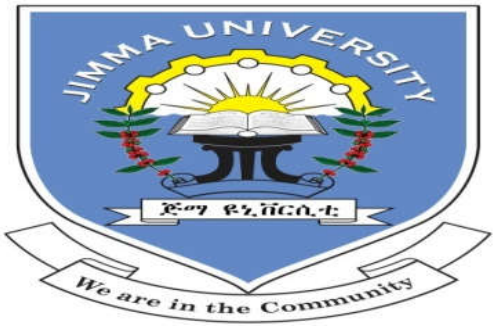

ASSOCIATION BETWEEN SELF-REPORTED SLEEP QUALITYAND BODY MASS INDEX AMONG JIMMA UNIVERSITY ACADEMIC STAFF: A STRUCTURAL EQUATION MODELING

BY: ESSA AHMED (Bsc)

A THESIS SUBMITTED TO JIMMA UNIVERSITY INSTITUTE OF HEALTH, FACULTY OF PUBLIC HEALTH, DEPARTMENT OF POPULATION AND FAMILY HEALTH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER OF SCIENCE DEGREE IN HUMAN NUTRITION.

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Association between self-reported Sleep Quality and Body Mass Index among Jimma University Academic Staff: A Structural Equation Modeling

By

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Abstract

***Background**: According to the World Health Organization report, in 2016, more than 1.9 billion adults were overweight, with more than 650 million being obese. If present trends continue unabated, by 2030, 1.12 and 2.16 billion adults will suffer from obesity and overweight, respectively. Sleep duration and sleep quality has declined simultaneously with the increased prevalence of overweight and obesity, thereby suggesting a potential link. However, there are limited published article showing that poor sleep quality is an independent risk factor to cause obesity for young and older adults in Ethiopia.*

***Methods:** An institution based cross sectional study was conducted in Jimma University academic staff. A total of 427 academic staff participated in the study. A two-stage cluster sampling procedure was employed to select study participants by their departments. Height and weight measurements were collected by trained data collectors. Sleep quality was assessed by a reliable self-administered questionnaire. Analysis was done using Stata version13.1.Structural equation modeling using maximum likelihood estimation method was used to analyze the data.*

***Result:** The prevalence of poor sleep quality was 32.3% (95% CI: 28.0, 36.9). The mean (±SD) BMI of the respondents was 22.7 (±3.1) kg/m^2. The study indicated that 23.1% of academician in Jimma University had a BMI of greater than 25 kg/m^2. The overall prevalence of depression, anxiety, and stress was found to be 25.5%, 44.7%, and 16.62%, respectively. Poor **s**leep quality has appeared to have an inverse and significant indirect association with BMI (β = -0.08 / P = 0.042), mediated through depression and obsogenic dietary behavior.*

***Conclusion:** Poor sleep quality is found to be inversely associated with BMI among Jimma University academic staff. The present findings highlight the interplay between depression, obsogenic eating behavior and poor sleep quality in influencing healthy weight. Future research should test the clinical significance of this observation by tailoring weight management programs according to these characteristics.*

***Keywords:** Sleep quality; Body Mass Index; Depression; Dietary Behavior; Mediation*

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ACRONYMS

AHI	Apnea Hypopnea Index
AOR	Adjusted Odd Ratios
BMI	Body Mass Index
BP	Blood Pressure
CDC	Centers for Disease Control and Prevention
CFI	Comparative Fit Index
COR	Crude Odd Ratios
DASS	Depression Anxiety and Stress Scale
DBP	Diastolic Blood Pressure
EBPQ	Eating Behavior Pattern Questionnaire
EDHS	Ethiopian Demographic Health Survey
EPHA	Ethiopian Public Health Association
ESS	Epworth Sleepiness Scale
FFQ	Food Frequency Questionnaire
GL	Glycemic Load
NHANES	The National Health and Nutrition Examination Survey
OSA	Obstructive Sleep Apnea
PSQI	Pittsburgh Sleep Quality Index
RMSEA	Root Mean Squared Error Approximation
SEM	Structural Equation Modeling
SBP	Systolic Blood Pressure
SD	Sleep Deprivation
TLI	Tucker Lewis Index
WC	Waist Circumference
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Background

Obesity is a major public health problem worldwide. According to the World Health Organization report, the global prevalence of obesity has doubled between 1980 and 2014. In 2016, more than 1.9 billion adults were overweight, with more than 650 million being obese [1]. If present trends continue unabated, by 2030, 1.12 and 2.16 billion adults will suffer from obesity and overweight, respectively [2]. In Sub Saharan African countries, overweight/obesity levels are still lower than in high-income countries but certainly higher than they were two decades ago and increasing at an alarming rates [3]. Demographic Health Survey (DHS) analysis of 32 Sub-Saharan African countries revealed that the pooled prevalence of overweight in the region was 15.9% with the lowest in Madagascar 5.6% and the highest in Swaziland 27.7%, similarly, the prevalence of obesity was also lowest in Madagascar 1.1% and highest in Swaziland 23.0%[4]. Analysis of Ethiopian Demographic Health Survey (EDHS) found that the prevalence of overweight and obesity for urban settings were 12.1% and 2.8%, respectively [5].A study done in Bahir-Dar city revealed that the overall prevalence of overweight/obesity was 11.3 (95% CI: 9.6, 13.1), in which 9.3% and 2% of adults were overweight and obese respectively [6].

Lifestyle factors are cited as one of the reasons for an increase in the prevalence of overweight or obesity. Significant studies have been conducted to identify the relationship between lifestyle factors and obesity. Prior research has examined factors such as nutrition transition, junk food and soft drink intake frequency and physical inactivity due to increasing sedentary nature of many forms of activities, changing modes of transportation and increasing urbanization for their association with the prevalence of overweight or obesity [7, 8]. An optimal public health outcome is achievable if the factors causing obesity, besides the conventional ones of diet and physical activity, can be scientifically found, and corresponding remedial measures implemented. Among these other factors, sleep deprivation has been found to have an association with overweight and obesity in many studies, most of which have been conducted outside Ethiopia [9-11]. The prevalence of chronic partial sleep deprivation has increased dramatically in the past half century, in parallel with the rising epidemics of overweight and obesity [12].

However, in recent years, sleep deprivation mainly sleep duration has received greater attention as independent risk factor for overweight and obesity in adolescents and adults [13, 14].Many cross-sectional and longitudinal studies in developed countries have shown short sleep duration could increase energy intake by increasing hunger, giving people more time to eat and promoting people to choose less health diets; and could decrease energy expenditure by decreasing physical activity and lowering body temperature [15, 16, 17]. Recently there is convincing evidence that getting a less than the recommended amount of sleep is independent and strong risk factor for overweight and obesity in younger age groups including adults [15].

