A Cross-Sectional Analysis of Association between Sleeping Pattern & BMI among Adults of Bangladesh

Submitted

To

Dr.Nizam Uddin

Associate Professor and Head

Department of Food and Nutrition Engineering

Faculty of Allied Health Sciences

Daffodil International University

Submitted

By

Tahera Akter Toma

Student ID: 181-34-763

Department of Nutrition and Food Engineering

Faculty of Allied Health Sciences

Daffodil International University

Date of Submission: 14/01/2023

DEDICATION

My thesis project I would like to dedicate to all the teachers of my varsity who work tirelessly for us and give their best effort to build us as the backbone of the nation.

CERTIFICATION

This is to certify that **Tahera Akter Toma** has completed his project report entitled **"A Cross-Sectional Analysis of Association between Sleeping Pattern & BMI among Adults of Bangladesh"**, for the partial fulfillment of the requirements for the conferment of the **Bachelor of Science (Hon's)** degree in **Nutrition and Food Engineering (NFE)** under my direct supervision. To my knowledge, the results embodied in this project report have not been submitted to any other University or Institute for the award of any degree or diploma.

Signature of the Supervisor: ……………………………………

> **Ms. Nasima Akter Mukta**
> **Assistant Professor**
>
> Department of Nutrition and Food Engineering
> Faculty of Allied Health Sciences
>
> DIU, Dhaka, Bangladesh

DECLARATION

By submitting this project report entitled "**A Cross-Sectional Analysis of Association between Sleeping Pattern & BMI among Adults of Bangladesh**", I declare that this is a unique work and all entirety of the work contained therein is my own, original work, and I have collected and analyze all the data. Moreover, I am the sole author of this report. It also declares that it has not been submitted elsewhere for any other degree conferment.

Signature

Tahera Akter Toma

Student ID: 181-34-763

 Department of Nutrition and Food

EngineeringFaculty of Allied Health Sciences (FAHS)
DaffodilInternational University

Dhaka, Bangladesh

LETTER OF APPROVAL

I am happy to approve the project report entitled **"A Cross-Sectional Analysis of Association between Sleeping Pattern & BMI among Adults of Bangladesh",** for the partial fulfillment of the requirements for the conferment of the **Bachelor of Science (Hon's)** degree in **Nutrition and Food Engineering (NFE)** from the Department of Nutrition and Food Engineering (NFE) of the Faculty of Allied Health Sciences (FAHS), Daffodil International University (DIU), Dhaka, Bangladesh. To my knowledge, the results embodied in this project report have not been submitted to any other University or Institute for the award of any degree.

(Dr.Nizam Uddin)

Associate Professor and Head

Department of Food and Nutrition Engineering

Faculty of Allied Health Sciences, DIU, Dhaka, Bangladesh

ACKNOWLEDGEMENTS

First, I would like to express my gratitude to my creator, the almighty Allah, for enabling me the strength and opportunity to complete the project report in time successfully. I am grateful to my parents; without whom I would not be here. Without the support of my parents, I would not be able to achieve my objectives and goals.

I want to express my deep gratitude and sincere thanks to the honorable Dean, Faculty of Allied Health Science, Professor Professor Dr. Abu Naser Zafar Ullah, for his kind cooperation and for accepting this degree.

I would like to express my deep sense of gratitude and indebtedness to my respected mentor Ms. Nasima Akter Mukta, Lecturer (Senior Scale), Department of Nutrition and Food Engineering, FAHS, DIU, for his direct, incessant and untiring supervision in every step of the study. Without his support, submission of this dissertation would not have been a reality.

I'm grateful for the unwavering support of all NFE faculty members over the past four years of my university tenure.

I am grateful for the help, inspiration, and support of my seniors, juniors, and classmates

TABLE OF CONTENT

ABSTRACT

According to the findings of this study, there is a significant but weak connection between the amount of sleep a person gets and their likelihood of becoming overweight. Participants ranged in age from middle-aged to senior citizens and came from six different countries with middle-incomes. These findings provide support for earlier findings in groups with high incomes and imply that longer sleep durations are related with decreased obesity levels across cultures and in a variety of different civilizations. The correlation between longer sleep durations and lower obesity levels was found in groups with higher incomes. Therefore, increasing the amount of time spent sleeping in people who suffer from chronic sleep deprivation should be the primary focus of any future clinical research conducted with the intention of reducing the percentage of elderly people who are obese. This is because people who suffer from chronic sleep deprivation tend to have trouble falling asleep and staying asleep.

Key words: sleep duration; sleep pattern; napping; variability; bmi

CHAPTER 01
INTRODUCTION

1.1 Background of the Study

Given its high link with injury, chronic disease, and mortality, insufficient sleep is widely regarded as an important public health issue (SMITH, April 2014). There is growing evidence that shorter sleep duration predicts obesity (hhs author manuscript, 2014). Sleep disorders are ailments that result in altered sleeping patterns. The sleep issue can have a negative impact on your general health, safety, and quality of life. Sleep deprivation can impair your ability to drive safely, raise your chance of developing various health issues, and have an impact on your BMI (Mayo Clinic Family Health Book, 2019,). Globally, 62% of adults report they don't sleep as well as they'd like (Marissa Walsh, Mar. 25, 2021). 67% of individuals report experiencing at least one nightly sleep disturbance (Marissa Walsh, Mar. 25, 2021)[1]. Over the previous five years, sleep quality has deteriorated for 44% of adults worldwide (Marissa Walsh, Mar. 25, 2021). It is estimated that 30% to 48% of senior citizens suffer from sleeplessness (Suni, November 12, 2021)[3]. At least a few evenings per week, the lowest rates of sleep loss owing to personal financial concerns are reported by Asians (Foundation, March 27, 2010). Sleep duration in the Bangladeshi population and the fraction of the population at increased risk for acquiring chronic diseases as a result of insufficient sleep were determined (FAKIR M. YUNUS, 2016)[4]. More than half of school-age children (55%) slept less than recommended, whereas 28.2% of older persons slept longer (FAKIR M. YUNUS, 2016). Intriguingly, lengthy sleep duration, commonly characterized in epidemiological studies as sleeping more than 9 h per night, is also connected with detrimental health conditions and premature mortality, and may be a more pervasive problem, affecting 25 to 40 percent of adults worldwide (SMITH, April 2014)[2]. The physiological and behavioral impacts of excessive sleep as well as the underlying causes contributing to long sleep duration have, however, garnered less attention than inadequate sleep (SMITH, April 2014).

Obesity is a global public health issue connected with a variety of major health problems and early mortality (SMITH, April 2014). In 2014, the worldwide prevalence of overweight and obesity among adults (18 years) was 39% and 13%, respectively (Body Mass Index = BMI 25 kg/m2) (Pengpid, 26 May 2017). In the regions of South Asia and Southeast Asia, the prevalence was

21.2% among men and 25.4% among women (Pengpid, 26 May 2017) Overweight and obesity are characterized by an abnormal or excessive accumulation of fat that poses a threat to health. Overweight is defined as a body mass index (BMI) greater than 25, and obesity as a BMI greater than 30[5]. (WHO). The Body Mass Index (BMI) is a good indicator of overweight and obesity. It is calculated based on a person's height and weight. The body mass index (BMI) is an estimation of body fat and an excellent predictor of the risk of developing diseases that are associated with obesity. The higher your BMI, the greater your risk for ailments such as cardiovascular disease, high blood pressure, type 2 diabetes, gallstones, respiratory issues, and some malignancies (Health N. I.). According to the global burden of illness, the problem has reached epidemic proportions, with over 4 million people dying annually from being overweight or obese in 2017. (WHO)[7]. The World Health Organization (WHO) estimates that in 2016, more than 1.9 billion persons over the age of 18 were overweight and 650 million were obese, which corresponds to 39% of adults globally being overweight and 13% being obese (WHO). The Asia and Pacific area is home to the greatest number of overweight and obese individuals, approximately 1 billion or two out of every five adults (Matthias Helble, June 10, 2020). Only 4% of the 17% of overweight or obese people in Bangladesh were obese, and the rate of obesity increase in Bangladesh is slowing (SMITH, April 2014)[9].

In unadjusted analyses, lower sleep duration was related with a higher BMI, but only among those aged 18–29 and 30–49 years. The association between sleep duration and BMI was likewise shown to be linear. (2015) (HHS Author)[10].

1.2 Scope Of the study

The correlation between sleep time and weight may vary by age group because of the correlation between body mass and years of accumulated illness. Youth obesity, for instance, may be an indicator of more immediate health and lifestyle issues like insufficient shut-eye (HHS Author, 2015). A growing number of people in both industrialized and developing nations are overweight or obese, a condition defined by the World Health Organization as a body mass index (BMI) of 25 or more (Md. Hasan Al Banna, 08 Dec 2020)[12]. As populations in emerging regions like South Asia become more urban and embrace high calorie dietary habits along with an increasingly sedentary lifestyle, the prevalence of OWOB has skyrocketed over the past two decades (Md. Hasan Al Banna, 08 Dec 2020). Due to its correlation with diseases like diabetes, metabolic syndrome, cardiovascular disease, and cancer, OWOB has recently emerged as a major public health issue worldwide (Md. Hasan Al Banna, 08 Dec 2020).

