesity and overweight ($P=0.043$) (Tab.2) Bivariate and multivariate logistic regression analyses were performed. In the adjusted model indicated that Physical inactivity was associated obesity. Students reporting physically inactive were 0.416 times more likely to get obesity (AOR: 0.416; 95%CI=0.185-0.938, $p<0.0034$). In case of loneliness in unadjusted model participants who are suffering from loneliness has 0.474 times more chance to get obese than who are not suffering from loneliness (COR: 0.474, 95%CI=0.214-1.047, $p=0.48$) In adjusted model its insignificant. The purpose was this study to assesses the overweight and obesity among ten to nineteen years old urban high school and college going adolescents. This study reports the factors associated with overweight/obesity among 10–19-year-old high school and college going adolescents in Lakshmipur district, Bangladesh.

KEYWORD: Obesity, Overweight, Physical Inactivity, Loneliness, BMI.

1. INTRODUCTION

1.1. Background of The Study

WHO defines overweight and obesity as abnormal or excessive fat accumulation that poses a risk to health.¹ It is a multifactorial disease, defined as a state of imbalance between calories ingested versus calories expended would lead to excessive or abnormal fat accumulation. Globally, overweight and obesity among children adolescents are considered a major public health issue because of their contribution to the development of chronic non-communicable diseases (NCDs) in adulthood. WHO (2013) considers childhood obesity as “one of the most serious public health challenges of 21st century”. According to the World Health Organization (WHO) (2014) overweight and obesity is one of today’s most important public health problem, which is being escalated as a global epidemic. It is also increasingly recognized as a significant problem in developing countries and countries undergoing economic transition. Obesity is a medical condition, sometimes considered a disease in which excess body fat has accumulated to such an extent that it may negatively affect health. People are classified as obese when their body mass index (BMI)—a person's weight divided by the square of the person's height—is over 30 kg/m²; the range 25–30 kg/m² is defined as overweight. Some East Asian countries use lower values to calculate obesity. Obesity is a major cause of disability and is correlated with various diseases and conditions, particularly cardiovascular diseases, type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis.

De Onis & Blössner (2000) stated that, “global trends of childhood obesity show huge shifts in recent times. Surveys from 144 countries suggest that 43 million preschool children (35 million in developing countries) are overweight and obese and 92 million are at risk of being overweight. The worldwide prevalence of childhood overweight and obesity increased from 4.2% in 1990 to 6.7% in 2010. This trend is likely to continue, and the prevalence is expected to reach 9.1%, or 60 million, in 2020. In Bangladesh, the context of obesity and overweight has been underexplored, more so amongst younger age groups. Understanding the current situation and trends will provide useful insights into its risk factors and will assist health professionals and policymakers in decision making and developing future research agenda. This paper explored the availability of literature adolescent obesity/overweight and its determinants in Bangladesh through a scoping review which, unlike a systematic review, offers a much broader perspective in the respective field which makes it more appropriate method to assess the present situation of childhood and adolescent obesity in Bangladesh.” Wang & Lobstein (2006) conducted a study and found that “during 2005, the prevalence of childhood overweight and obesity in high-income countries was 10.6% whereas in low-income countries, the prevalence was 5.2%.” The people of Lakshmipur district are not well concern about their life style. Sedentary behavior, physical inactivity, unhealthy diet is very common among school and college going children and adolescents. As a result, obesity and overweight become a major health issues day by day. There is a noticeable published literature gap regarding adolescence obesity/overweight in Bangladesh. Although, in general, young age obesity is not considered as a major public health problem in Bangladesh yet, it is alarmingly high and on rise amongst certain groups, particularly amongst urban children from affluent households. This study aims to find out the prevalence of obesity among adolescents of Lakshmipur district and its associated sociodemographic and behavioral factors.

Chumlea et al. (2002) stated that, “obesity and its attendant conditions have become major health problems worldwide, and obesity is currently ranked as the fifth most common leading cause of death globally.” The World Health Organization (WHO) defines obesity as an “abnormal or excessive fat accumulation that may impair health,” further clarifying that “the fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended”. In the absence of established criteria that define childhood obesity on the basis of whole-body fatness and its relationship to health outcomes, cutoff points based on distributions of anthropometric measurements (e.g., weight and BMI) generally are used.

Childhood obesity is one of the major public health problems of the 21st century. Global trends of childhood obesity show huge shifts in recent times. Surveys from 144 countries suggest that 43 million preschool children (35 million in developing countries) are overweight and obese and 92 million are at risk of being overweight. The worldwide prevalence of childhood overweight and obesity increased from 4.2% in 1990 to 6.7% in 2010. This trend is likely to continue and the prevalence is expected to reach 9.1%, or 60 million, in 2020. Raj et al. (2007) conducted a study among 24,000 school children in south India showed that the proportion of overweight children increased from 4.94% of the total students in 2003 to 6.57% in 2005 demonstrating the time trend of this rapidly growing epidemic. At least 30% of obesity begins in childhood. Conversely 50% to 80% of obese children become obese adults.

In Bangladesh, the rate of malnutrition is one of the highest in the world, with 6 million children estimated to be chronically undernourished. About 36% Bangladeshi children are suffering from malnutrition. Biswas et al. (2017) reported in a study that the prevalence of overweight and obesity among Bangladeshi school going children and adolescents was 7.9% and 9%, respectively, with a clear upward trend. A change of socioeconomic status as well as physical activity pattern, led to the emergence of obesity-related metabolic problems among Bangladeshi high school and college going adolescents.

Koplan et al. (2005) conducted a study and found that obesity is not a simple problem but a complex health issue stemming from a combination of individual factors (genetics, learned behaviors) and substantial causes (unhealthy societal or cultural eating habits, food deserts). Johnson et al. (1975) found in a study that obesity is an “acquired” disease that, heavily depends on lifestyle factors (i.e., personal choices), such as low rates of physical activity and chronic overeating, despite its genetic and epigenetic influences. Researchers have also noted that various forms of obesity, including abdominal obesity, are related to increased risk of several chronic conditions and diseases, which include asthma, cancer, diabetes, hypercholesterolemia, and, cardiovascular diseases. Rahman et al. (2014) stated that in recent years, physical activity has been decreasing and sedentary activities have been increasing due to several factors such as rapid urbanization, continually decreasing numbers of playgrounds, increasing purchasing power and easy access to new technological devices such as hand-held computer toys, and thereby have attributed to an emerging overweight and obesity problem among young children in urban settings.

Adolescents' obesity is the precursor of obesity in the adulthood. Styne (2001) from Harvard University found in a study, morbidity from cardiovascular diseases, diabetes, obesity-related cancers and arthritis were 50–100% higher in obese individuals who were also obese as children and generally the cardiovascular mortality in such individuals was doubled. Huly (2020) noted that various forms of obesity, including abdominal obesity, are related to increased risk of several chronic conditions and diseases, which include asthma, cancer, diabetes, hypercholesterolemia, and, cardiovascular diseases. Thus, while obesity is undoubtedly a condition, it also exacerbates pre-existing conditions and instigates new ones. More specifically, Bischoff *et al.* (2017) maintained that obesity can affect nearly every organ system, from the cardiovascular (CV) system to the endocrine system, central nervous system, and the gastrointestinal (GI) system. In addition, obesity is associated with the growing prevalence of several CV conditions, from hypertension and coronary heart disease (CHD) to atrial fibrillation (AF) and even total heart failure.