1.2 Statement of the problem

The need for sleep in adulthood becomes reduced compared to healthy children and adolescents. Data show a decline in adult sleep duration over recent decades. There are many probable reasons for this, including lifestyle choice, family or work commitments, and psychological or physical problems. Sleep curtailment, as a result of voluntary bedtime control has become increasingly common in today's modern world.[18] Technological advances has resulted in a modern society which is operational 24-hours a day, 7 days a week and may have altered leisure time behaviors with individuals spending their leisure time watching television, video gaming, using mobile telephone and internet surfing. Use of these media may result in chronic sleep deprivation through delayed bedtime [19]. Physiological pathways may also be involved such as increased exposure to light which suppresses the release of melatonin [20]. Additionally, these behaviors are sedentary and may have replaced more active pursuits. Sleep duration and sleep quality has declined simultaneously with the increased prevalence of obesity, thereby suggesting a potential link. Sleep could be a novel factor that impinges on both sides of the energy balance equation with data suggesting that sleep deprivation is associated with obesity.

The association between sleep duration and overweight or obesity has been mostly studied in developed countries. Several findings suggested that these observations may not fully extrapolate a wider diversity of ethnic group and socio-demographic variables [21]. In Ethiopia, different studies showed that overweight and obesity are caused due to increased intake of energy-dense food, physical inactivity, changing modes of transportation and increasing urbanization.

However, there are limited published article showing that sleep quality and short sleep duration is an independent risk factor to cause obesity for young and older adults in the country.

In Ethiopia, though it is common to see overweight people in all age groups, there are no researches done to assess the association of sleep deprivation and overweight/obesity among staff of Jimma University. Thus, the main aim of this study was to determine associations between sleep quality and body mass index in a sample of Jimma University academic staffs.

CHAPTER TWO: LITERATURE REVIEW

The underlying mechanisms mediating the link between sleep and obesity are complex and not fully understood. According to a hypothesized model by Taheri [17], sleep loss may result in two major changes: 1) An alteration in regulation of appetite hormones which could result in higher food intake; and 2) Fatigue that may lead to a decrease in physical activity. Insulin resistance as a result of weight gain would also contribute to greater adiposity.

Researchers speculate that there are several ways that sleep deprivation might lead to weight gain, either by increasing how much food people eat or decreasing the energy that they burn [22].
Sleep deprivation could increase energy intake by;-

- **Increasing hunger:** Sleep deprivation may alter the hormones that control hunger [23]. One small study, for example, found that young men who were deprived of sleep had higher levels of the appetite-stimulating hormone ghrelin and lower levels of the satiety-inducing hormone leptin, with a corresponding increase in hunger and appetite-especially for foods rich in fat and carbohydrates. [24]

- **Giving people more time to eat:** People who sleep less each night may eat more than people who get a full night's sleep simply because they have more waking time available [17]. Recently, a small laboratory study found that people who were deprived of sleep and surrounded by tasty snacks tended to snack more-especially during the extra hours they were awake at night-than when they had adequate sleep [25].

- **Prompting people to choose less healthy diets:** Observational studies have not seen a consistent link between sleep and food choices [22]. But one study of Japanese workers did find that workers who slept fewer than six hours a night were more likely to eat out, have irregular meal patterns, and snack than those who slept more than six hours [26].

Sleep deprivation could decrease energy expenditure by;-

- ✓ **Decreasing physical activity:** People who don't get enough sleep are more tired during the day, and as a result may curb their physical activity [27].

Some studies have found that sleep-deprived people tend to spend more time watching TV, less time playing organized sports, and less time being physically active than people who get enough sleep. But these differences in physical activity or TV viewing are not large enough to explain the association between sleep and weight [20].

- ✓ **Lowering body temperature:** In laboratory experiments, people who are sleep-deprived tend to see a drop in their body temperatures [22]. This drop, in turn, may lead to decreased energy expenditure. Yet a recent study did not find any link between sleep duration and total energy expenditure [28].

2.1 Sleep deprivation and Obesity link

Most studies that measure adults' sleep habits at one point in time (cross-sectional studies) have found a link between short sleep duration and obesity [22]. Longitudinal studies, though, can better answer questions about causality-and in adults the findings from such studies have been less consistent than those in children [29].Obesity epidemic has been paralleled in modern society by a trend of reduced sleep duration [30]. Poor sleep quality, which is often associated with overall sleep loss, has also become a frequent complaint [30]. Growing evidence both from laboratory and epidemiological studies points to short sleep duration as a new risk factor for the development of obesity and its complications. Sleep is an important modulator of neuro endocrine function and glucose metabolism and sleep loss has been shown to result in metabolic and endocrine alterations, including decreased glucose tolerance and alteration of appetite regulating hormone [31, 32].

The largest and longest study to date on adult sleep habits and weight is the Nurses' Health Study, which followed 68,000 middle-age American women for up to 16 years [27]. Compared to women who slept seven hours a night, women who slept five hours or less were 15 percent more likely to become obese over the course of the study. A similar investigation in the Nurses' Health Study and the Nurses' Health Study II, a cohort of younger women, looked at the relationship between working a rotating night shift-an irregular schedule that mixes day and evening work with a few night shifts, throwing off circadian rhythms and impairing sleep-and risk of type-2 diabetes and obesity. Researchers found that the longer women worked a rotating night shift, the greater their risk of developing diabetes and obesity [33].

In a cross-sectional study, Jennings and colleagues studied 210 participants (57% men) with a mean age of 46 years and they found that Pittsburgh Sleep Quality Index (PSQI) global scores was significantly associated with increased BMI and all the other components of metabolic syndrome [34].

The results of a recent cross-sectional study involving 400 adult women demonstrated that both sleep duration and sleep quality, defined by sleep efficiency and sleep architecture (minutes of SWS and REM sleep) were inversely associated with waist circumference following multivariate adjustment for potential confounders including age, physical activity level, smoking, alcohol consumption and apnea hypopnea index (AHI). However, such associations were less robust among older age women (age >50 years) [35].

Bidulescu and colleagues analyzed data from the Cardiovascular Health Epidemiology Study (CHES) which involved 1,515 African-American aged 30-65 years. They found that poor sleep quality (measured using PSQI) was associated with increased BMI in women. The authors suggested that such an association may have been mediated by stress [36]. The impact of gender on the association of poor sleep quality and obesity has been confirmed in a longitudinal study conducted among 7,000 Finnish adults who aged between 40 to 60 years old [37].

The National Sleep Foundation identified indicators of sleep quality for all age groups as: sleep onset latency, number of awakenings lasting less than 5 min, wake time after sleep onset, and sleep efficiency (ratio of total sleep time to time in bed) [38]. Part of a cross sectional studies by Quick et al. Of 1,252 college students across nine U.S. universities evaluated sleep quality by self-report using the Pittsburgh Sleep Quality Index and weight status using two categories, normal weight (BMI less than 25) and overweight or obese (BMI 25 or greater). Poorer sleep quality was significantly associated with being overweight or obese with an odds ratio of 1.07 [39].