This study aimed to determine the average amount of time people in Bangladesh spend sleeping and the percentage of the population at risk for developing chronic diseases due to rising BMI caused by insufficient sleep[8].

Because sleep is necessary for many physiological, mental, and emotional functions, sleep deprivation can be harmful (Diekelmann and Born, 2010; Siegel, 2009). The average adult needs between 7 and 8 hours of sleep per night, with the exception of the elderly, who sleep fewer than 7 hours per night per night, according to several studies (Horne, 2011; National Heart, Lung and Blood Institute, 2011; Siegel, 2009). Other sleep-related factors, such as sleep duration, sleep frequency, and napping during the day, are also understudied despite their potential significance. According to a recent study conducted on young adults, those who stayed up later than their peers tended to eat more, leading to increased body fat (hhs author manuscript, 2014)[14]. However, the average amount of time people spend sleeping varies greatly from one person to the next. Some people, especially adolescents and young adults, struggle to get the recommended amount of sleep due to the hectic pace of modern life (Leger et al., 2012)[15]. Adults, on average, get fewer than the advised 8 hours of sleep per night, according to studies. Another disturbing trend is the rise from 22% in 1985 to nearly 28% in 2007 of adults who report sleeping for less than 6 hours per night on a daily basis. In recent years, the prevalence of sleep problems has been rising in Bangladesh, contributing to higher body mass indexes, which in turn raise the risk of a wide range of diseases[16].

1.3 The rationale of the Study

Emerging adulthood, which happens between the ages of 18 and 25, is usually when young adults go to college and get more freedom. This is also a time when obesity, unhealthy eating, and less daily physical activity can start to happen (Md. Hasan Al Banna, 08 Dec 2020). A review of many countries found that first-year college students in North America and Europe gain weight and continue to do so over the next few years (Md. Hasan Al Banna, 08 Dec 2020)[17]. Also, OWOB was found to be present in 20% of university students from Asian countries in a recent multi-country study (Md. Hasan Al Banna, 08 Dec 2020). Meta-analyses and systematic reviews have shown that the way people sleep, how long they sleep, and how well they sleep are all linked to being overweight or obese. Short sleepers were more likely to be overweight or obese than long sleepers, and the link was stronger in boys than in girls (Roberta Ferranti, 2016). Even though teenagers need about 9 to 10 hours of sleep (Roberta Ferranti, 2016)[18]. The evidence we have suggests that about 20% of university students in Bangladesh regularly eat fast food (Md. Hasan Al Banna, 08 Dec 2020). But there haven't been many studies done on the factors that put

Bangladesh university students at risk for OWOB (Md. Hasan Al Banna, 08 Dec 2020). Previous research has only looked at the relationship between OWOB and either nutrition or fast food (Md. Hasan Al Banna, 08 Dec 2020). Because of this, it is very important to find other behavioral and sociodemographic risk factors for OWOB in Bangladesh as soon as possible[17].

Along with the rise in overweight and obese people in the US, there has also been a change in how people sleep. People in general have been studied a lot about insomnia and trouble sleeping. Adults sleep less than the recommended 8 hours a night, according to research. Also, the number of adults who sleep less than 6 hours a night rose from 22% in 1985 to almost 28% in 2007. (Perla A. Vargas PhD, 05 Nov 2014.). In a previous study of college students from mostly high-income countries, the average length of sleep was found to be 7.47 hours. Local studies of college students from low- and middle-income countries found that Ethiopian college students slept an average of 6.79 hours a night, Nigerian college students slept an average of 5.1–6.2 hours a night, and Palestinian college students slept an average of 6.4 hours a night[20]. Concerning short and long sleepers, a study of 15,465 college students found that 21% were short sleepers and 16% were long sleepers. This is compared to the reference group, which slept for 7–8 hours, where 63% of the students fell into. Some studies have found that a lot of university students in Lebanon (around 40%) sleep less than 8 hours per night (Pengpid K. P., 07 Jan 2015)[22]. A recent review of six studies from Bangladesh shows that 18 to 46.3% of people have problems with insomnia. The rates are 23% to 46.3% for the general population, 18.6% to 44.2% for healthcare workers, and 27.1% for students (Mahmudul Hasan, 2021 Aug 16).

Cross-sectional studies aren't done enough in low- and middle-income countries and in different parts of the world, but they are important for figuring out the links between sleep patterns and obesity (Pengpid, 26 May 2017). This may be especially important for young adults, such as college students, whose lifestyles change when they move from home to college. These changes include sleep patterns, eating habits, and how much they exercise (Pengpid, 26 May 2017)[22]. This could help tell the difference between biological and social/environmental causes of obesity, which is needed for culturally appropriate strategies to stop obesity. It is thought that a higher BMI and a bigger waist circumference (WC) will go along with less sleep and poor sleep quality (Pengpid, 26 May 2017).

The goal of this study was to find out how BMI is related to sleep parameters like sleep duration and sleep disturbances. Based on the fact that fragmented sleep changes metabolic functions that help control appetite, we thought that sleep disturbances, not sleep duration, would be linked to

BMI among adults in Bangladesh[17]. (Perla A. Vargas PhD, 05 Nov 2014.) Still, not much is known about how long people in Bangladesh sleep based on their age, gender, and socioeconomic status (FAKIR M. YUNUS, 2016).

1.4 Literature Review

In contrast to other mammals, humans sleep in blocks of 7–9 hours (Scheen AJ, 1996). During normal sleep, both the use of glucose and the production of glucose drop at the same time during the first part of the night and both go up at the same time in the early morning (Boyle PJ, 1994). But when people are kept at rest but don't get enough sleep, the pattern of glucose use changes, and glucose levels stay the same all night long (Scheen AJ, 1996). Several studies have shown that disrupting normal sleep patterns can cause changes in the body's metabolism that can lead to obesity, heart disease, insulin resistance, and diabetes (Perla A. Vargas PhD, 05 Nov 2014.). Cross-sectional research on the link between obesity and sleeping habits shows that overweight, obesity, and/or related metabolic markers are linked to shorter sleep times in children, teens, and adults (Perla A. Vargas PhD, 05 Nov 2014.)[23]. Also, studies looking at the link between adolescent sleep and BMI suggest that the link may have more than one layer (Perla A. Vargas PhD, 05 Nov 2014.). For example, in a sample of American teens, researchers found that each hour of lost sleep made the chance of being overweight go up by 80%. (Perla A. Vargas PhD, 05 Nov 2014.). Even though sleep problems were not directly linked to obesity, they were linked to less physical activity. This suggests that sleep problems could indirectly affect body weight by making people less active. In a similar way, a study of European teenagers found that short sleep duration was linked to obesity, eating more, and being less active, but not to the amount of physical activity (Garaulet M, 2011 Oct) [17]. Others have found a U-shaped relationship, where the odds go up both for people who sleep less and for people who sleep more. In many studies, however, it is not possible to tell the difference between the effects of not getting enough sleep and the effects of having trouble sleeping. In more recent lab studies, this problem has been solved by measuring changes in metabolism while controlling for sleep length and sleep problems. For example, when young, healthy adults didn't get enough deep non-rapid eye movement (NREM) sleep without also getting less total sleep, their insulin sensitivity went down. This meant they couldn't handle glucose as well and were more likely to get diabetes. More evidence supports the idea that sleep fragmentation, regardless of how long you sleep, can change how your body handles glucose (Perla A. Vargas PhD, 05 Nov 2014.)[23].

The goal of this study was to find out how BMI is related to sleep parameters like sleep duration and sleep disturbances. Based on the fact that sleep fragmentation changes metabolic functions

that control appetite, we thought that sleep disturbances, not sleep length, would be linked to a BMI of 25 or more (Perla A. Vargas PhD, 05 Nov 2014.).

1.5 OBJECTIVES

General Objectives:

Identification of BMI on sleeping pattern.

Specific objectives:

- To know the social demographic status of the responds.
- To know the sleeping behaviors of the responds.
- To know anthropometric (BMI) & lifestyle measurement.
- To know the relationship between social demographic status and sleeping behaviors.
- To know the relationship between sleeping behaviors & anthropometric (BMI) or
- Lifestyle measurement.
- To know the relationship between anthropometric (BMI) or lifestyle measurement & Social demographic.

CHAPTER 02
METHODOLOGY

2.1 Equipment:

No.	Equipment	Purpose
1	Paper	To produce Questionnaire
2	Computer	Data entry Data analyze Report writing

2.2 Study Design & type

It will be a cross-sectional study among adult sleep disorder patients with the problem of increasing BMI (overweight obesity) in Dhaka from October 2021 to April 2022. Study participants will be selected on the basis of defined selection criteria following the purposive sampling method with specific inclusion and exclusion criteria. Written informed consent will be obtained before the interview. A semi structured questionnaire will be developed to collect the data by using the selected variables according to objectives including some scales related to study (PSQI) and BMI analysis report.