Body Mass Index" (BMI), which is measured by calculating $[(\text{weight in kg})/(\text{height in m}^2)]$, is a simple index intended to classify adults into one of three categories: "underweight," "overweight," or "obese." Though initially developed in the 1830s by a Belgian mathematician and sociologist, BMI is still widely used as a measurement of obesity and obesity rates. Krebs & Jacobson (2003) said that several expert and advisory groups have recommended BMI as the preferred measure for evaluating obesity among adolescents 2 to 19 years of age. It is correlated strongly with body fat percentage (especially at extreme BMI levels), it is associated only weakly with height, and it identifies the fattest individuals correctly, with acceptable accuracy at the upper end of the distribution.

Governments need to take clear and unequivocal action to promote healthy diets at every stage of a child's life. This must include 1) clear messaging about the healthy foods mothers and children should be eating, from the very start of a child's life, in addition to messaging about the unhealthy food they should not be eating; and 2) concrete actions to secure access to more nutritious diets for mothers, children and adolescents. This means making healthy food desirable, affordable and accessible and requires a special focus on maternal diets, breastfeeding practices, early childhood habits and healthy eating, and healthy food environments in schools. A strategy to promote healthy diets cannot focus on education alone; it must take a food systems approach, which means considering the multiple factors that affect how food is grown, distributed, marketed and made accessible. UNICEF is

positioned to make the convincing argument that healthy food must be affordable and accessible to disadvantaged and poorer communities. Firm government action to regulate harmful practices of the food and beverage industry will be needed to support healthy diets. Regulation has proven the most effective way of reducing the consumption of sugary beverages and high-calorie unhealthy foods, which contribute to overweight. The type of regulation on the food and beverage industry will vary according to context, but recommended policies include taxes on unhealthy foods and beverages, strict rules on front-of-package labelling, limitations on marketing – traditional and digital – and limits on in-store retail marketing. The strategy required to prepare and support governments to do this work requires a sound analysis and strong advocacy. Key actors that the government needs to engage with in this effort are: health officials, schools and education officials, social protection and social welfare sectors, government sectors related to food production and distribution, the general public, communities and families. The government also needs to address the role the private sector, especially the food and beverage industry, by requiring them to improve and/or regulate their practices.

According to World Health Organization (2019) many of these same key actors in society, especially in schools and government, need to promote healthy physical activity at every stage of a child's life, including through adolescence. Healthy physical activity is linked to healthy sleeping habits in children, another factor in overweight. World health organization (2020) also stated that beyond schools, encouraging physical activity means smart urban planning that makes it a form of easy transportation via walking and biking, and makes exercise an attractive and socially integrated activity. This also includes countering sedentary behavior (promoted by urbanization, technology and the proliferation of screen-time) by using clever social messaging, educating the public, and promoting strategic school and community activities that encourage exercise. The way we build our neighborhoods and cities and use public spaces such as parks and public transportation has a major impact on the amount of physical exercise people get. For instance, lower incomes generally translate to less physical activity because of housing quality and/or perceptions of safety, meaning that socioeconomic inequalities are a critical factor affecting children's habits around physical exercise. For children, physical activity also tends to drop when moving into adolescence, particularly among girls. Policies must therefore address two sides of the coin: working with urban planners, architects and communities to make outdoor spaces and regular transportation safe, attractive and integrated into children's everyday lives, while also reversing the

alarming trend of sedentary behavior that is linked to screen time with television, computers, and gaming.

Kivunja (2018) stated that Theoretical framework is the structure that can hold or support one or more theories of a study. The theoretical framework introduces as well as describes the theories which explains why the research problems under study exists. Swanson (2013) said that a theoretical framework comprises the theories expressed by experts in the field into which you plan to research, which you draw upon to provide a theoretical coat hanger for your data analysis and interpretation of results.”

The purpose of this study is to investigate the frequency of obesity in Bangladeshi adolescents and the difference in characteristics between the obese and non-obese groups, and to identify the factors that significantly predict the obese group to develop basic data necessary for the development of obesity prevention programs and early intervention for adolescents in the future. It will carry out to provide a specific research goal. ▪ Find out the frequency of obesity in target teenagers. ▪ Identify the general characteristics, obesity-related life characteristics, and psychological/mental characteristics of the target youth, and identify differences in each characteristic according to the obese group and non-obese group, obesity, and gender. ▪Analyze predictive variables and predictive power of obesity in obese adolescents.

Adom et al. (2016) said that a “conceptual framework is an analytical tool with several variations and contexts in which the relationships are clearly defined between the different variables. It is an interesting visual display which is used to make conceptual distinctions and organize ideas”. Mulder (2017) stated that “A Conceptual framework is a visual representation that helps to illustrate the expected relationship between cause and effect in several context. It is also called a Conceptual Model or Research Model. Different variables and the assumed relationships between those variables are included in the model and reflect the expectations.”