Fatima et al. published the first systematic review and meta-analysis looking at associations between sleep quality using the Pittsburgh Sleep Quality Index and overweight and obesity in youth. Poorer self-reported sleep quality, defined as higher sleep onset latency, more sleep disturbances, recurrent awakenings, and lower sleep efficiency, was associated with a higher odds of being overweight or obese (odds ratio of 1.46), independent of sleep duration [40].

Many epidemiological studies have described associations between self-reported habitual sleep duration and obesity. A meta-analysis by Cappuccio and colleagues found that across 23 studies of adults, a pooled odds ratio of 1.55 was found. Furthermore, analysis of 7 studies that examined linear relationships between sleep duration and body mass index as a continuous variable showed that for every increased hour of sleep, body mass index was reduced by 0.35 points [10].

A number of studies of adults have examined the association between sleep duration and central obesity. A meta-analysis found a significant negative association between sleep duration and waist circumference [41]. A study of 13,472 adults over 20 years of age participating in the NHANES 2009–2010 survey found that waist circumference was higher in those with short sleep duration (b6 h); no increase in central adiposity was seen in those with long sleep in this study. Of note, the relationship between sleep duration and central adiposity in this study was modulated by age: regression coefficients for the association between sleep duration and central adiposity were stronger in those ages 20–39 than in older adults [42], potentially for the same reasons discussed above.

Interestingly, a recent study of Chinese adults found that long sleep duration was associated with an increased risk of generalized adiposity in women but with lower waist circumference in men [43]. Of note, the waist circumference may not necessarily reflect visceral fat accumulation. A study of Japanese adults found that self-reported short sleep duration associated with greater waist circumference after adjustment for age, physical activity, smoking and drinking, but that this reflected subcutaneous rather than visceral fat tissue [44].

In the Quebec family study, compared with adults reporting 7 to 8 hours of sleep, those with 5 to 6hours of sleep had higher waist circumference [45].In contrast, sleep duration was not associated with abdominal obesity in sample of aged population (≥60 years) in Spain [46].The relationship between sleep duration and waist circumference is very important, as it has been found that central adiposity has a strong correlation with metabolic variables such as insulin resistance compared to general obesity [47].

Sleep duration and sleep quality may be influenced by menopausal state [48].It is also believed that menopause may also be associated with weight gain [49].However, the underlying mechanisms for development of abdominal adiposity are complex and may include several other factors. Findings from NHANES cohort demonstrated that each additional increase hour of total nocturnal sleep duration was negatively associated with change in BMI among men and women aged younger than 50 years (premenopausal state for women)[42].

Studies linking sleep deprivation to obesity and related metabolic diseases have largely been restricted to populations in developed countries, with very little data available from African nations. The social determinants of obesity have also been under studied in these countries. Developing nations in Africa have a rising prevalence of obesity, particularly in urban, female populations [50, 51].

A study done in urban African community in Soweto, South Africa found a negative relationship between night times sleep duration and BMI in both sexes. However, males who slept during the day had a lower BMI and a lower waist circumference than those who did not nap in the day [52]. A number of other studies have shown that inadequate sleep is associated with overweight and obesity. Limitations of this study are all sleep data were self-reported and quality of sleep was not objectively assessed. Additionally, there are other variables that were not measured in this study and which may explain some of the observed associations. Thus, income was not ascertained and neither was alcohol intake or dietary consumption. Also, the number of male subjects was lower than the number of female subjects and therefore the absence of associations in males may be due to a lack of statistical power [53].

2.1.1 Limitations of existing literature on sleep deprivation and overweight/obesity

Several limitations hamper the generalizability and consistency of the identified findings. First, all of the epidemiologic evidence to date is derived from cross-sectional analyses, which cannot inform temporal relations or causal pathways, and it is conceivable that increased body weight has an impact on sleep or that there are shared underlying inter individual differences that affect both sleep and obesity in parallel. The other limit is using self-report questionnaires. However, PSQI is areliable and validated instrument, although it cannot be used as an accurate diagnostic tool.

Furthermore, the studies described include populations of varying age groups, sex, and geographic regions (US, European, and others) with different lifestyle habits, dietary patterns, and cardio metabolic disease risk, which may contribute to inconsistent findings. Although longitudinal associations between sleep and these adverse health outcomes have been previously assessed by several large epidemiological studies, it is still unknown, whether short sleep duration, or long sleep duration or both cause any of these adverse health outcomes. Evidently, future experimental and intervention studies are needed to carefully manipulate sleep length for effective treatment purposes.

2.2 Other Covariates that have link with Sleep deprivation and BMI

Findings from a meta-analysis including three large prospective cohort studies comprising 133,468 American men and women showed that higher consumption of starchy vegetables such as peas, potatoes, and corn was associated with weight gain due to their higher glycemic load (GL) [54]. In addition, in the fruit group, increased consumption of fruit juices was related to long-term weight gain [55]. A meta-analysis on studies without any advice on calorie restriction revealed that increasing whole-fat and low-fat dairy food consumption resulted in modest weight gain that probably occurred owing to the increase of total calories. Increasing dietary vegetables, fruits, and dairy, without recommending substitution for other foods, can lead to increased energy intake in the long term, resulting in weight gain. On the other hand, foods with lower GL and high fiber content were more strongly inversely associated with weight change than low-fiber and high-GL food items [56].

The relationship between smoking and obesity is complex. Smoking cessation is frequently followed by weight gain [57, 58]. However, studies indicate that heavy smokers have a higher BMI than light smokers (8–10 cigarettes per day) [57, 58]. The fact that smokers have a lower body mass index (BMI) than non-smokers can be explained by the effect of nicotine, which increases energy expenditure and reduces appetite [58, 59]. It is therefore important that variables, such as smoking history should also be quantified when analyzing risk factors for obesity in different population groups.

Previous observational studies on the association between obesity and depressive symptoms have provided mixed findings, with some suggesting a positive association [60], while others have reported an inverse association (obesity associated with lower risk of depression) [61], no association [62], or a u-shaped association (higher risk of depressive symptoms among underweight and obese individuals) [63].

2.3 Significance of the study

A growing body of epidemiological evidence indicates that both sleep quantity and quality are associated with increased BMI and WC among men and women [64]. Higher institution workers are more vulnerable to sleep loss due to their increased tendency in spending times by reading and writing using laptops and computers, which in turn lessens time spent on sleeping. To my knowledge only few studies has examined the interactions among sleep and different measure of obesity in Ethiopia. Therefore, it is necessary to have a greater understanding of obesity and its interaction with sleep deprivation in Jimma University staffs. Recognition and addressing obesity problems among sleep deprived individuals is necessary as sleep improvement interventions may thus improve mental health and prevent worsening of obesity per se among this population. The findings of this study assist policy makers and other stakeholders by giving relevant information for future planning and interventions on these problems. It also provides base line data toconduct nationwide studies on related topics.

Research questions

- Is there any association between sleep deprivation and BMI among these individuals?