2.3 Study population

The study population will be the sleep disorder patients with the problem of increasing BMI (overweight, obesity), aged more than 18 (adult) and above living in Dhaka Metropolitan City. Total participants 65, 30 participants between 18 to 34 years, 20 participants between 35-40 years and 15 participants will be above 60, mostly females (73.2%). No personal identifiers were collected and, after reading a description of the study, participantsgive passive consent by proceeding to complete the survey.

2.4 Sample Size Estimation

In order to address the COVID-19 issue and meet the deadline, only 176 data sets were purposefully picked.

2.5 Data collection tool and methods

Data were collected online bases or collected by both interviewing and self-administration depending on the patient's educational status. Participants were directed to complete the Questionnaire. A semi-structured questionnaire will be prepared which comprised of items focusing on socio-demography, self-reported height and weight (BMI), and several standardized health-related measures including the PSQI.

2.6 Data processing and analysis

All the collected data from interview will be rechecked and then coded for errors and entered into the database using SPSS software.

2.7 Ethical Consideration

- Ethical approval was taken from the ethical review committee of the Dept. o Nutrition & Food Engineering, Daffodil International University.
- All the study participants were informed about theobjective of the study and their written consent was obtained.
- The confidentiality of theinformation was maintained.

2.8 Lists of Variables

Socio-demographic variables: Age, Sex, family type, family size, education level, occupation, household income.
Variables related to sleep disorder: Sleep duration, Treatment Regimen, Other
Treatment Assistances.

Variables related to overweight or obesity (BMI): Understanding BMI, knowledge of overweight and obesity and Diet Plan, Understanding of Medication, Understanding on BMI, Capabilities to understand the relationship between sleep pattern and BMI (overweight & obesity)

2.9 Limitation of the study

- Being a community-based cross-sectional study, the reported investigation had various limitations including small sample size, limited sampling area, and statistical analysis.
- The study had various limitations, such as the fact that it was confined to a certain tertiary level disadvantage location and that the information was insufficient owing to the respondents' lack of awareness of the subject issue.

CHAPTER 03

Result & Analysis

Socio Demographic Information

3.1 Figure: Frequency Distribution of Identify the gender
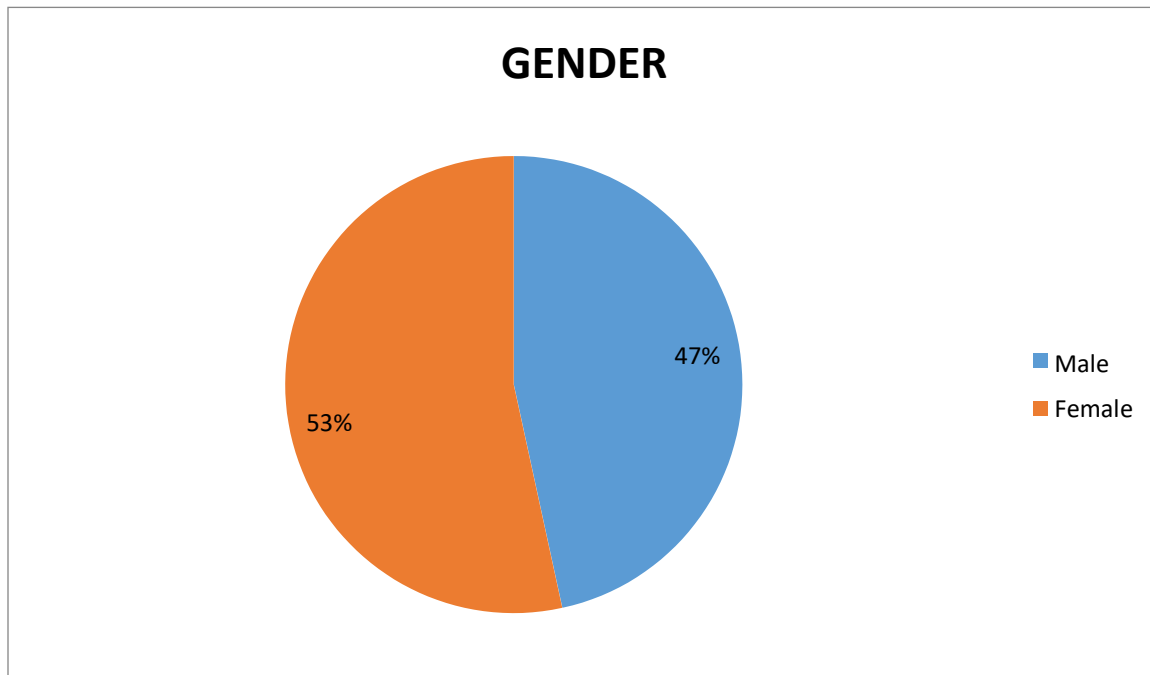
This figure represents the gender of participant where 53% which Female and 47% are male.

3.2 Figure: Frequency Distribution of Age of Participants

In this graph, the ages of the participants are distributed, where the highest number of participants are 88% which age is 18-30 years old and 8% is 31-40 years old and the lowest percentage is 4% which is 45+ years old participants.

Age

- 18-30
- 31-45
- 45+

4%

8%

88%
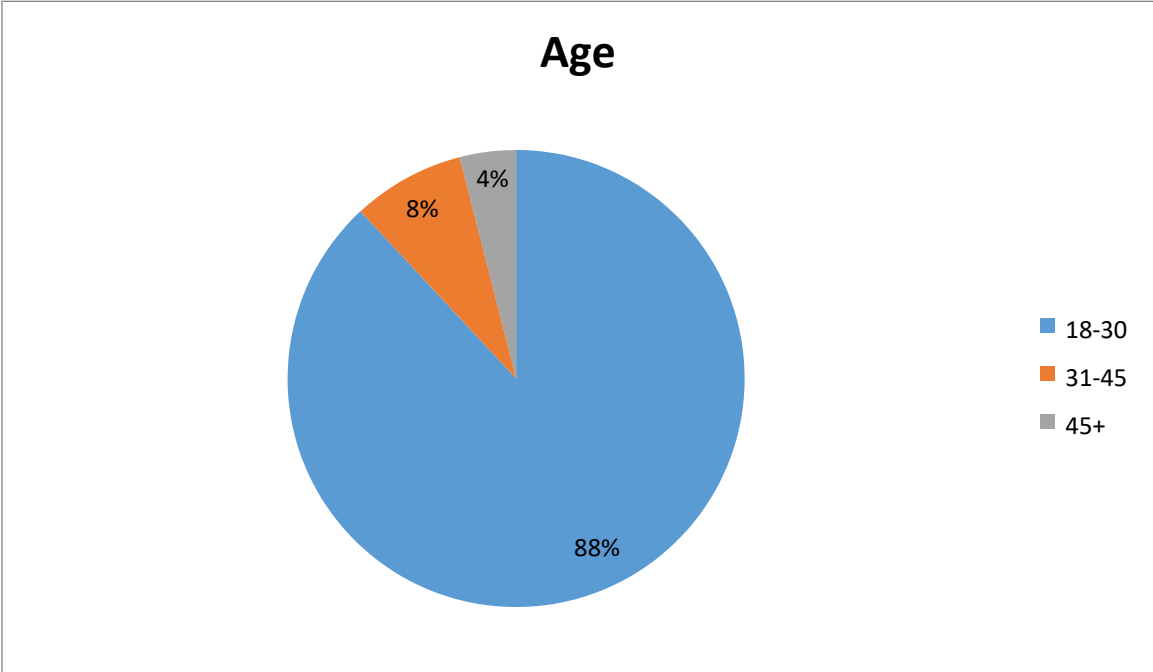
3.3 Figure: Frequency Distribution of Living Area