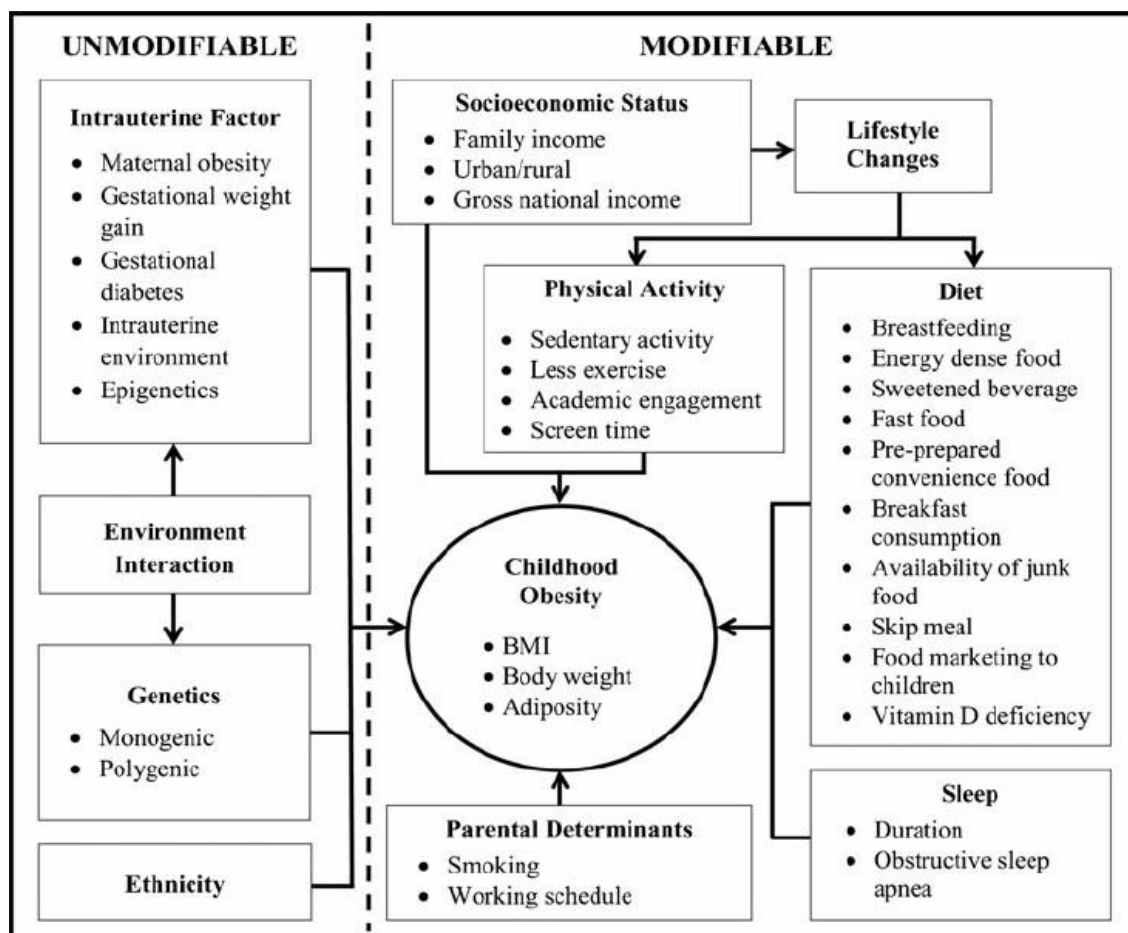


Figure 2.1: Conceptual Framework.

As noted in the background overweight and obesity is a major concerning issue now a day it is seen that people in Lakshmipur district which is an area people are not aware about their health condition. Most of the school and college going adolescence are prone to obese and in overweight condition which can lead them into some serious health issues in future. This is due to their unhealthy lifestyle, unhealthy dietary habit, lack of physical activity, socioeconomic conditions etc. Therefore, this study was aimed to assess the obese and overweight of school and college going adolescent by calculating their BMI and also see the factors associated with it.

2.0. Research Objectives

2.1.1. General objective

To assess the obesity and overweight condition of the high school and college going adolescents students of Lakshmipur district. And also provide the information about the factors associate with their conditions.

2.1.2. Specific objective

To fulfill the general objectives following are the specific objectives which were to be carried out.

- To assess the obesity of high school and college going adolescents (10 to 19) years through BMI calculation.
- To determine the prevalence of overweight, normal weight, under weight of 10 to 19 years old adolescents.
- To know the dietary habit of the study participants that can be associated with overweight and obesity.
- To know the physical activity status of the study participants which can be associated with overweight and obesity.
- To know the mental health condition of the study population which can be associated with overweight and obesity.
- To know the habit of smoking of the study population which can be associated with overweight and obesity.

2.2. Research question

1. What is the BMI of 10-19 years old adolescents?
2. What are the factors that potentially influence and/or cause adolescent's obesity?

2.3. Operational definitions

Overweight: Overweight is the condition that is characterized by excessive accumulation of fat where the BMI crosses the level 25 kg/m² that presents a risk to health.

Underweight: Underweight is defined as the condition of BMI <18.5 kg/m².

Obesity: According to World Health Organization obesity is defined as abnormal fat accumulation that presents a risk to health.

2.4. Anthropometry

BMI: BMI or Body Mass Index is an approximate measure of whether someone is overweight, underweight, calculated by dividing their weight in kilograms by the square of them in meters.

2.5. Report Organization

This thesis report is organized as follows: chapter 2 describes the review of the related literature, chapter 3 explains the research methodology, chapter 4 shows the result and

discussion the findings of thesis, chapter 5 describes the Conclusion and Recommendations.

3.0. METHODOLOGY

3.1. Methodological framework: Methodological framework of the study is displayed in Figure 3.1. The overall research activities had been designated into four stages. In the stage one, literatures were reviewed, and study were designed. Finalization of instrument were done in stage two through pretest and validation of the instrument. In this stage ethical approval was obtained from the Dissertation Examination Committee, Hamdard University Bangladesh. In the stage three, data collection was done through receiving the permission of local health authority and following the ethical guideline of research Examination Committee, Hamdard University Bangladesh. Data processing was also performing in this stage. In the final stage of four, data were analyzed using SPSS version 22.00. In addition, data interpretations were done in this stage and thesis paper was written according to the instructions of the Department of Public Health, Hamdard University Bangladesh. Dissemination of information also commenced in this stage.

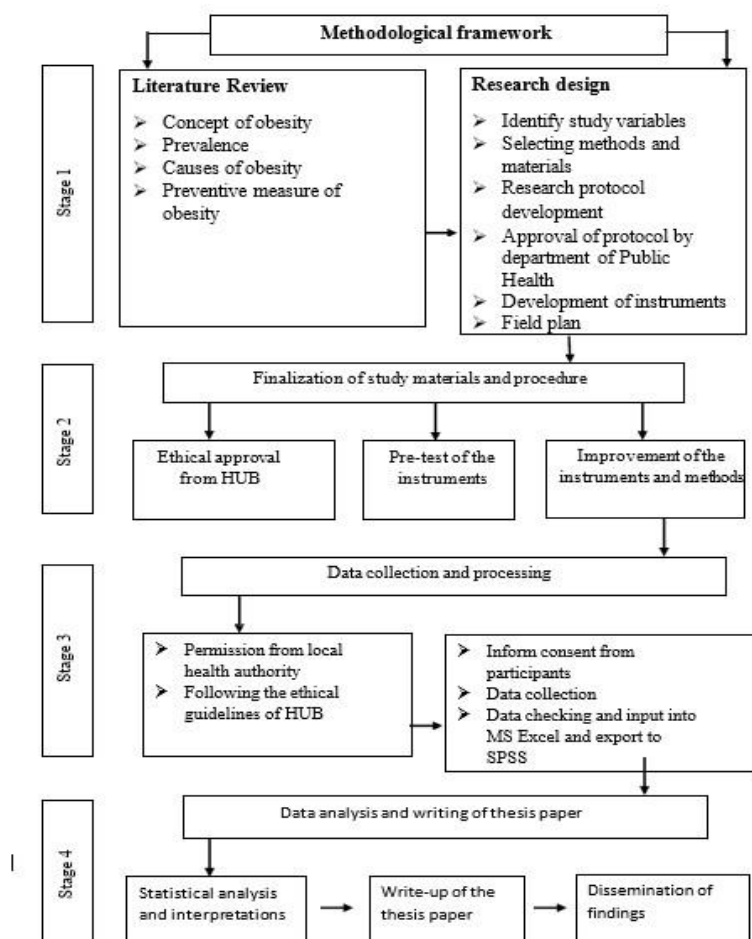


Figure 3.1: Methodological framework.

3.2. Study design

This study was an institution-based, cross-sectional analytical study designed to screen obesity among adolescent students and to explore factors associated with adolescence obesity in Lakshmipur district, Bangladesh. Data collection was performed from January 1 to 30 2024. The study participants were students of age 10-19 years corresponding to class 6 to class 12 in the selected schools and colleges.

3.3. Research Method

The research method applied by

- a) Anthropometric measurements of BMI of 10 to 19 years' adolescent.
- b) Household survey with the help of questionnaire.