2.4 Conceptual framework

Specific hypotheses derived from review of evidence are presented in a path diagram with directions of linkages (Figure 1). Socio-demographic characteristics being as an underlying factors, poor sleep quality can affects one's weight status by inducing obsogenic dietary behavior through hedonic signaling, lowering physical activity and through psychological factors. History of medical disorders like, Hypertension, Diabetes and Obstructive Sleep Apnea and some behavioral factors like alcohol intake, smoking and khat chewing are found to be confounders which affect both sleep quality and Body Mass Index.

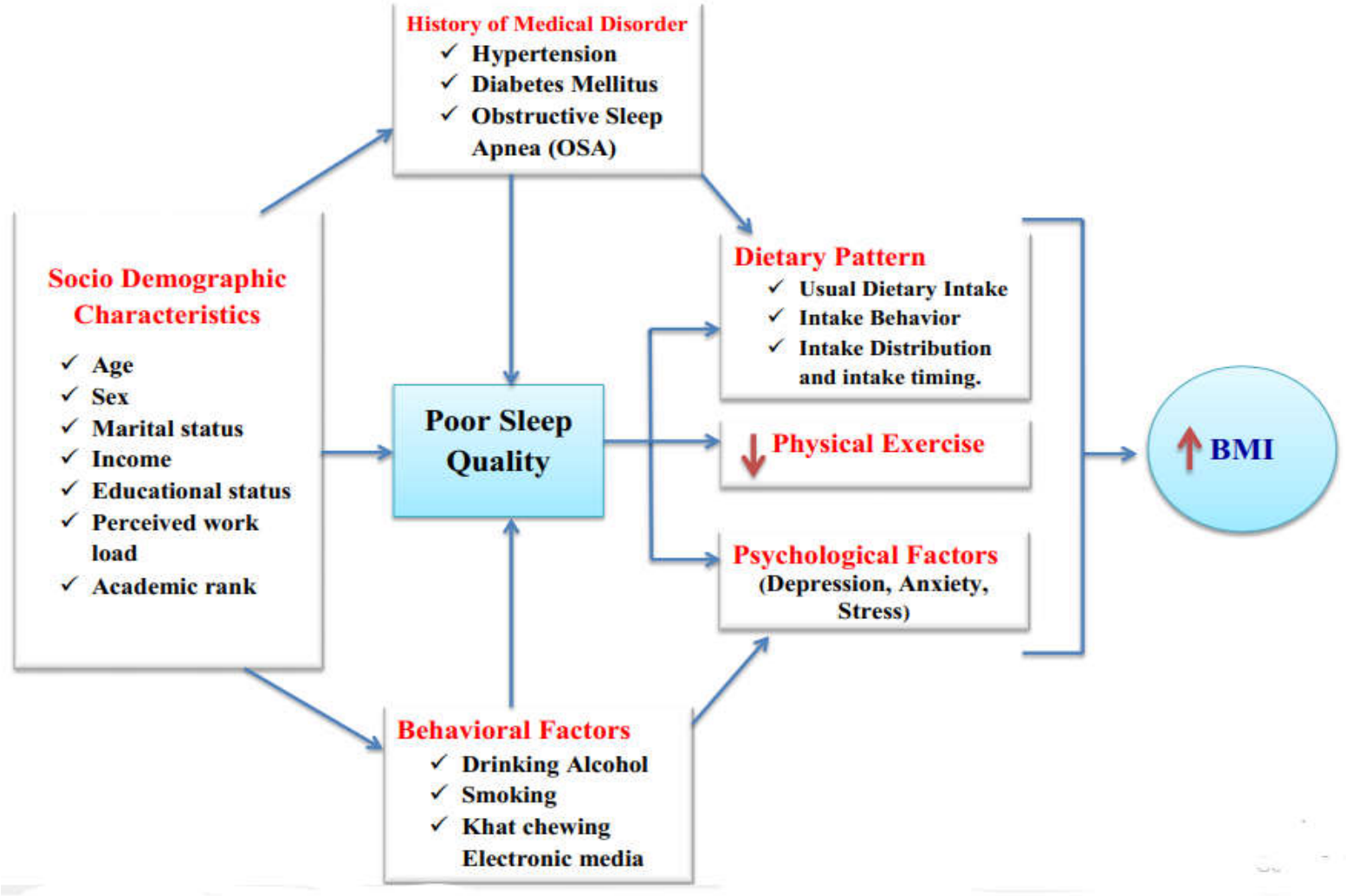

Figure 1 Schematic representation of proposed mechanisms that simulate the relationship between sleep deprivation and BMI, May 2019.

CHAPTER THREE: OBJECTIVES

3.1 General objective

The main objective of this study is to assess the association between sleep quality and body mass index among Jimma University academic staff.

3.2 Specific objectives

- To determine the magnitude of overweight/obesity among Jimma University teachers.
- To determine the magnitude of sleep quality among Jimma University staff academician.
- To examine the pathways through which sleep quality is associated with BMI among Jimma University academic staff

CHAPTER FOUR: STUDY DESIGN AND METHODS

4.1 Study area and Period

The Study was conducted from February to March 2019 in Jimma University Ethiopia. Jimma University is located in Jimma city, Oromia regional state, 335 km southwest of Addis Ababa. It is established in December 1999, by the amalgamation of Jimma College of agriculture and Jimma institute of health science. There are four campuses in the University (Main campus, Technology campus, college of Business and Economics, and Agricultural campus) with a total of 8,000 staff of which 1661 are teaching staff under six colleges and two institutes.

4.2 Study design

Institution based cross sectional study was conducted.

4.3 Population

4.3.1 Source population

All academic staff who has been working in Jimma University for at least the past 6 months prior to the study was our source population.

4.3.2 Study population

All randomly selected individuals from academic staff of Jimma University

4.4 Inclusion Criteria

All Jimma University teachers who were present in the campus during the period of data collection were eligible for the study.

4.5 Exclusion Criteria

- ✓ Pregnant women
- ✓ Subjects who were taking sleep or psycho-therapy medications currently and until recently, that could directly affect sleep pattern was excluded.

4.6 Sample size determination

Sample size calculation was conducted for each of our three objectives and the largest sample size was considered for the study.

Objective1. To determine the magnitude of obesity among Jimma University academic staff

The sample size was determined by using Epi Info™ 7 by considering the following assumptions, 11.3% overall prevalence of overweight/obesity in Bahir-Dar city [6], 5% margin of error, 5% of non-response rate, source population of 1664 and the final sample size were 148.

Objective2. To determine the magnitude of sleep quality among Jimma University Staff

The sample size was determined by using Epi Info™ 7 by considering the following assumptions, 50% overall magnitude of sleep deprivation ,5% margin of error, 5% of non-response rate, source population of 1661 and the final sample size were 327.

Objective3. **To predict the association between sleep quality and BMI mediated through dietary pattern and physical exercise.**

A sample size of 316 subjects is determined to detect a correlation of at least 0.16 between sleep deprivation and BMI with a 95% confidence level, a power of 80%, and an anticipated 5% non-response rate using the G-power software [73]. Therefore, the minimum required sample size for this study was 316 with 5% non-response rate. The formula for calculation is based on two-tailed test. Sample size for correlation was generated using G-power software.