Living area

Rural
16%

Sub Arban
15%
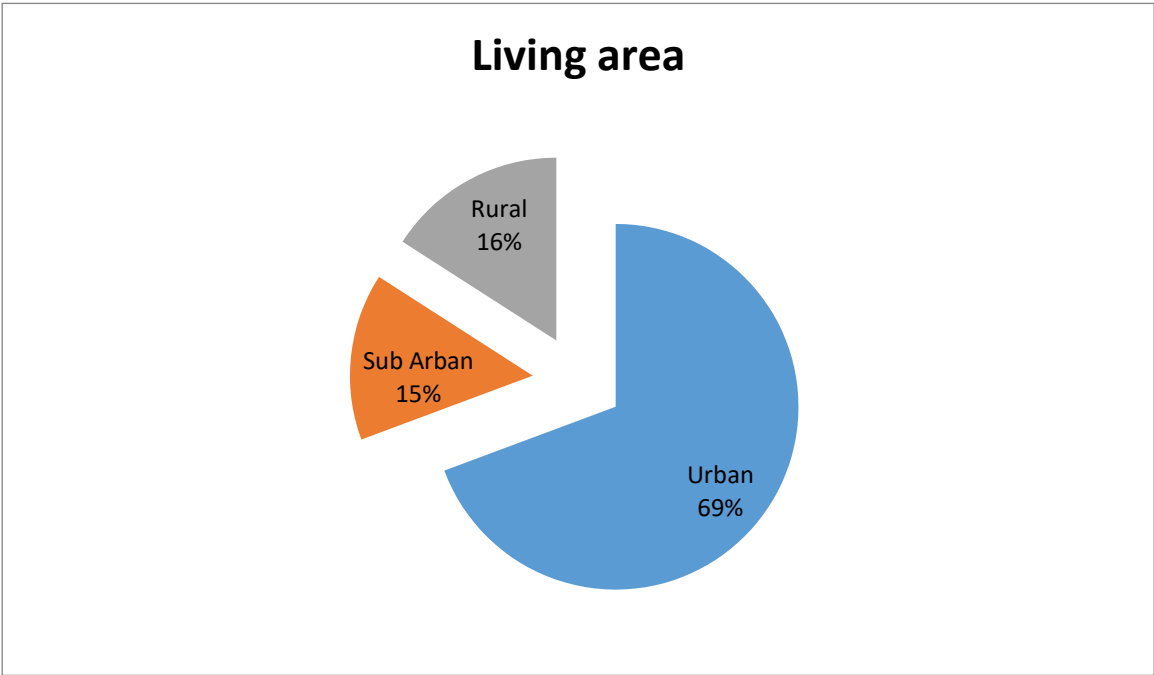
Urban
69%

This graph is the living area of the participants, where the highest number of participants are 69% and they lives in the urban area. On the other hand 16% of them are living in rural area and 15% of them lives in sub-arban area.
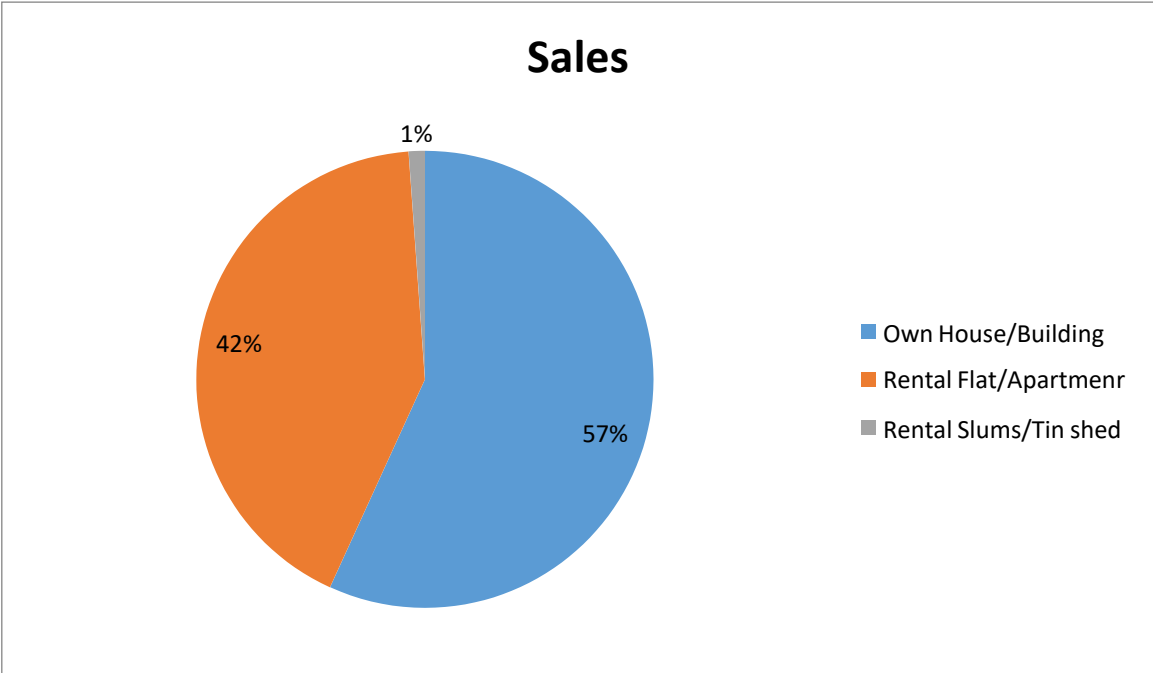
3.4 Figure: Frequency Distribution of Type of Participants House

This graph shows that the participants lives in their own house or in rental flat. Survey shows that 57% lives in their own houses, 42% of them lives in rental houes and a few lives in the tin shed area.

3.5 Figure: Frequency Distribution of the Educational Qualification of Participants
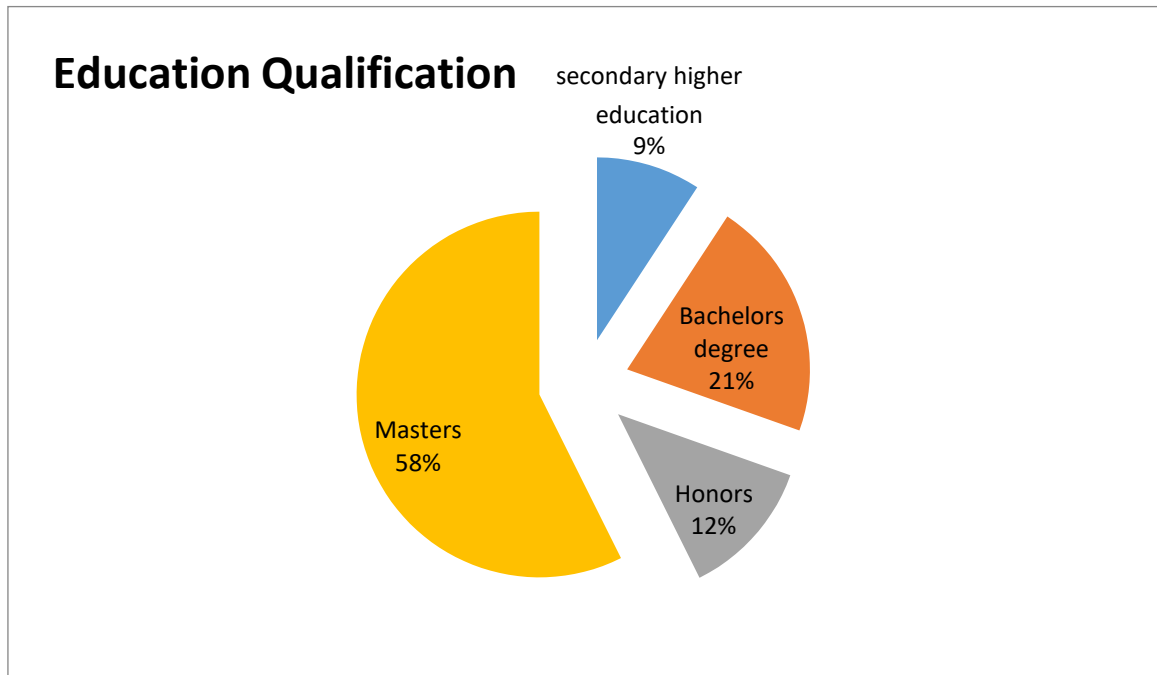
This graph is about the education qualification of the participants. The height number of them is have completed their heigher education live masters and the number is like 58%. Bachelors has been done by 21% and 12% have done honors. 9% of the participant have completed SSC and HSC.

3.6 Figure: Frequency Distribution of Marrital Status

This graph is about the Married Status of participants. 21% participant is married and 79% participant is not married.