The Bangladeshi version of the standard Global School Health Survey (core questionnaire modules 2021) was used to collect data on noncommunicable disease behavioral risk factors among the students. GSHS is a school health survey primarily conducted among students of the 10–19 years age group. In our study, we chose to enroll students from grades 6,7, 8, 9,10,11 and 12. The GSHS survey questionnaire was developed by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) for obtaining information from students to promote global school health and young health programs and policies. The GSHS questionnaire consists of ten core questionnaire modules which measure the behavior and protective factors associated with the leading causes of morbidity and mortality among adults. They included questions related to demography, dietary behaviors, drug use, hygiene, mental health, physical activity, protective factors, sexual behaviors, tobacco use, and violence and unintentional injury. The Nepalese version of the GSHS questionnaire has already been used in previous national school-based health surveys. Permission was granted to use the Bangladeshi version of the GSHS questionnaire. Among the ten core questionnaire modules, questions related to demography, dietary behaviors, mental health, physical activity, and tobacco use were used in the present study to explore association with adolescent obesity.

3.4. Study sites/participants

The study was conducted in seven schools and three colleges located in Lakshmipur district. The schools and colleges were selected based on three criteria: large number of students, having reputation for better education facility, and availability of play-ground within school premises.

3.5. Justification of selection of the area

This Lakshmipur district was chosen purposively as it is very convenient for the researcher and formation of sampling frame was very convenient. On rise other hand study status of the adolescents is almost homogeneous.



Figure 3.2: Study area in the map of Bangladesh.



Figure 3.3: Map of the study area.

3.6. Sampling Methods/Techniques

This research was adopting sampling followed by convenient sampling method. The study population were 10 to 19 years aged randomly selected and included in study.

3.7. Sample Size

The sample size for the study was determined by the following equation:

$$n = Z^2 pq / d^2$$

Where,

n = Desired sample size

z = Standard normal variation usually at 1.96 which corresponds to 95% confidence interval.

p = 0.41 (Islam et al, 2018)

q = 1-p = 1-0.41 = 0.59

d = Standard error = 5% = 0.05 So, $n = \{(0.41) \times (0.59) \times (1.96)^2\} \div (0.05)^2 = 348$

Hence, Desired sample size will be, n = 348

3.8. Criteria for Sample Selection

- Inclusion criterion: adolescent aged 10 to 19 Years.
- Exclusion criterion: - Person who was not interested to give data.
- Person who were in underweight condition

3.9. Data Collection

After getting permission from the school and college administration and consent from students and parents, we distributed the self-administered questionnaires to all the students of grades 6,7,8, 9, 10,11 and 12 of the selected schools and colleges, with instructions to fill up the questionnaires from coinvestigators and schoolteachers. Then, after collecting the filled-up questionnaires from the students, the height and weight of each student were measured and noted down in the same questionnaire. The height of the students was measured using a portable stadiometer and without shoes. It was measured in centimeters in one decimal figure, and the average of two readings was recorded. Weight was measured using digital weighing measures with minimal clothing and without shoes and taken in kilograms in two decimal figures. Two readings were taken, and the average of the two readings was recorded. I was used a structured questionnaire (GSHS) to collect demographic information and information on exposures of interest: regular habit of physical activities, dietary habit, habit of smoking, alcohol intake, mental conditions, duration of sedentary activities which included watching television, use of computer and video games,

and duration of sleep/day of each study participant. In order to know regular habit of physical activity, I was asked participants to report how long did they spend every day in a typical week doing activities which require physical activity. These activities included playing games such as football, cricket and other outdoor games, running in field and cycling. WHO recommends spending at least 60 minutes of physical activity per day for adolescent aged 10–19 years. Since conducted this study among school children who might be involved in physical activities during their school stay, I was splinted this recommended duration of physical activity per day into two bouts, in school and at home. I was assumed that splitting the physical activity habit into school and home would give us the opportunity to have better understanding of actual physical activity pattern of students and also to help determining if any particular habit serves as risk factor for overweight problem in children. I was asked the respondents to report the actual physical activity habit both in school and at home and add to find the duration of total physical activity. I recorded the response into following categories.

3.10. Study Time Framework

Table 3.1. Study Time.

No.	Activities	Months					
		2022			2023		
		Oct.	Nov.	Dec.	Jan.	Feb.	March
1	Literature review						
	Study design						
2	Development of study questionnaire, pre-test and improvement						
4	Data collection						
5	Data input and analysis						
6	Report writing						

3.11. Data Collection Technique and Methods

A community based descriptive cross-sectional study conducted in people living in Lakshmipur district. The data collection process consists 2 parts:

- pre-structured questionnaire: - A set of questionnaires will be asked to the adolescents.
- Anthropometric measurements of 10 to 19 years age adolescent: - The following indices were used; Weight-for-age, Height-for-age and Weight-for-height

3.12. Data Collection Tools

Data collection tools and equipment require for the survey consist of:

- Weighing machine: Weighing machine of capacity 100 kg and having the least count of 0.1 kg-1 piece)

B. Height measuring scale (stadiometer)-1 piece

3.13. Pre testing the data collection tools

The prepared sets of questionnaire and anthropometric instruments were pre-tested among 10 to 19 years adolescent respectively. Pre-testing was conducted in order to maintain accuracy and clarity of questionnaire, to check the consistency in interpretation of questions by respondents and to identify ambiguous item. After pretesting all the ambiguous, misleading and wrongly interpreted questions was omitted and questionnaire was revised in accordance with the findings of pretesting.

3.14. Plan for supervision and monitoring

During the field work and the data analysis I mentioned and supervised by the guide teacher.

3.15. Plan for Data Management and Analysis

Quantitative data will be first cleaned, coded and will be entered in WHO Anthro. Similarly, qualitative data will be transcribed and coded by assigning labels to various categories. And further analysis will be done by using the SPSS software.

3.16. Ethical considerations

- Ethical approval had been taken from Hamdard University Bangladesh Research Ethics Committee (HUBREC) in due course of the study.
- Informed consent (both verbal and written) had been from each individual.
- The purpose of the study was to describe properly to the respondents.
- All the information collected from the respondents kept confidential.
- Data did not used for any other purpose other than the research.
- Participants was ensured that there will no harm or risk in participating as no invasive procedure was used.
- Participants was to withdraw themselves from the study at any time of data collection as well as to skip any particular question.
- No compensation or incentive were provided to the participants for participating in the study.

4.1. RESULTS

This cross-sectional study was carried out among 490 respondents to assess factors associated with obesity and overweight. They were interviewed with GSHS questionnaire. Collected

data were cleaned and analyzed with the help of SPSS (statistical package for social science) version 20. This chapter presents the findings of those data. The analyzed data were presented under the followings: Socio-demographic and economic characteristics, Dietary habit related information, Physical activity related information, Sedentary behavior related information, Mental health related information, Smoking related information, Is performed only association related analysis include it.

4.1.1. Socio-demographic and economic characteristics

The pie chart showed that the most frequent age group of the respondents was 13-16 years which was 182 (37.1%) followed by the age group 16-19 years which was 176 (35.9%) and age group 10-13 years which was 132 (26.9%).

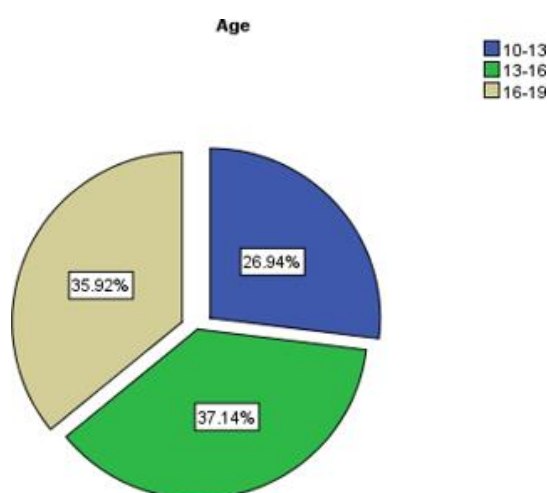


Figure 4.1: Distribution of respondent Age in Percentage.