Since the biggest number amongst all the three objectives was used and the final sample size were 327. Since clustering by department was done to select study participants and thus design effects of 1.5 were used to yield a total sample size of 491.

4.7 Sampling technique

A two-stage cluster sampling procedure was employed to select study participants from JU academic staff. First, 30% of study departments were selected from the total department found in the campus. Then, each academic staff under each selected departments was included in the study. Computer generated random numbers was used to select the department based on lists of department.

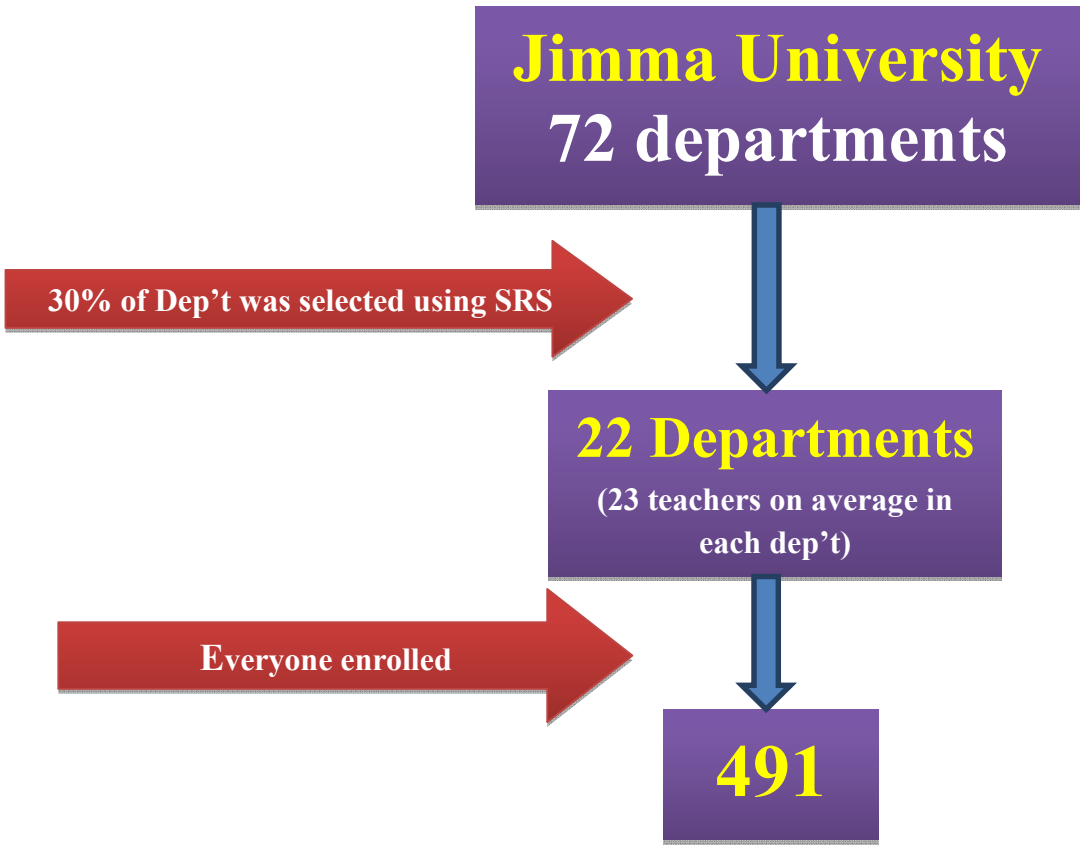

Figure 2: Sampling Procedure used for sleep-BMI study in Jimma University academic staff, May 2019(n=427).

4.8 Data Collection Tools

Data were collected using the anonymous self-administered questionnaire and the major elements of the questionnaire were Pittsburgh Sleep Quality Index, Eating Behavior Pattern Questionnaire, WHO-STEP instrument and Depression, Anxiety and Stress Scale.

4.8.1 Pittsburg Sleep Quality Index

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) developed by Buysse et al. (65) and has been widely used to assess sleep quality during the previous month using self-report data. The PSQI consists of 7 elements, including perceived sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction, as has been described previously.

Total sleep quality score was calculated for each subject by summing the responses for all items with possible score ranging from 0 to 21, with higher scores indicating poorer sleep quality. Participants were further categorized into "poor sleep quality" and "good sleep quality" groups using their total sleep quality score and a cutoff score of 5. The reliability of these instruments was checked using the Cronbach α and it was 0.77.

4.8.2Eating Behavior Pattern Questionnaire (EBPQ)

Eating behavior data were collected using the Eating Behavior Pattern Questionnaire (EBPQ) (66). The EBPQ is a validated 51-item questionnaire designed to measure nine dimensions of human eating behavior: This questionnaire consists of 51 self-report items on healthy and unhealthy eating behaviors. Every item was rated in a 5-point Likert scales ranging from strongly disagree to strongly agree. Six eating behavior patterns were assessed by the questionnaire including low fat eating (11 total items), snacking and convenience (10 total items), emotional eating (8 total items), planning ahead (6 total items), meal skipping (7 total items), and cultural / lifestyle behavior (9 total items) Additional questions were added that have used to assess intake behavior, intake distribution and intake timing. The reliability of this instrument was checked using the Cronbach α and it was 0.94.

4.8.3 WHO STEPS Instrument

Core items from WHO STEP-wise approach to chronic disease risk factor surveillance (STEPS) instrument was used to assess study participant's physical activity level and behavioral factors, like tobacco use and alcohol consumption [67]. Standard WHO definitions for measuring the prevalence of tobacco use and alcohol consumption and internationally derived measures of physical activity were used. Questions regarding selected Non Communicable Disease (NCD), i.e., Hypertension and Diabetes Mellitus, were part of the instrument and it was used to assess Hypertension and Diabetes Mellitus status of the participant.

4.8.4 Depression Anxiety and Stress Score

Psychological factors, depression anxiety and stress were measured using Lovibond and Lovibond's short version of the DASS-21 [68]. DASS-21 is a psychological screening instrument which is capable of differentiating symptoms of depression, anxiety, and stress. It is a validated and reliable instrument with 21 items in three domains.

Each domain comprises seven items assessing symptoms of depression, anxiety, and stress. Participants were reported to indicate the presence of symptoms in each domain over the past week scoring from 0 (did not apply at all) to 3 (applied most of the time). Scores from each dimension was summed. Then, the final score was multiplied by 2 and then categorized according to the DASS manual as normal, mild, moderate, severe, and extremely severe. The reliability of these instruments was checked using the Cronbach α and it was 0.85 for depression, 0.84 for anxiety and 0.83 for stress components.