3.7 Figure: Frequency Distribution of Monthly Household Income
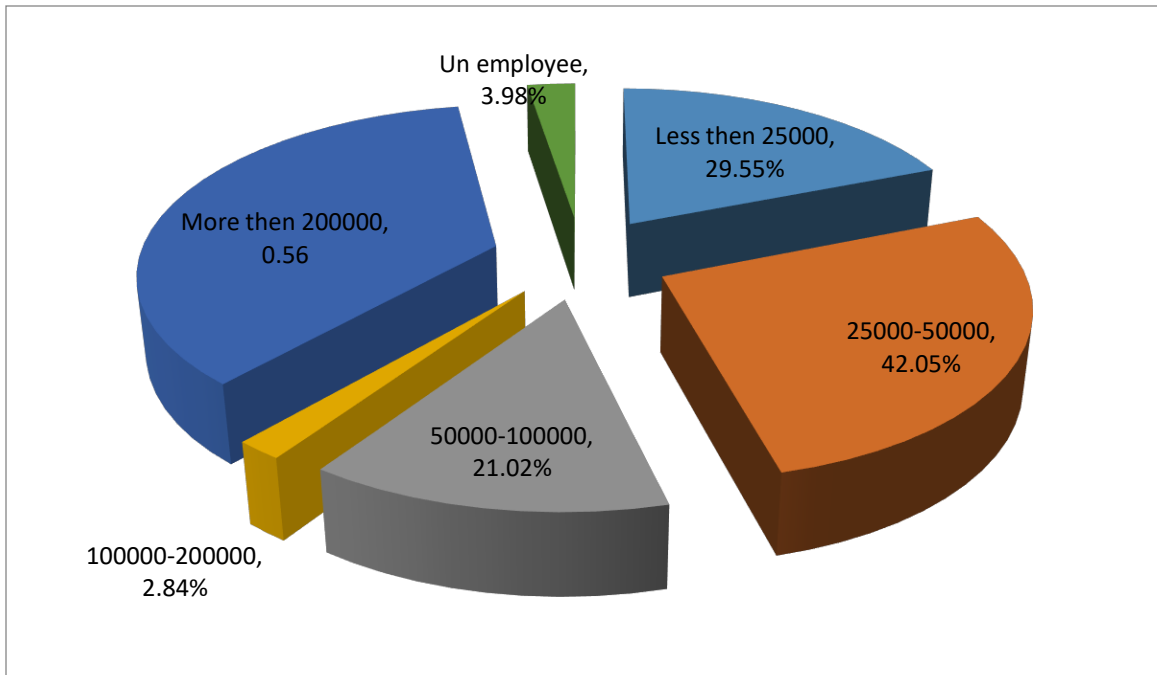
This graph is about the monthly household income. About 3.98 % of them is unemployed.
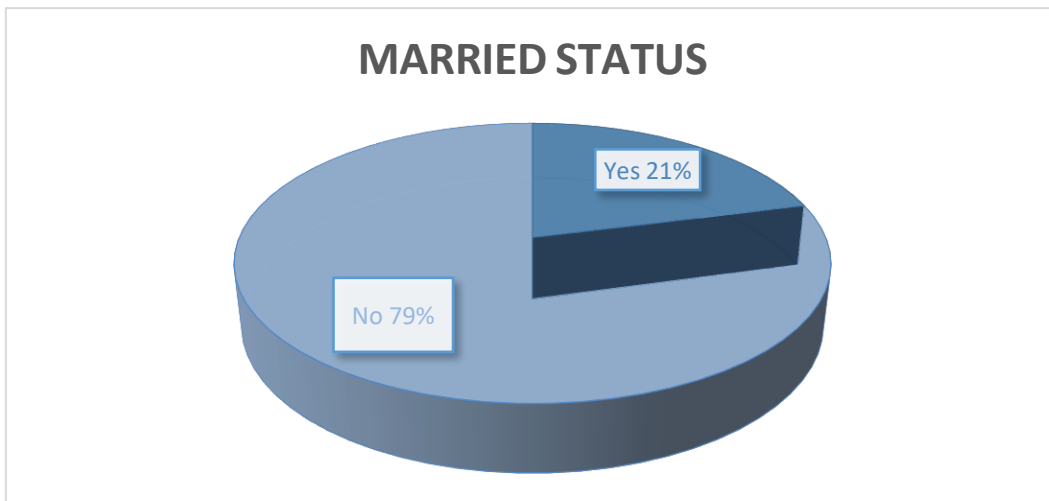
29.55% have a monthly income of 25000 tk. A good amount like 42.05% have a monthly income of 25000 to 50000 tk. About 21.02% have 50k to 1 lak and also a very few have a monthly income of 1 lak to 2 taka.
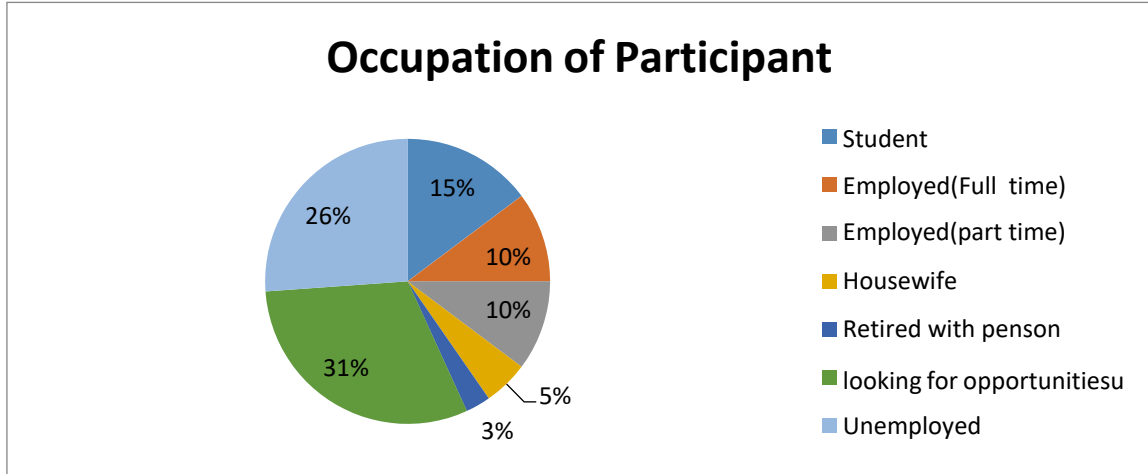
3.8 Figure: Frequency Distribution of Occupation

This graph is about the participant's occupation. About 15% of them is student. 10% is enployed and they are working full-time. 10% is part time employee. 5% of them is housewife. 3% of them is retired person. 31% of them is searching for a opportunity and 26% of them is unemployed.

3.9 Figure: Frequency Distribution of Family member

Number of Familly member

- Less then 5
- 5to8
- More then 8

8%
27%
65%
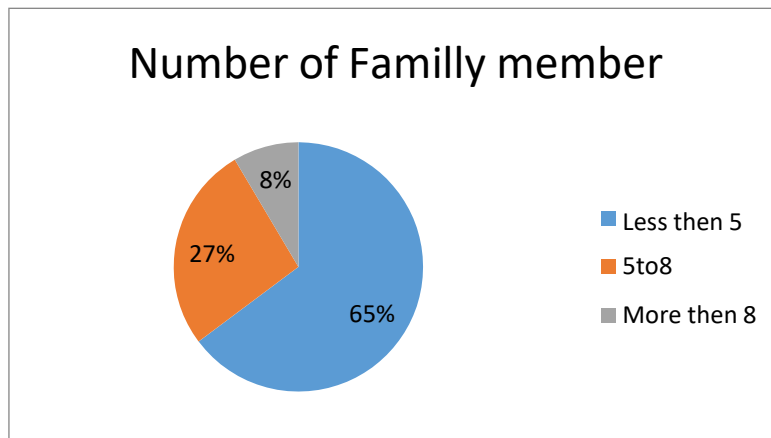
This graph is about the participant's family members. About 65% have a family of less then 5 persons. 27% have a family of 5 to 8 person. And a few number like 8 % have a fimily of more than 8 people.

3.10 Figure: Frequency Distribution of the Participants Religion

Religion

Hindunism
11%

Islam
89%
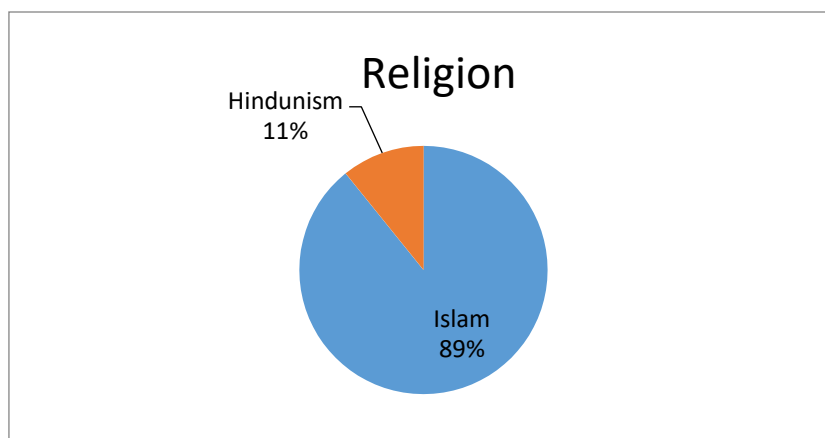
This graph is about the participant's religion. About 89% are muslim and 11% of them is hindu.

ANTHROPOMERTIC (BMI) & LIFESTYLE RELATED INFORMATION

Frequency distribution table of ANTHROPOMERTIC (BMI) & LIFESTYLE RELATED INFORMATION

Weight of the participants	Frequencies	Percentage
40-55 kg	57	32.4
55-65kg	54	30.7
65-75kg	31	17.6
75-85 kg	25	14.2
85-95 kg	8	4.5
95-105 kg	1	0.6
Height of the participants		
4 feet 5 inches-5 feet	32	18.2
5 feet -5feet 5 inches	94	53.4
5 feet 5 inches -6 feet	46	26.1
6 feet-6feet 5 inches	4	2.3
BMI		
	47	26.7
	92	52.3
	30	17.0
Having meal (per day)		
More than four times	33	18.8
Three times	118	67.0
Two times	23	13.1
One times	2	1.1
Have the last meal of the day		
Less than two hours before sleep	80	45.5
More than two hours before sleep	96	54.5
Choosing drink something other than water		
Green tea	24	13.6
Coffee(without sugar)	22	12.5
Black tea(or other kind of tea)	43	24.4
Coffee with sugar	31	17.6