The graph shows that most of the respondents 43.3% (n=212) were Male and 56.7% (n=278) were Female.

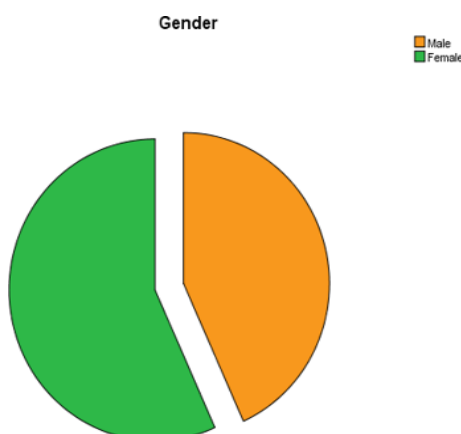
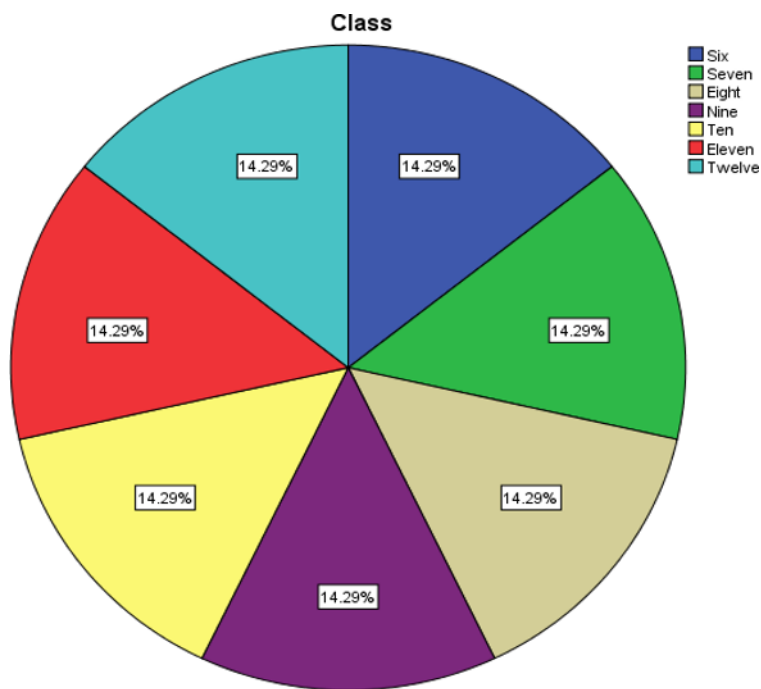


Figure 4.2: Distribution of respondent Gender in Percentage.

The graph (Graph 4.3) shows that the respondents 14.3% (n=70) were class six, 14.3% (n=70) were class seven. 14.3% (n=70) were class eight, 14.3% (n=70) were class nine, 14.3% (n=70) were ten, 14.3% (n=70) were eleven and 14.3% (n=70) were twelve.



The graph (Graph 4.4) shows that among the respondents 77.8% (n=153) were from rural areas and the rest 22.2% (n=109) were from urban areas.

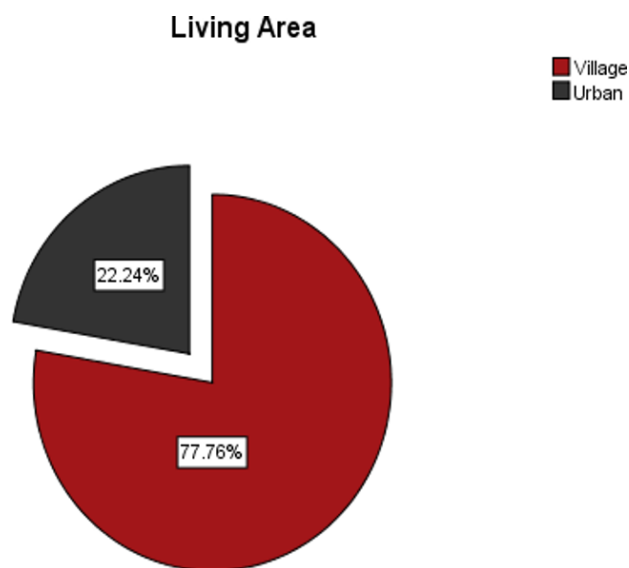


Figure 4.4: Respondents living area.

The graph (Graph 4.5) shows that among the respondents, 4.9% (n=24) had no formal Education, 22.2% (n=109) had educational status up to primary, 34.5% (n=169) respondents had educational

status up to secondary and 29.8% (n=146) respondents had educational status up to higher secondary level and 8.6% (n=42) respondents had educational status up to Bachelor/Master's level.

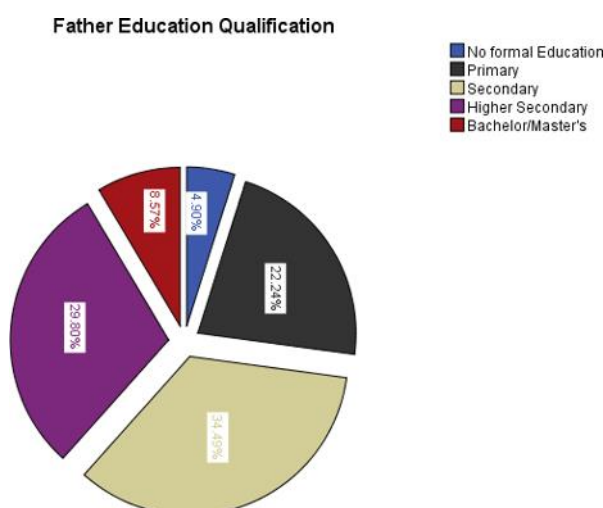


Figure 4.5: Respondents Father Education Qualification.

The graph (Graph 4.6) shows 13.7% (n=67) were farmer, 38.8% (n=190) were employee, 20.4% (n=100) were businessman and 27.1% (n=79) were others.

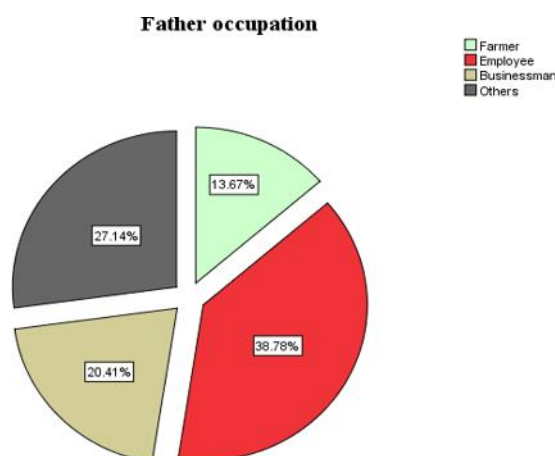


Figure 4.6: Respondents Father occupation in percentage.