4.8.5 Anthropometric Measurement

Height and weight was taken using the standard procedures. Height was measured using a height measuring board, (Seca) to the nearest 0.1 cm while subjects having no shoes. Weight was measured by twice to the nearest 0.1 kg using a digital weight scale (Seca) while subjects having no shoes and with minimal clothing. Body mass index was then calculated by dividing weight (in kilograms) by square of height (in meters). BMI values were categorized based on the WHO recommended cut-off for underweight, normal, overweight, and obese categories.

4.9 Study variables

4.9.1 Dependent variable

- ✓ BMI

4.9.2 Independent variable

- ✓ **Socio-demographic characteristics**

  Age, Sex, Marital status, Level of education, academic rank, work load and income
- ✓ **Sleep Quality**
- ✓ **Dietary pattern**
- ✓ **Physical activities**
- ✓ **Behavioral factor**

  Smoking, alcohol drinking and Khat chewing
- ✓ **Psychological factors**

  Perceived Depression, anxiety and stress level
- ✓ **History of Hypertension, Diabetes and Obstructive Sleep Apnea(OSA)**

4.10 Data Analysis Procedures

Data were edited, coded and entered into EpiData version 3.1 and then exported to Stata version 13.1(Stata Corp) for data cleaning and analysis. All analyses were two-sided and statistical significance was considered at alpha < 0.05. Data were checked for consistency, missing values, outliers and normality prior to analysis.

Descriptive statistics were reported using percentage and mean (SD).To provide a sound explanation on how participants' sleep quality could predict BMI through their dietary pattern and/or physical activity; we conducted Structural Equation Modeling (SEM). Accordingly, we hypothesized that poor sleeping habit would result in weight gain and/or an increase in BMI that would be mediated through: 1) participants obsogenic dietary behavior, and 2) subject's physical inactivity, that would finally result in increased BMI.

SEM with maximum likelihood estimation was fitted to model the above hypothesized relationships. In the measurement models, factor analysis was employed to estimate the latent variables, dietary pattern, sleep quality and perceived depression status from their construct observed variables. In the structural models, we estimated both un-standardized and standardized estimates of the direct and indirect effect of sleep quality on BMI through the hypothesized pathways. The need of further model adjustment for relevant variables was checked by including important covariates. We evaluated the reliability of the measurement scales and the relative importance of each construct variable in a scale using Cronbach's alpha coefficient. Model fit was evaluated by utilizing Chi-Square statistic, Standardized Root Mean Square Residual (SRMR), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). As proposed by Hu and Bentler [71], TLI and CFI values ≥0.95, SRMR values ≤0.08, and RMSEA values ≤0.06 were defined to indicate an adequate fit for the data.

4.11 Data Quality Management

The questionnaire was prepared in English. Training of data collectors and supervisors and pre testing of questionnaire was made to ensure the quality of data. Principal investigator and supervisor's were present on the spot to check and review all the completed questionnaires; and to ensure completeness and consistency of the information to be collected.

4.12 Ethical considerations

Ethical approval was obtained from the Institutional Review Board of Jimma University after submission of the proposal. Verbal consent for participation was obtained from each respondent after they are informed about the objective and purpose of the study including their right not to participate or withdraw at any time. Privacy and confidentiality was maintained both during and after conducting the interview. For this purpose, all questionnaires were anonymous by excluding name of the respondent.

4.13 Dissemination Plan

The final report of the study will be presented to concerned bodies and submitted to Jimma University Department of Population and Family Health, Human Nutrition Unit. The study findings will be prepared in a brief for disseminated to the Jimma university administration and other relevant bodies. Attempts will be made to publish the findings in a peer reviewed journal.

4.14 Operational Definitions

BMI thresholds were set according to the World Health Organization (WHO) protocol [72]

- **Underweight:**<18.5 kg/m2;
- **Normal:** 18.5–24.9 kg/m2;
- **Overweight:** 25.0–29.9 kg/m2;
- **Obese** ≥30 kg/m2)

Good sleep quality: Subjects who scores global PSQI scores 5 or < 5 [65].

Poor sleep quality: Subjects who scores global PSQI scores > 5 [65].

Dietary pattern: Are obsogenic eating behavior data that were collected using the Eating Behavior Pattern Questionnaire (EBPQ).

Former Smoker: Respondent who has smoked 100 cigarettes in his or her lifetime and wh0 currently are not smoking cigarettes.

Current smoker: Respondent who has smoked 100 cigarettes in his or her lifetime and who currently smokes cigarettes.

Non-smoker: Respondents who has never smoked, or who has smoked less than 100 cigarettes in his or her lifetime.

Physical activity:

- **Active –** Respondent who qualifies one of the WHO global recommendations on physical activity
- **Inactive –** Respondent who failed to qualify one of the WHO global recommendations on physical activity

WHO global recommendations on physical activity for health

Throughout a week, including activity for work, during transport and leisure time, adults should do at least;

- 150 minutes of moderate-intensity physical activity OR
- 75 minutes of vigorous-intensity physical activity OR
- An equivalent combination of moderate and vigorous-intensity physical activity achieving at least 600 MET-minutes.[68]

Vigorous exercise: Is an exercise which makes you breathe much harder than normal, like running or jogging, high-intensity aerobic classes, competitive fulfilled sports (soccer) or basketball [68].

Moderate exercise: Is an exercise which makes you breathe somewhat harder than normal, like low-impact aerobic exercise classes, brisk walking or hiking, recreational team sports (volleyball, soccer, etc.) [68].

Obstructive sleep apnea (OSA): is a disorder in which breathing is repetitively interrupted during sleep due to collapse of the upper airway.

Psychological factors, depression anxiety and stress are defined based on WHO report on Global estimate on depression and other common mental disorder [69].

Depression: Is characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration [69].

Anxiety: Anxiety is a response of body to a perceived threat which is triggered by an individual's beliefs, feelings, and thoughts and is characterized by worried thoughts, tension, increased blood pressure, respiratory rate, pulse rate, sweating, and difficulty of swallowing, dizziness, and chest pain [69].

Stress: Stress is a feeling that is initiated when a person perceives that demands exceed resources mobilized by the individual [69].

Alcohol Drinkers (Binge drink) according to WHO-STEP definition [68]:

For females: Having 4 or more standard drinks in a two hours period in the past 30 days.

For Males: Having 5 or more standard drinks in a two hours period in the past 30 days.

1 Standard drink =
- 1 standard bottle of regular beer (285ml) or
- 1 single measure of spirit (30ml) or
- 1 medium size glass of wine (120ml) or
- 1 measure of aperitif(60ml)

CHAPTER FIVE: RESULTS

5.1 Socio demographic characteristics of respondents

A total of 491 Jimma University academicians from 27 departments were selected to participate in the study, of which 427 were involved, making a response rate of 88.9%. Of the 427 participants, 340 (79.6%) were males and 87 (20.4%) were females and 320 (74.9%) were between the age of 25-34 and the mean (± SD) age of participant was 30.6 years (± 5.8). Almost half (52.9%) of participants were single and 49.6%of the study subjects were orthodox Christianity followers followed by Protestant34.8%. Three hundred twelve respondents (73.1%) had a Master's degree and 73 (17.1%) had a bachelor degree and of which 58.1% them has achieved an academic ranks of Lecturer. The mean monthly incomes of the respondents were, 10194.02 Birr.