Juice (for non-carbonated drinks)	40	22.7
Activity in Physical activity	16	9.1
Yes	176	100
Type of physical activity involved in		
Walking	95	54.0
House work	55	31.3
Work in the yard or garden	5	2.8
Exercise	21	11.9
Time that spend on physical activity (last week)		
less than 5 hours	36	20.5
5-20 hours	91	51.7
20-35 hours	15	8.5
35-50 hours	14	8.0
50-65 hours	9	5.1
65-80 hours	11	6.3
Type of physical activity that involved in work		
I am not in employment	92	52.3
I spend most of my time at work siting	42	23.9
I spend most of my time at work standing or walking	36	20.5
My work involves definite physical effort	5	2.8
My work involves vigorous physical activity including handling of heavy objects	1	0.6
Usually avoid physical activity for		
For illness	28	15.9
For shortness of time	62	35.2
For Laziness	74	42.0
I don't think it's important	12	6.8
Spending time on social media or television		
0-5 hours	126	71.6
5-10 hours	31	17.6

10-15 hours	18	10.2

SLEEP QUALITY ASSESSMENT (PSQI)RELATED INFORMATION

Frequency distribution table of sleep quality assessment related information

Time to go to sleep		
9 pm-11 pm	40	22.7
11 pm-1 am	98	55.7
1 am-3 am	33	18.8
3am-5 am	5	2.8
Usually take time to sleep at night		
less than 15 minutes	66	37.5
15 min-1 hour	72	40.9
1 hours-2 hours	30	17.0
2 hours-3 hours	8	4.5
Time for get up in the morning		
5 am-6am	50	28.4
6am-8am	59	33.5
8am-10am	58	33.0
10am-12pm	7	4.0
12pm-2pm	2	1.1
Sleep time that get at night		
3-6 hours	60	34.1
6-9 hours	109	61.9
9-12 hours		
Trouble to sleep because cannot get sleep with in 30 min		
Not during the past month	54	30.7
Less than once a week	36	20.5
Once or twice a week	45	25.6
Three or more times a week	41	23.3
Trouble to sleep because of getting up to use bathroom		
Not during the past month	74	42.0

Less than once a week	42	23.9
Once or twice a week	37	21.0
Three or more times a week	23	13.1
Trouble to sleep because cannot breathe comfortably		
Not during the past month	120	68.2
Less than once a week	27	15.3
Once or twice a week	20	11.4
Three or more times a week	9	5.1
trouble to sleep because of cough or snore loudly		
Not during the past month	132	75.0
Less than once a week	21	11.9
Once or twice a week	15	8.5
Three or more times a week	8	4.5
Trouble to sleep because of feeling too cold		
Not during the past month	110	62.5
Less than once a week	35	19.9
Once or twice a week	19	10.8
Three or more times a week	12	6.8
Trouble to sleep because of feeling too hot		
Not during the past month	96	54.5
Less than once a week	45	25.6
Once or twice a week	23	13.1
Three or more times a week	12	6.8
Trouble to sleep because of having bad dreams		
Not during the past month	97	55.1
Less than once a week	46	26.1
Once or twice a week	21	11.9
Three or more times a week	12	6.8
Trouble to sleep because of having pain		
Not during the past month	118	67.0
Less than once a week	29	16.5
Once or twice a week	13	7.4
Three or more times a week	16	9.1
Other reason		

Not during the past month	132	75.0
Less than once a week	22	12.5
Once or twice a week	7	4.0
Three or more times a week	6	3.4
Admission tension 2	1	0.6
Because of exam 2	1	0.6
Because of online job 3	1	0.6
Depression 3	1	0.6
Depuration 3	1	0.6
Due to tension 1	1	0.6
For the baby 3	1	0.6
Tension 2	2	1.1
Taken medicine for sleep		
Not during the past month	143	81.3
Less than once a week	19	10.8
Once or twice a week	11	6.3
Three or more times a week	3	1.7
Trouble for staying awake while driving eating engaging social work		
Not during the past month	94	53.4
Less than once a week	34	19.3
Once or twice a week	24	13.6
Three or more times a week	24	13.6
Problem for keeping up enthusiasm to get things done		
Not during the past month	87	49.4
Less than once a week	34	19.3
Once or twice a week	28	15.9
Three or more times a week	27	15.3
Rating sleep quality overall		
Very good	51	29.0
Fairly good	98	55.7
fairly bad	17	9.7
very bad	10	5.7

Association table between BMI & Socio Demographic Information

		BMI				Total	Percent	Person Chi-square
		15-20	20-26	26-32	32-38			
Gender	Male	19	44	17	2	82	46.59	0.49
	Female	28	49	13	4	94	53.40	
Age	18-30	45	82	23	5	155	88.06	0.27
	31-45	2	9	3	0	14	7.95	
	45+	0	2	4	1	7	3.97	
Education Qualification	Secondary higher education	10	19	4	1	34	19.31	0.39
	Bachelors degree	19	41	14	4	78	44.31	
	Honors	16	24	6	0	46	26.13	
	Masters	2	9	6	1	18	10.22	
Type of House Live in	Own house/Building	21	52	21	6	100	56.81	0.05
	Rental flat/Apartment	25	41	8	0	74	42.04	
	Rental Slums/ Tin shed house	1	0	1	0	2	1.136	
House hold income	less than 25000	6	15	5	1	27	15.34	0.04
	25000-50000	1	5	1	1	8	4.54	
	50000-100000	0	2	5	2	9	5.11	

	100000-200000	0	1	1	0	2	1.13	
	Un employed	40	70	18	2	130	73.86	
Occupation of participant	Student	9	13	3	1	26	14.77	0.001
	Employed(full time)/Business	1	11	5	1	18	10.22	
	Employed part Time	6	9	3	0	18	10.22	
	Housewife	3	4	2	0	9	5.11	
	Retired with pension	0	0	3	2	5	2.84	
	Looking for opportunities	12	30	10	2	54	30.68	
	Unemployed	16	26	4	0	46	26.13	

Association table between type of physical activity involved in & Socio Demographic Information

		Physical activity involved in				Total	Percent	Person Chi-square
		Walking	House work	Work in the yard or garden	Exercise			
Gender	Male	53	13	3	13	82		0.01
	Female	42	42	2	8	94		
Age	18-30	84	46	4	21	155		0.37
	31-45	6	7	1	0	14		
	45+	5	2	0	0	7		
Type of house live in	Own house/Building	61	24	2	13	100		0.11
	Rental flat/Apartment	34	29	3	8	74		
	Rental Slums/ Tin shed house	0	2	0	0	2		
Education Qualification	Secondary higher education	22	6	2	4	34		0.01
	Bachelors degree	40	32	0	6	78		
	Honors	24	9	3	10	46		
Married Status	Yes	18	17	0	2	37		0.09
	No	77	38	5	19	139		
	less then 25000	19	8	0	0	27		0.31
	25000-50000	5	2	1	0	8		

						Total	Percent	Person Chi-square
	50000-100000	6	3	0	0	9		
	100000-200000	1	1	0	0	2		
Occupation of participant	Student	12	11	0	3	26		0.006
	Employed(full time)/Business	15	3	0	0	18		
	Employed part Time	9	8	1	0	18		
	Housewife	1	8	0	0	9		
	Retired with pension	3	2	0	0	5		
	Looking for opportunities	33	12	1	8	54		
	Unemployed	22	11	3	10	46		

Association table between having meal (per day) & Socio Demographic Information

	Having meal (per day)				Total	Percent	Person Chi-square
	More then four times	Three times	Two times	One times			

Age of the Participants	18-30	29	104	21	1	155		0.04
	31-45	2	10	2	0	14		
	45+	2	4	0	1	7		
Living area	Urban	25	83	14	0	122		0.01
	sub-urban(Division/district city)	3	15	6	2	26		
	Rural	5	20	3	0	28		
Type of house live in	Own house/Building	22	68	9	1	100		0.40
	Rental flat/Apartment	11	49	13	1	74		
	Rental Slums/ Tin shed house	0	1	1	0	2		
Education Qualification	Secondary higher education	6	23	4	1	34		0.53
	Bachelors degree	13	55	10	0	78		
	Honors	9	29	8	0	46		
	Masters	5	11	1	1	18		
Monthly household income	less then 25000	4	20	3	0	27		0.03
	25000-50000	0	7	1	0	8		
	50000-100000	3	5	0	1	9		
	100000-200000	2	0	0	0	2		

						Total	Percent	Person chi-squire
	Un employed	24	86	19	1	130		
Occupation of participant	Student	4	19	3	0	26		0.64
	Employed(full time)/Business	3	13	1	1	18		
	Employed part Time	2	12	4	0	18		
	Housewife	2	5	2	0	9		
	Retired with pension	3	2	0	0	5		
	Looking for opportunities	12	36	6	0	54		
	Unemployed	7	31	7	1	46		
Number of family member	1-5	25	97	20	2	144		0.85
	5-8	5	14	1	0	20		
	more then 8	3	7	2	0	12		

Association table between Sleep Quality Assessment & Identifying Gender of participants