The graph (Graph 4.7) shows that among the respondents, 4.9% (n=24) were no formal Education, 18.8% (n=92) had educational status up to primary, 43.1% (n=211) respondents had educational status up to secondary and 29.4% (n=144) respondents had educational status up to higher secondary level and 3.9% (n=19) respondents had educational status up to Bachelor/Master's level.

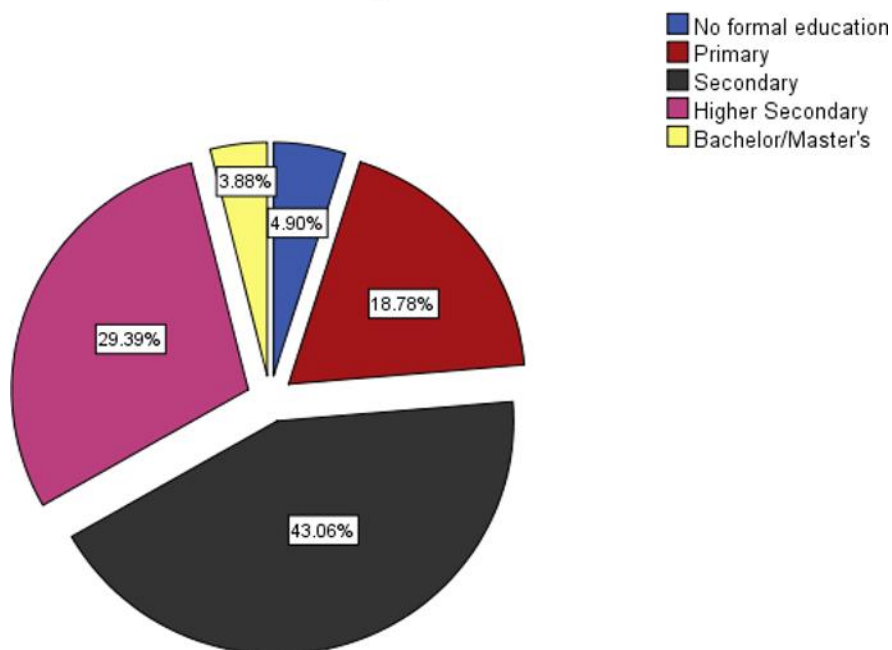
Mother Education Qualification

Figure 4.7: Respondents Mother education in percentage.

The graph (Graph 4.8) shows that 85.1% (n=417) were housewife, 13.5% (n=66) were employee and 1.4% (n=7) were others.

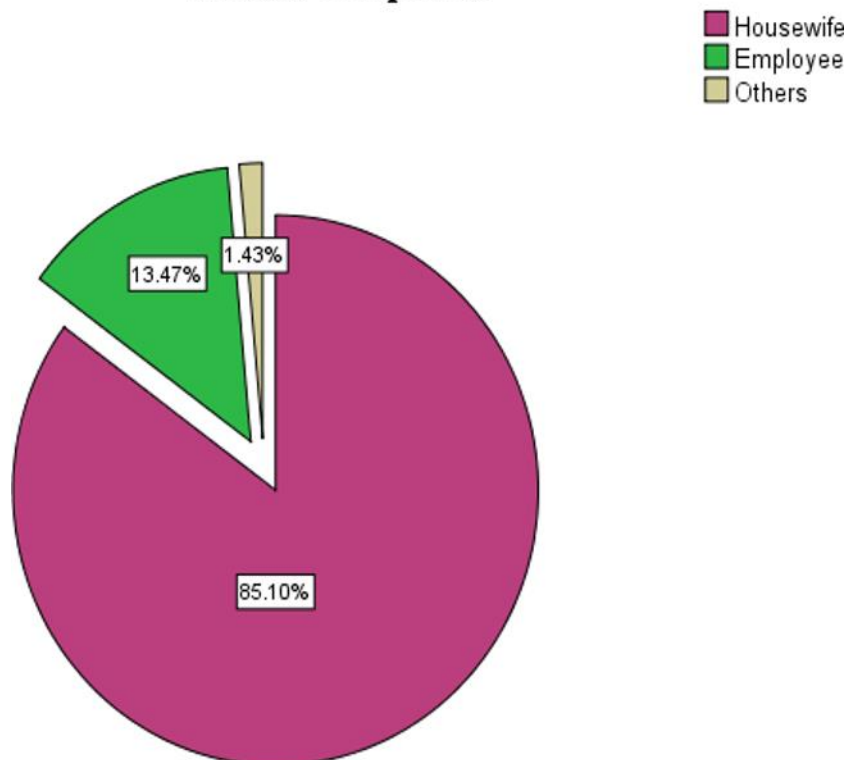
Mother occupation

Figure 4.8: Respondents Mother occupation in percentage.

The graph (Graph 4.9) shows that the respondents family income 31% (n=152) were <20000 Tk, 35.9% (n=176) were 20000-30000 Tk and 33.1% (n=162) were >30000 Tk.

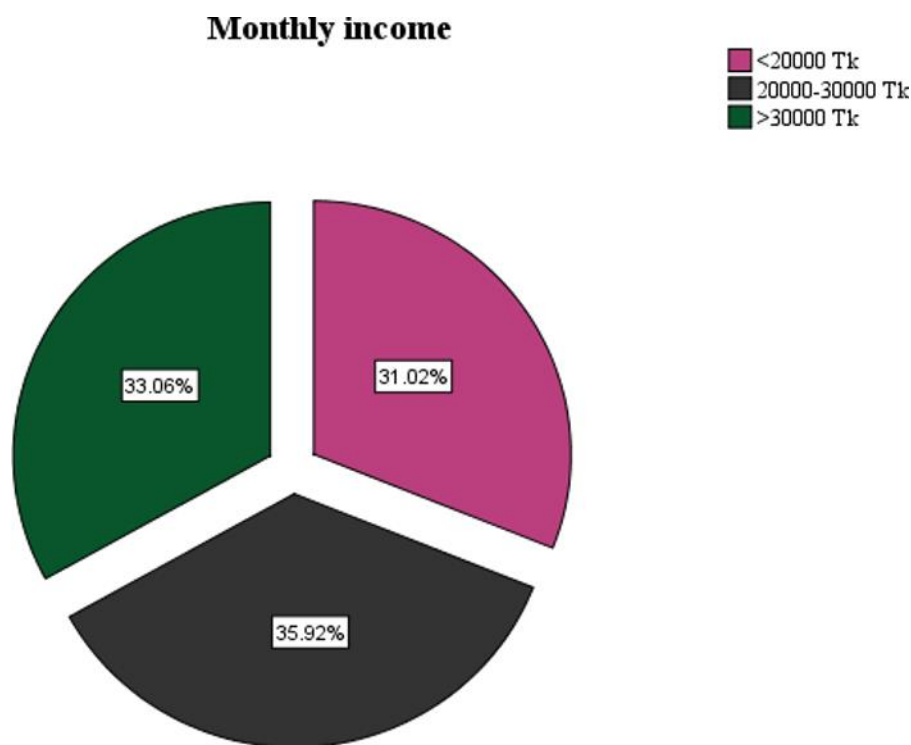


Figure 4.9: Respondents Monthly income.