Table 1: Socio demographic Characteristics of the participants, Jimma University, South West Ethiopia, May 2019(n=427)

Variable(n=427)	Category	Frequency	Percent (%)
Sex	Male	340	79.6
	Female	87	20.4
Age	≤ 24	37	8.8
	25-34	320	74.9
	35-44	53	12.4
	≥45	17	3.9
Marital Status	Single	226	52.9
	Married	198	46.4
	Divorced	3	0.7
Religion	Orthodox	212	49.6
	Protestant	149	34.9
	Muslim	45	10.4
	Others*	21	4.91
Educational Status	Bachelor Degree	73	17.1
	Master's Degree	312	73.1
	Professional Degree	18	4.2
	Doctorate and above	24	5.6
Academic Rank	Assistant 1 & 2	33	7.7
	Assistant Lecturer	58	13.7
	Lecturer	248	58.1
	Assistant Professor	71	16.6
	Associate Professor and Professor	17	3.9

Perceived Work Load	Excessive	22	5.2
	High	151	35.4
	Comfortable	228	53.4

*Catholic, Evangelical and No religion

5.2 Sleep quality

The participants went to bed on average at 10:38 pm, and rose in the morning at 6:45 am. Their average (± SD) night sleep duration was 7:38 hours (± 1:35).The median (range) total PSQI score was 8 (0 – 16).One hundred thirty eight (32.3%) participants were assessed as poor sleepers by global PSQI score less than 5.Poor sleep quality was more prevalent in males (35.6%)than in females (19.5%) (P = 0.004) and in the age group of greater than 45 years (41.2%) (P = 0.026) than younger age group, 25-34 (33.8%) (P = 0.005).

Table 2: Sleep quality and its components scores among Jimma University academic staff, May 2019 (n=427)

Variables (n=427)	Level	Frequency	Percent (%)
Subjective Sleep Quality	Very good	231	54.2
	Fairly good	152	35.6
	Fairly bad	37	8.6
	Very bad	7	1.6
Sleep Latency	0	87	20.3
	1	246	57.6
	2	81	18.9
	3	13	3.04
Sleep Duration	> 7 Hours	127	29.7
	6-7 Hours	199	46.6
	5-6 Hours	94	22.0
	< 5 hours	7	1.7
Sleep Efficiency	> 85%	295	69.1
	75-84%	83	19.4
	65-75%	17	4.0
	< 65%	32	7.5
Sleep Disturbance	0	51	11.9
	1	307	71.9
	2	69	16.2
Sleep Medication	Not during the past month	391	91.5
	Less than once a week	9	2.1
	Once or twice a week	25	5.9
	Three or more times a week	2	0.5

Daytime Dysfunction	0	256	59.9
	1	132	30.9
	2	34	7.96
	3	5	1.17
Sleep Quality Score	Good Sleep	289	67.68
	Poor Sleep	138	32.32

5.3 Body Mass Index (BMI)

The overall mean (± SD) height was 170 .82 (± 6.13) cm and the overall mean (± SD) weight was 66.53 (± 10.87) kg. The mean (±SD) BMI of the respondents was 22.7 (±3.1) kg/m^2. Twenty eight percent of the participants had a BMI ≥ 25.0 kg/m^2 from which 92 (21.8%) and 7 (1.6%) were overweight and obese respectively (Figure 3).

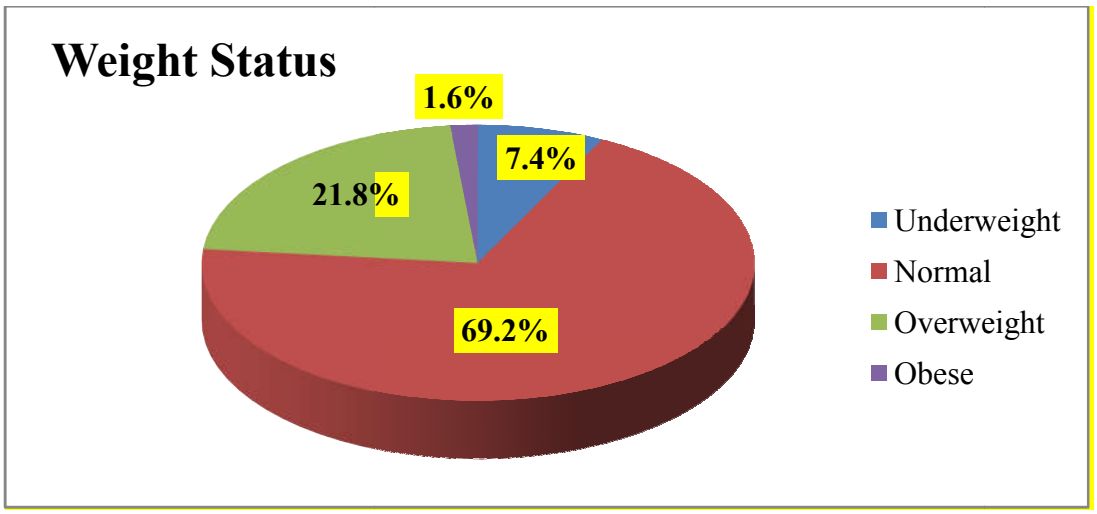

Figure 3 Weight status among Jimma University academic staff, May 2019 (n=427)

5.4 Dietary pattern, Physical activity and Depression

Frequency of meal pattern attended by participants shows that 318 (74.5%) ate meal three times per day, while 28 (6.5%) ate less than three times per day. From the total sampled respondents, majority of them, 386 (90.4%) took lunch every day and 346 (81%) took dinner daily while 52 (12.2%) took breakfast rarely. More than half of the study participant, 271 (63.5%) have reported of snacking at least once per day (Table 4). The mean (± SD) time of respondent's last meal of the days were 8:28 PM (± 1:06).

Only 174 (40.8%) of the participants reported that they do a vigorous physical exercise; whereas 158 (37%) reported to do a moderate level physical activities. With regard to the time spent resting like watching TV, playing video games or browsing on internet, 236 (55.3%) respondents report that they spend an average time of 7-9 hours per day, while 16 (3.7%) reported to spend at least 13 hours per day (Table 4).