		Identifying Gender		Total	Percent	Person chi-squire
		Male	Female			
Time to go to sleep	9 pm-11 pm	16	24	40		0.27
	11 pm-1 am	44	54	98		
	1 am-3 am	18	15	33		
	3am-5 am	4	1	5		
Trouble to sleep because of	Not during the past month	39	35	74		0.17

getting up to use bathroom	Less than once a week	22	20	42		
	Once or twice a week	13	24	37		
	Three or more times a week	8	15	23		
Trouble to sleep because of feeling too cold	Not during the past month	55	55	110		0.18
	Less than once a week	16	19	35		
	Once or twice a week	9	10	19		
	Three or more times a week	2	10	12		
Trouble to sleep because of having pain	Not during the past month	61	57	118		0.028
	Less than once a week	14	15	29		
	Once or twice a week	5	8	13		
	Three or more times a week	2	14	16		
Trouble for staying awake while driving eating engaging social work	Not during the past month	51	43	94		0.077
	Less than once a week	16	18	34		
	Once or twice a week	8	16	24		
	Three or more times a week	7	17	24		
Problem for keeping up enthusiasm to	Not during the past month	48	39	87		0.028
	Less than once a	15	19	34		

get things done	week					
	Once or twice a week	13	15	28		
	Three or more times a week	6	21	27		
Rating sleep quality overall	Very good	29	22	51		0.054
	Fairly good	44	54	98		
	fairly bad	8	9	17		
	very bad	1	9	10		

Association table between Sleep Quality Assessment & occupation of participants

		occupation of participants							Total	Percent	Person chi-squire
		Student	Employed(full time)/Business	Employed part Time	Housewife	Retired with pension	Looking for opportunities	Unemployed			
Time to go to sleep	9 pm-11 pm	6	4	2	2	4	16	6	40		0.156
	11 pm-1 am	13	12	14	6	1	27	25	98		
	1 am-3 am	6	2	1	1	0	9	14	33		
	3am-5 am	1	0	1	0	0	2	1	5		

Usually take time to sleep at night	less than 15 minutes	9	8	5	1	4	22	17	66		0.047
	15 min-1 hour	11	6	9	7	1	21	17	72		
	1 hours-2 hours	6	4	1	1	0	6	12	30		
	2 hours-3 hours	0	0	3	0	0	5	0	8		
Time for get up in the morning	5 am-6am	3	6	7	4	5	12	13	50		0.019
	6am-8am	7	9	6	1	0	20	16	59		
	8am-10am	13	3	5	3	0	18	16	58		
	10am-12pm	3	0	0	0	0	3	1	7		
	12pm-2pm	0	0	0	1	0	1	0	2		
Trouble to sleep because cannot get sleep with in 30 min	Not during the past month	3	5	6	1	2	22	15	54		0.062
	Less than once a week	3	9	2	2	1	9	10	36		
	Once or twice a week	10	3	6	4	2	10	10	45		
	Three or more times a week	10	1	4	2	0	13	11	41		
trouble to sleep because of cough or snore loudly	Not during the past month	17	15	14	8	3	45	30	132		0.201
	Less than once a week	3	3	4	0	1	2	8	21		
	Once or twice a week	4	0	0	1	0	6	4	15		
	Three or more times a	2	0	0	0	1	1	4	8		

									Total	Percent	Person chi-squire
	week										
Taken medicine for sleep	Not during the past month	22	13	13	7	4	49	35	143		0.188
	Less than once a week	3	1	3	1	0	3	8	19		
	Once or twice a week	0	3	2	0	1	2	3	11		
	Three or more times a week	1	1	0	1	0	0	0	3		
Rating sleep quality overall	Very good	6	6	6	1	2	15	15	51		0.909
	Fairly good	15	8	8	7	2	30	28	98		
	fairly bad	3	3	3	1	1	5	1	17		
	very bad	2	1	1	0	0	4	2	10		

Association table between Sleep Behaviors & Anthropometric (BMI) Measurement

		BMI				Total	Percent	Person chi-squire
		15-20	20-26	26-32	32-38			
Trouble to sleep because cannot get sleep with in 30 min	Not during the past month	7	35	11	1	54		0.039
	Less than once a week	9	16	8	3	36		
	Once or twice a week	19	20	4	2	45		
	Three or more	12	22	7	0	41		

	times a week							
Trouble to sleep because cannot breathe comfortably	Not during the past month	31	63	24	2	120		0.068
	Less than once a week	10	12	3	2	27		
	Once or twice a week	6	9	3	2	20		
	Three or more times a week	0	9	0	0	9		
Trouble to sleep because of feeling too cold	Not during the past month	23	60	24	3	110		0.001
	Less than once a week	14	17	4	0	35		
	Once or twice a week	7	10	2	0	19		
	Three or more times a week	3	6	0	3	12		
Trouble to sleep because of feeling too hot	Not during the past month	23	60	24	3	110		0.001
	Less than once a week	14	17	4	0	35		

	Once or twice a week	7	10	2	0	19		
	Three or more times a week	3	6	0	3	12		
Trouble to sleep because of having bad dreams	Not during the past month	20	53	22	2	97		0.025
	Less than once a week	18	20	5	3	46		
	Once or twice a week	3	16	2	0	21		
	Three or more times a week	6	4	1	1	12		
Trouble to sleep because of having pain	Not during the past month	26	63	26	3	118		0.045
	Less than once a week	12	13	3	1	29		
	Once or twice a week	6	6	1	0	13		
	Three or more times a week	3	11	0	2	16		
Trouble for staying awake	Not during	20	53	20	1	94		0.008

while driving eating engaging social work	the past month							
	Less than once a week	10	20	3	1	34		
	Once or twice a week	9	12	3	0	24		
	Three or more times a week	8	8	4	4	24		

Association table between Type of physical activity involved in &

Sleep Behaviors

		physical activity involved in				Total	Percent	Person chi-Squire
		Walking	House work	Work in the yard or garden	Exercise			
Time for get up in the morning	5 am-6am	25	16	2	7	50		0.65
	6am-8am	32	18	2	7	59		
	8am-10am	34	19	1	4	58		
	10am-12pm	3	1	0	3	7		
	12pm-2pm	1	1	0	0	2		

Trouble to sleep because of feeling too cold	Not during the past month	64	30	3	13	110		0.06
	Less than once a week	22	8	2	3	35		
	Once or twice a week	6	9	0	4	19		
	Three or more times a week	3	8	0	1	12		
Trouble to sleep because of feeling too hot	Not during the past month	64	30	3	13	110		0.06
	Less than once a week	22	8	2	3	35		
	Once or twice a week	6	9	0	4	19		
	Three or more times a week	3	8	0	1	12		
Trouble to sleep because of having pain	Not during the past month	75	25	2	16	118		0.004
	Less than once a week	12	13	1	3	29		
	Once or twice a week	3	7	1	2	13		
	Three or more times a week	5	10	1	0	16		
Taken medicine for sleep	Not during the past month	79	44	1	19	143		0.008
	Less than once a week	7	8	3	1	19		
	Once or twice a week	8	1	1	1	11		
	Three or more times a week	1	2	0	0	3		
Trouble for	Not during the	57	26	2	9	94		0.032

staying awake while driving eating engaging social work	past month							
	Less than once a week	19	8	2	5	34		
	Once or twice a week	5	13	0	6	24		
	Three or more times a week	14	8	1	1	24		
Rating sleep quality overall	Very good	31	11	2	7	51		0.291
	Fairly good	48	37	2	11	98		
	fairly bad	11	5	1	0	17		
	very bad	5	2	0	3	10		

CHAPTER 4

4.1 Discussion

Evidence from both large-scale cohort studies and more modest interventional trials suggests that insufficient sleep is an independent risk factor for obesity. The majority of this research has been on sleep time, however it is still unclear which sleep features most contribute to obesity. Independent of average nightly sleep length, we found that substantial variability in sleep duration from night to night, as well as greater time spent napping throughout the day, was strongly related with obesity. There was weaker support for a correlation between obesity and either a later sleep onset or more sleep timing variability. However, it did suggest that higher levels of obesity were linked to later sleep times in women on average.

There are numerous good points to our work. As an alternative to relying on self-report, we used actigraphy as an objective marker of sleep. We looked at an older age group, so we know that sleep is less affected by things like work and family obligations. We attempted to account for the most important medical comorbidities (depression, heart disease, diabetes, and stroke) and medications that could affect sleep. Finally, we evaluated the stability of the found relationships by verifying our hypothesis in two independent cohorts.

It would be unfair to attribute disparities in results between the two cohorts entirely to differences in gender; the cohorts are different in other ways as well. MrOS men, for instance, were, on average, 7 years younger than SOF women. Furthermore, more days were recorded in the MrOS cohort due to the differences in methods, which may have allowed for more accurate estimates of night-to-night variation. In spite of these variations, both cohorts showed a striking similarity in the connection between daytime napping and obesity, as well as between sleep duration variability and obesity.

There was also a striking similarity between the two cohorts in terms of the pattern of interaction between daytime napping and nocturnal sleep duration on obesity risk, with the impact of napping being greatest on those with average nocturnal sleep durations and least on those with short nocturnal sleep durations.