4.2. Socio-demographic and lifestyle factors among students

There were 490 school and college going adolescents recruited the study. Among them 278 (56.7%) was female and 212 (43.3%) was male. The average age of the participant was 14.5 years and most of the participant belong this group (37.5%). Most of the participants came from rural area (77.8%). Participants from different classes six, seven, eight, nine, ten, eleven and twelve were in equal amount (14.3%). Most of the participant's father was employee (38.8%) and mother was house wife (85%). The educational status of most of the participant's father was secondary school (34.5) and mother was also secondary school (43.1). Most of the family's monthly come was ranged between 20000-30000 (35.9%). Most of the participants did not take vegetables daily (76.7%) and 82.7% were not taking fruits daily. Most of the participants were not facing food insecurity (88.4%). 70.8% participants did not perform physical activity and 86.1 % participants did not attend physical education class. 47.1% participants were habitual of sedentary behavior. (Tab. 4.10)

Table 4.10: Socio-demographic and lifestyle factors among 490 students.

Variables	Categories	Frequency(f)	Percentage (%)
Age	10-13	132	26.9
	13-16	182	37.1
	16-19	176	35.9
Sex	Male	212	43.3
	Female	278	56.7
Class	Six	70	14.3
	Seven	70	14.3
	Eight	70	14.3
	Nine	70	14.3
	Ten	70	14.3
	Eleven	70	14.3
	Twelve	70	14.3
Living area	Rural	381	77.8
	Urban	109	22.2
Father's education	No formal education	24	4.9
	Primary	109	22.2
	Secondary	169	34.5
	Higher Secondary	146	29.8
	Bachelor/Master's	42	8.6
Father's occupation	Farmer	67	13.7
	Employee	190	38.8
	Business	100	20.4
	Others	133	27.1
Mother's education	No formal education	24	4.9
	Primary	92	18.8
	Secondary	211	43.1
	Higher Secondary	144	29.4
	Bachelor/Master's	19	3.9
Mother's occupation	Housewife	417	85.1
	Employee	66	13.5
	Others	7	1.4
Monthly income	<20000	152	31.0
	20000-30000	176	35.9
	>30000	162	33.1
Daily eating fruits	No	405	82.7
	Yes	85	17.3
Daily eating Vegetables	No	376	76.7
	Yes	114	23.3
Food insecurity	No	433	88.4
	Yes	57	11.6
Physical activity	Physically inactive	347	70.8
	Physically active	143	29.2
Attendance in physical	Irregular attendance	422	86.1

education class			
	Regular attendance	68	13.9
Sedentary behavior	No	259	52.9
	Yes	231	47.1
Smoking habits	No	456	93.1
	Yes	34	6.9
Feeling lonely in 12 months	No	387	79
	Yes	103	21
Feeling anxiety in 12 months	No	209	42.7
	Yes	281	57.3
Suicidal attempt in 12 months	No	484	98.8
	Yes	6	1.2

4.3. Associations between factor and BMI among students

However, there is a relationship between physical inactivity with obesity and overweight. ($\chi^2 = 3.922$ df=1 and $p=0.048$). Age is also associated with obesity and overweight. ($\chi^2 = 7.944$, df=2 and $P=0.019$). There is also association between loneliness and obesity ($\chi^2 = 4.000$, df=1 and $P=0.045$). Association also found in between age and obesity ($\chi^2 = 7.944$, df=2 and $P=0.019$). Father education is also associated obesity and overweight ($\chi^2 = 9.852$, df=4 and $P=0.043$) (Tab.4.11)

Table 4.11: Associations between factor and BMI among 490 students.

Variables	Categories	Frequen cy(f)	Percenta ge(%)	χ^2	df	P value
Age	10-13	132	26.9	7.944	2	0.019
	13-16	182	37.1			
	16-19	176	35.9			
Sex	Male	212	43.3	3.375	1	0.053
	Female	278	56.7			
Class	Six	70	14.3	12.446	6	0.053
	Seven	70	14.3			
	Eight	70	14.3			
	Nine	70	14.3			
	Ten	70	14.3			
	Eleven	70	14.3			
	Twelve	70	14.3			
Living area	Rural	381	77.8	1.937	1	0.164
	Urban	109	22.2			
Father's education	No formal education	24	4.9	9.852	4	0.043
	Primary	109	22.2			
	Secondary	169	34.5			
	Higher Secondary	146	29.8			
	Bachelor/Mas	42	8.6			

	ter's					
Father's occupation	Farmer	67	13.7	0.975	3	0.807
	Employee	190	38.8			
	Business	100	20.4			
	Others	133	27.1			
Mother's education	No formal education	24	4.9	7.256	4	0.123
	Primary	92	18.8			
	Secondary	211	43.1			
	Higher Secondary	144	29.4			
	Bachelor/Master's	19	3.9			
Mother's occupation	Housewife	417	85.1	2.604	2	0.272
	Employee	66	13.5			
	Others	7	1.4			
Monthly income	<20000	152	31.0	0.994	2	0.608
	20000-30000	176	35.9			
	>30000	162	33.1			
Daily eating fruits	No	405	82.7	0.387	1	0.534
	Yes	85	17.3			
Daily eating Vegetables	No	376	76.7	3.446	1	0.063
	Yes	114	23.3			
Food insecurity	No	433	88.4	3.712	1	0.054
	Yes	57	11.6			
Physical activity	Physically inactive	347	70.8	3.9221	1	0.048
	Physically active	143	29.2			
Attendance in physical education class	Irregular attendance	422	86.1	0.042	1	0.837
	Regular attendance	68	13.9			
Sedentary behavior	No	259	52.9	0.017	1	0.895
	Yes	231	47.1			
Smoking habits	No	456	93.1	1.636	1	0.201
	Yes	34	6.9			
Feeling lonely in 12 months	No	387	79	4	1	0.045
	Yes	103	21			
Feeling anxiety in 12 months	No	209	42.7	0.091	1	0.763
	Yes	281	57.3			
Suicidal attempt in 12 months	No	484	98.8	0.752	1	0.386
	Yes	6	1.2			

4.4. Logistic regression analysis showing associated factors with obesity/overweight among students

Bivariate and multivariate logistic regression analyses were performed and the unadjusted and adjusted odds ratios are shown in Table 4.12. In the adjusted model indicated that Physical inactivity was associated obesity. Students reporting physically inactive were 0.416 times more likely to get obesity (AOR: 0.416; 95%CI=0.185-0.938, $p<0.0034$) In the unadjusted model, the result is insignificant. (COR: 0.416, 95%CI=0.196-0.944, $p=0.05$). In case of loneliness in unadjusted model participants who are suffering from loneliness has 0.474 times more chance to get obese than who are not suffering from loneliness (COR: 0.474, 95%CI=0.214-1.047, $p=0.48$) In adjusted model its insignificant. In unadjusted model participant's mother whose educational status was bachelor and masters those participants are 0.527% times more chance to get obese than other participants (COR: 0.527, 95%CI=0.102-2.716, $p=0.011$). In adjusted model it is not significant. In unadjusted model participants who belongs to the age group 13-16 have 3.32 times more chance to get obese than other age group. participants (COR: 3.320, 95%CI=0.168-65.565, $p=0.007$). In adjusted model it is insignificant. In unadjusted model participants who belongs to class nine has 0.832 times more chance to get obese than other class. participants (COR: 0.832, 95%CI=0.131-5.279, $p=0.017$). In adjusted model it is insignificant. (Tab. 4.12)

Variables	Categories	Unadjusted Module			Adjusted Module		
		COR	95% CI	<i>p</i> value	AOR	95% CI	<i>p</i> value
Age	10-13	Ref			Ref		Ref
	13-16	3.320	0.168-65.565	0.007	3.246	0.173-61.073	0.432
	16-19	1.931	0.485-7.692	0.093	1.961	0.484-7.950	0.345
Sex	Male	Ref			Ref		Ref
	Female	1.992	0.872-4.553	0.055	2.061	0.881-4.821	0.095
Class	Six	Ref			Ref		Ref
	Seven	0.260	0.011-6.281	0.699	0.289	0.012-6.827	0.442
	Eight	0.085	0.003-2.079	0.102	0.088	0.904-2.051	0.130
	Nine	0.832	0.131-5.279	0.017	0.854	0.134-.455	0.867
	Ten	1.308	0.249-6.875	0.236	1.302	0.244-6.938	0.757
	Eleven	1.584	0.274-	0.514	1.588	0.277-	0.604

			9.163			9.115	
	Twelve	0.587	0.187-1.845	0.156	0.589	0.188-1.846	0.364
Living area	Rural	Ref			Ref		Ref
	Urban	1.245	0.419-3.695	0.168	1.232	0.414-3.662	0.708
Father's education	No formal education	Ref			Ref		Ref
	Primary	0.196	0.016-2.381	0.250	0.202	0.012-2.504	0.213
	Secondary	0.766	0.194-3.017	0.370	0.791	0.198-3.156	0.739
	Higher Secondary	0.400	0.109-1.475	0.497	0.411	0.108-1.555	0.190
	Bachelor/Master's	0.489	0.127-1.886	0.069	0.564	0.144-2.209	0.411
Father's occupation	Farmer	Ref			Ref		Ref
	Employee	0.682	0.215-2.162	0.637	0.590	0.179-1.943	0.385
	Business	1.232	0.521-2.916	0.756	1.294	0.534-3.136	0.568
	Others	1.138	0.395-3.280	0.986	1.161	0.401-3.367	0.783
Mother's education	No formal education	Ref			Ref		Ref
	Primary	1.358	0.170-10.869	0.257	1.839	0.217-15.564	0.576
	Secondary	1.169	0.223-6.140	0.114	1.387	0.252-7.634	0.707
	Higher Secondary	0.913	0.196-4.261	0.083	1.137	0.231-5.601	0.874
	Bachelor/Master's	0.527	0.102-2.716	0.011	0.530	0.097-2.912	0.465
Mother's occupation	Housewife	Ref			Ref		Ref
	Employee	0.624	0.055-7.121	0.115	0.646	0.055-7.644	0.729
	Others	0.940	0.064-13.861	0.716	0.923	0.060-14.173	0.954
Monthly income	<20000	Ref			Ref		Ref
	20000-30000	0.736	0.298-1.818	0.795	0.741	0.300-1.833	0.517
	>30000	0.580	0.247-1.366	0.504	0.535	0.223-1.284	0.162
Daily eating fruits	No	Ref			Ref		Ref
	Yes	1.069	0.445-	0.535	0.977	0.396-	0.960

			2.568			2.408	
Daily eating Vegetables	No	Ref			Ref		Ref
	Yes	0.873	0.381-2.000	0.066	0.926	0.396-2.164	0.859
Food insecurity	No	Ref			Ref		Ref
	Yes	3.880	0.767-19.623	0.072	4.074	0.791-20.995	0.093
Physical activity	Physically inactive	Ref			Ref		Ref
	Physically active	0.430	0.196-0.944	0.050	0.416	0.185-0.938	0.034
Attendance in physical education class	Irregular attendance	Ref			Ref		Ref
	Regular attendance	0.938	0.343-2.570	0.837	0.936	0.342-2.564	0.898
Sedentary behavior	No	Ref			Ref		Ref
	Yes	0.898	0.416-1.939	0.895	0.921	0.421-2.011	0.836
Smoking habits	No	Ref			Ref		Ref
	Yes	0.824	0.222-3.063	0.207	0.842	0.227-3.144	0.798
Feeling lonely in 12 months	No	Ref			Ref		Ref
	Yes	0.474	0.214-1.047	0.048	0.451	0.201-1.011	0.053
Feeling anxiety in 12 months	No	Ref			Ref		Ref
	Yes	1.073	0.520-2.215	0.763	1.016	0.487-2.117	0.966
Suicidal attempt in 12 months	No	Ref			Ref		Ref
	Yes	3345262 9.00	0.000	0.999	3228143 0.29	0.00	0.999

5. DISCUSSION

To determine the factors associated with obesity we performed a survey among 490 school and college going adolescents from Lakshmipur district, Bangladesh. Our study revealed that most of the factors are associated with obesity and overweight. In terms of physical activity, students who were physically inactive suffered from obesity. Karki and Shrestha (2019) conducted a study which results dd support to this conclusion. Rahman et al. (2019) conducted a study among English medium schools also identified food habits, less active

lifestyles, and high levels of sedentary activities, physical inactivity as the major contributors to developing obesity. Spending more than three hours a day seated while watching television, playing video games, or browsing the Internet not only keeps children from being physically inactive, but unhealthy food advertisements on TV and the Internet could also contribute to children becoming overweight or obese. 13-16 years of specific age group has association with obesity and overweight. The participants who were suffering some mental conditions like loneliness also have obesity in our study. Brown et al. (2018) also conducted a study and argue that loneliness might increase obesity. Father and mother educational status also associated with obesity. Highly educational father's and mothers' status is associated with the condition. Association between participants of class 9 with obesity was revealed also. The present study revealed that there is no association of mother occupation, father occupation, living area, family income, eating vegetables, fruits, sedentary behavior, anxiety, family income with obesity. Our results have significant potential implications for the planning and implementation of preventive and therapeutic strategies for adolescent obesity. Particular attention may need to be paid to physical activity, loneliness and other risk factors for adolescent obesity. physical activities; behavior modification program targeting children, caregivers, and schools, etc.) to prevent overweight/ obesity among school children. However, it is also crucial to take into account additional variables that might increase the risk of becoming obese and to create comprehensive treatments that target these variables holistically in the country context.

6. CONCLUSION

The purpose was this study assess the overweight and obesity among ten to nineteen years old urban high school and college going adolescent. This study reports the factors associated with overweight/obesity among 10–19-year-old high school and college going adolescents in Lakshmipur district Bangladesh. Physical inactivity, loneliness, and some socio demographic characteristics like father and mother education, age group and class also associated with obesity and overweight. There is a great need for developing public health policy/strategies to ensure early detection and targeted interventions (e.g., campaign for healthy foods; ensure availability of public parks and open places/land for physical activities; behavior modification program targeting children, caregivers, and schools, etc.) to prevent overweight/ obesity among high school and college adolescent.

7. Conflict of interest

There is no conflict of interest.

8. Limitation

- 1) The use of self-reported data which might have influenced the results through method biases, social desirability biases, and memory recall biases.
- 2) The cross-sectional nature of the study, no conclusions can be drawn regarding causality.
- 3) The study is also limited by the relatively small sample size.

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