Our findings are in line with cross-sectional data from a group of adults that found that, regardless of mean sleep length, erratic sleep habits were associated with an elevated risk of obesity. It should be noted, however, that this does not inevitably indicate that those who are chronically sleep deprived should not take the opportunity to get more shut-eye when it presents itself. Humans, in contrast to most other mammals, sleep in distinct cycles of 7 to 9 hours (Scheen AJ, 1996). Both glucose consumption and production decrease simultaneously during the early stages of a normal night's sleep, and both increase simultaneously during the early stages of a typical morning (Boyle PJ, 1994). However, the pattern of glucose utilization alters, and glucose levels remain constant all night long, when people are kept at rest but not getting adequate sleep (Scheen AJ, 1996). Sleep deprivation has been linked to metabolic alterations that increase the risk of weight gain, cardiovascular disease, insulin resistance, and diabetes, according to a number of studies (Perla A. Vargas PhD, 05 Nov 2014.). Shorter sleep duration is associated with overweight, obesity, and/or related metabolic indicators in children, adolescents, and adults (Perla A. Vargas PhD, 05 Nov 2014.). There may be more than one layer to the connection between adolescent sleep and BMI, as suggested by studies (Perla A. Vargas PhD, 05 Nov 2014.). In a study of American adolescents, for instance, sleep loss was found to increase the risk of being overweight by 80% for every hour of sleep missed. A Ph.D. Dissertation by Perla A. Vargas, 05 November 2014. Although disrupted sleep did not cause weight gain, it was associated with less exercise. This shows that inactivity brought on by sleep issues may contribute to overall body weight. Similarly, a European adolescent study indicated that low sleep duration was associated with being overweight, eating more, and being less active (Garaulet M, 2011 Oct). Some researchers have observed a U-shaped association, where the chances increase for both short- and long-sleepers. However, it is often impossible to separate the consequences of insufficient sleep from those of sleep disturbances in scientific studies. Recent laboratory investigations have addressed this issue by calculating metabolic changes while accounting for sleep duration and disturbances. For instance, insulin sensitivity was reduced in young, healthy persons who did not obtain adequate deep NREM sleep without also getting less overall sleep. This increased their risk of developing diabetes since glucose was being metabolized less efficiently in the body. No matter how long you sleep, sleep disruption can affect your body's response to glucose, according to new research.

The goal of this research was to determine if and how body mass index (BMI) affects various aspects of sleep, such as duration and quality. We hypothesized that sleep disruptions, and not total sleep time, would be associated with a BMI of 25 or greater, due to the fact that sleep deprivation disrupts metabolic systems that regulate food.

CHAPTER 5
Conclusions & Recommendations

Although an imbalance between calorie intake and physical exercise is a significant cause of obesity environmental and behavioral factors may also be contributing. New data links body weight to sleeping disorders, including duration and quality. Studies on adolescent sleep and BMI show a complex link.

Many research combine sleep duration and disruptions to determine sleep quality, making it difficult to examine their independent impacts on BMI. We employed the PSQI global score and its 7 individual components to study the sleep patterns of college students and evaluate the association between sleep quality and overweight/obesity. Overall, college students' sleep patterns were poor. College students had low sleep duration, fragmented sleep, and poor PSQI sleep quality. Sleep length was not a significant predictor for BMI after controlling for age and sex, but sleep disruptions were. We also discovered an interaction between sleep disturbances and age, suggesting sleep disturbances may have a larger effect on BMI as students age. Sleep disturbances can affect weight regardless of how much time is spent sleeping, and age can amplify this effect. These data support the concept that sleep restriction alters circulation levels of metabolically important hormones including leptin and ghrelin, affecting glucose homeostasis and hunger regulation. Age and sleep problems interact consistent with age-related changes in sleep schedule and structure. As we age, overall sleep time, sleep efficiency, percentage of slow-wave sleep, percentage of REM sleep, and REM latency decrease, while sleep latency and wake after sleep start increase.

Recommendations

- Stick to a sleep schedule Set aside no more than eight hours for sleep.
- The recommended amount of sleep for a healthy adult is at least seven hours.
- Go to bed and get up at the same time every day, including weekends.
- Repeat as needed, but continue to maintain your sleep schedule and wake-up time.2.
- Create a restful environment Keep your room cool, dark and quiet.
- Avoid prolonged use of light-emitting screens just before bedtime.
- Include physical activity in your daily routine Regular physical activity can promote better sleep.

CHAPTER 6
Reference

1. Must A, Barish EE, Bandini LG. Modifiable risk factors in relation to changes in BMI and fatness: what have we learned from prospective studies of school-aged children? Int J Obes (Lond) 2009;33:705–715.

2. Chen X, Beydoun MA, Wang Y. Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. Obesity (Silver Spring) 2008;16:265–274.

3. Cappuccio FP, Taggart FM, Kandala NB et al. Meta-analysis of short sleep duration and obesity in children and adults. Sleep 2008;31:619–626.

4. Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. Obesity (Silver Spring) 2008;16:643–653.

5. Iglowstein I, Jenni OG, Molinari L, Largo RH. Sleep duration from infancy to adolescence: reference values and generational trends. Pediatrics 2003;111:302–307.

6. Mokdad AH, Bowman BA, Ford ES et al. The continuing epidemics of obesity and diabetes in the United States. JAMA 2001;286:1195–1200.

7. Marshall NS, Glozier N, Grunstein RR. Is sleep duration related to obesity? A critical review of the epidemiological evidence. Sleep Med Rev 2008;12:289–298.

8. Spiegel K, Tasali E, Penev P, Van Cauter E. Brief communication: Sleep curtailment in healthy young men is associated with decreased leptin levels, elevated ghrelin levels, and increased hunger and appetite. Ann Intern Med 2004;141:846–850.

9. Schmid SM, Hallschmid M, Jauch-Chara K et al. Short-term sleep loss decreases physical activity under free-living conditions but does not increase food intake under time-deprived laboratory conditions in healthy men. Am J Clin Nutr 2009;90:1476–1482.

10. Basner M, Fomberstein KM, Razavi FM et al. American time use survey: sleep time and its relationship to waking activities. Sleep 2007;30: 1085–1095.

11. Stranges S, Dorn JM, Shipley MJ et al. Correlates of short and long sleep duration: a cross-cultural comparison between the United Kingdom and the United States: the Whitehall II Study and the Western New York Health Study. Am J Epidemiol 2008;168:1353–1364.

12. Knutson KL. Sex differences in the association between sleep and body mass index in adolescents. J Pediatr 2005;147:830–834.

13. 13. Ko GT, Chan JC, Chan AW et al. Association between sleeping hours, working hours and obesity in Hong Kong Chinese: the 'better health for better Hong Kong' health promotion campaign. Int J Obes (Lond) 2007;31:254–260.

14. Gangwisch JE, Malaspina D, Boden-Albala B, Heymsfield SB. Inadequate sleep as a risk factor for obesity: analyses of the NHANES I. Sleep 2005;28:1289–1296.

15. Cournot M, Ruidavets JB, Marquié JC et al. Environmental factors associated with body mass index in a population of Southern France. Eur J Cardiovasc Prev Rehabil 2004;11:291–297.

16. Chaput JP, Després JP, Bouchard C, Tremblay A. Short sleep duration is associated with reduced leptin levels and increased adiposity: Results from the Quebec family study. Obesity (Silver Spring) 2007;15:253–261.

17. St-Onge MP, Perumean-Chaney S, Desmond R et al. Gender Differences in the Association between Sleep Duration and Body Composition: The Cardia Study. Int J Endocrinol 2010;2010:726071.

18. Hasler G, Buysse DJ, Klaghofer R et al. The association between short sleep duration and obesity in young adults: a 13-year prospective study. Sleep 2004;27:661–666.

19. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity (Silver Spring) 2008;16:2205–2211.

20. Neumark-Sztainer D, Croll J, Story M et al. Ethnic/racial differences in weight-related concerns and behaviors among adolescent girls and boys: findings from Project EAT. J Psychosom Res 2002;53:963–974.

21. Larson N, Neumark-Sztainer D, Laska MN, Story M. Young adults and eating away from home: associations with dietary intake patterns and weight status differ by choice of restaurant. J Am Diet Assoc 2011;111: 1696–1703.

22. Pasch KE, Laska MN, Lytle LA, Moe SG. Adolescent sleep, risk behaviors, and depressive symptoms: are they linked? Am J Health Behav 2010;34:237–248. 23. Lytle LA, Pasch KE, Farbaksh K. The relationship between sleep and weight in a sample of adolescents. Obesity (Silver Spring) 2011;19: 324–31.

24. Kandel DB, Davies M. Epidemiology of depressive mood in adolescents: an empirical study. Arch Gen Psychiatry 1982;39:1205–1212.

25. Patel SR, Malhotra A, Gottlieb DJ, White DP, Hu FB. Correlates of long sleep duration. Sleep 2006;29:881–889.

26. Feskanich D, Rimm EB, Giovannucci EL et al. Reproducibility and validity of food intake measurements from a semiquantitative food frequency questionnaire. J Am Diet Assoc 1993;93:790–796.

27. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. Can J Appl Sport Sci 1985;10:141–146.

28. Healthy People 2020. 2020 Topics and Objectives: Sleep Health. U.S. Department of Health and Human Services: Washington, DC.

29. Little R. Survey nonresponse adjustments for estimates of means. Int Stat Rev 1986;54:139–157.