Table 3: Dietary pattern, physical activity and depression status among Jimma University academic staff, May 2019 (n=427)

Variable (n=427)	Level	Frequency	Percent (%)
Usual food habit	Different every day	52	12.2
	Different Some days	302	70.7
	Different only in weekends	43	10.1
	Very monotonous	30	7.0
Number of meal per day	1 meals per day	1	0.2
	2 meals per day	27	6.3
	3 meals per day	318	74.5
	> 3 meals per day	81	19.0
Breakfast	Everyday	268	62.7
	Most of the days	107	25.1
	Rarely	52	12.2
Lunch	Everyday	386	90.4
	Most of the days	41	9.6
Dinner	Everyday	346	81.0
	Most of the days	72	16.8
	Rarely	9	2.1
Snacks per day	None	115	26.9
	1	271	63.4
Vigorous exercise	Yes	174	40.7
	No	253	59.2
Moderate exercise	Yes	158	37.0
	No	269	63.0
Walk/bicycle for 10 min	Yes	286	66.9
	No	141	33.0
Level of total physical activity	Active	165	38.6
	Inactive	262	61.36
Time spent watching TV, Internet surfing, game playing	None at all	3	0.7
	4 to 6 hours per day	74	17.3
	7 to 9 hours per day	236	55.4
	10 to 12 hours per day	98	22.9
	13 to 15 hours per day	16	3.7

The overall magnitude of depression, anxiety, and stress was found to be 25.5%, 44.7%, and 16.62%, respectively. Seventy-one (16.6%) respondents had moderate and 38 (8.9%) had severe depression. Similarly, 119 (27.9%) respondents had moderate anxiety and 72 (16.9%) had severe anxiety. Forty-eight (11.2%) respondents had moderate stress and 23 (5.4%) had severe stress (Figure 4).

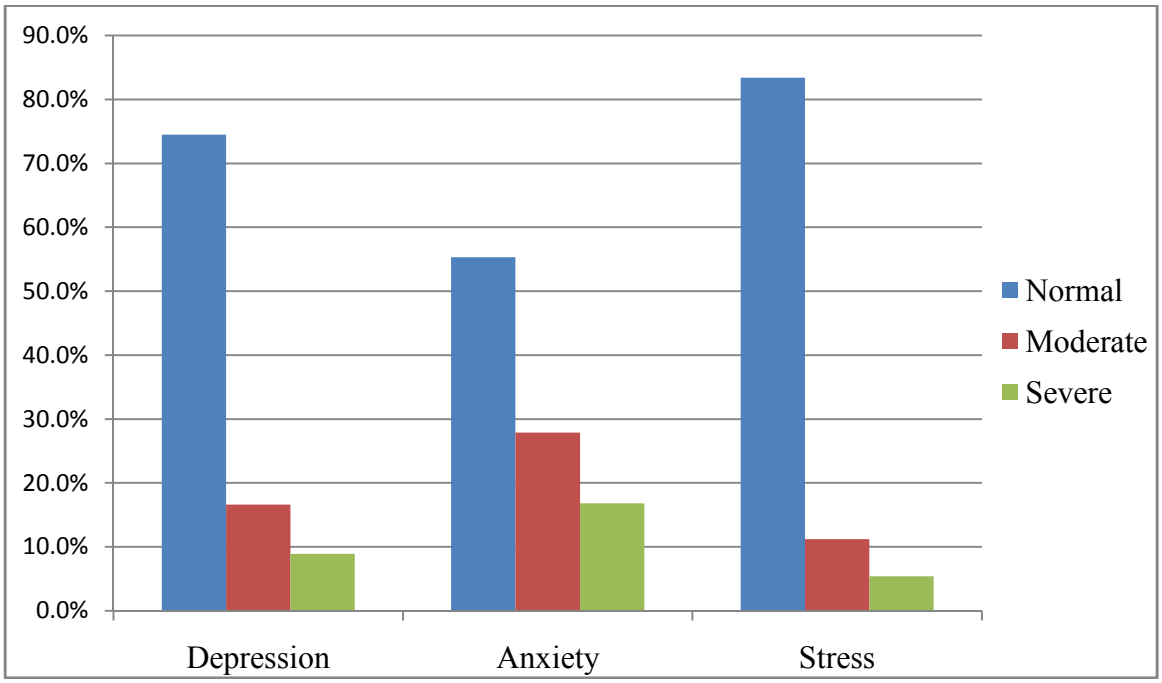

Figure 4: Psychological Status of Jimma University academic staff, May 2019 (n = 427).

Table 4 : Association between poor sleep quality and different factors Jimma University academic staff, May 2019

Variable	Level	Sleep Quality[1]						P-value
		Good (PSQI > 5) n=289		Poor (PSQI ≤ 5) n=138		Total (N= 427)		
		N	%	N	%	N	%	
Age category (years)	< 24**	33	89.2	4	10.8	37	8.7	
	25 - 34	212	66.3	108	33.8	320	74.9	0.35
	35 - 44	34	64.2	19	35.8	53	12.4	0.55
	> 45	10	58.8	7	41.2	17	4.0	0.21*
sex	Men**	219	64.4	121	35.6	340	79.6	
	Women	70	80.5	17	19.5	87	20.4	0.3
Marital Status	Single**	150	66.4	76	33.6	226	52.9	
	Married	136	68.7	62	31.3	198	46.4	0.38
	Divorced	3	100.0	0	0.0	3	0.7	<**0.001***
Physical exercise	Active**	118	71.5	47	28.5	165	38.6	
	Non-active	171	65.3	91	34.7	262	61.4	0.24
Workload	Excessive**	17	77.3	5	22.7	22	5.2	
	High	101	66.9	50	33.1	151	35.4	0.002*
	Comfortable	153	67.1	75	32.9	228	53.4	0.004*
Depression[2]	Normal**	229	72.0	89	28.0	318	74.5	
	Moderate	40	56.3	31	43.7	71	16.6	**< 0.001***
	Severe	20	52.6	18	47.4	38	8.9	**< 0.001***
Anxiety[2]	Normal**	188	79.7	48	20.3	236	55.3	
	Moderate	65	54.6	54	45.4	119	27.9	**< 0.001***
	Severe	36	50.0	36	50.0	72	16.9	**< 0.001***
Stress[2]	Normal**	255	71.6	101	28.4	356	83.4	
	Moderate	30	62.5	18	37.5	48	11.2	0.08
	Severe	4	17.4	19	82.6	23	5.4	0.89
Categories of BMI (kg/m^2)	Underweight**	20	64.5	11	35.5	31	7.3	
	Normal	191	65.6	100	34.4	291	68.1	0.89
	Overweight	69	75.0	23	25.0	92	21.5	0.28
	Obese	5	71.4	2	28.6	7	1.6	0.72

*Significantly associated **Reference group.

[1] **Sleep quality** was be assessed using the Pittsburgh Sleep Quality Index (PSQI) developed by Buysse et al. (69), with higher scores indicating poorer sleep quality.

[2] **Depression, Anxiety, and Stress** level were measured using Lovibond and Lovibond's short version of the DASS-21 [70].

5.5 Association between sleep quality and BMI

The main aim of this study was to explore the association between self-reported sleep quality and BMI among Jimma University academic staff. It is hypothesized that having poor quality of sleep will have an effect on one's increase in BMI. The mechanism of action for the proposed associations was through physical inactivity, depression and through obsogenic dietary behavior. Three factors, sleep quality, dietary pattern and depression are the latent construct, whereas physical activity level and BMI are observed variable (Figure 5).

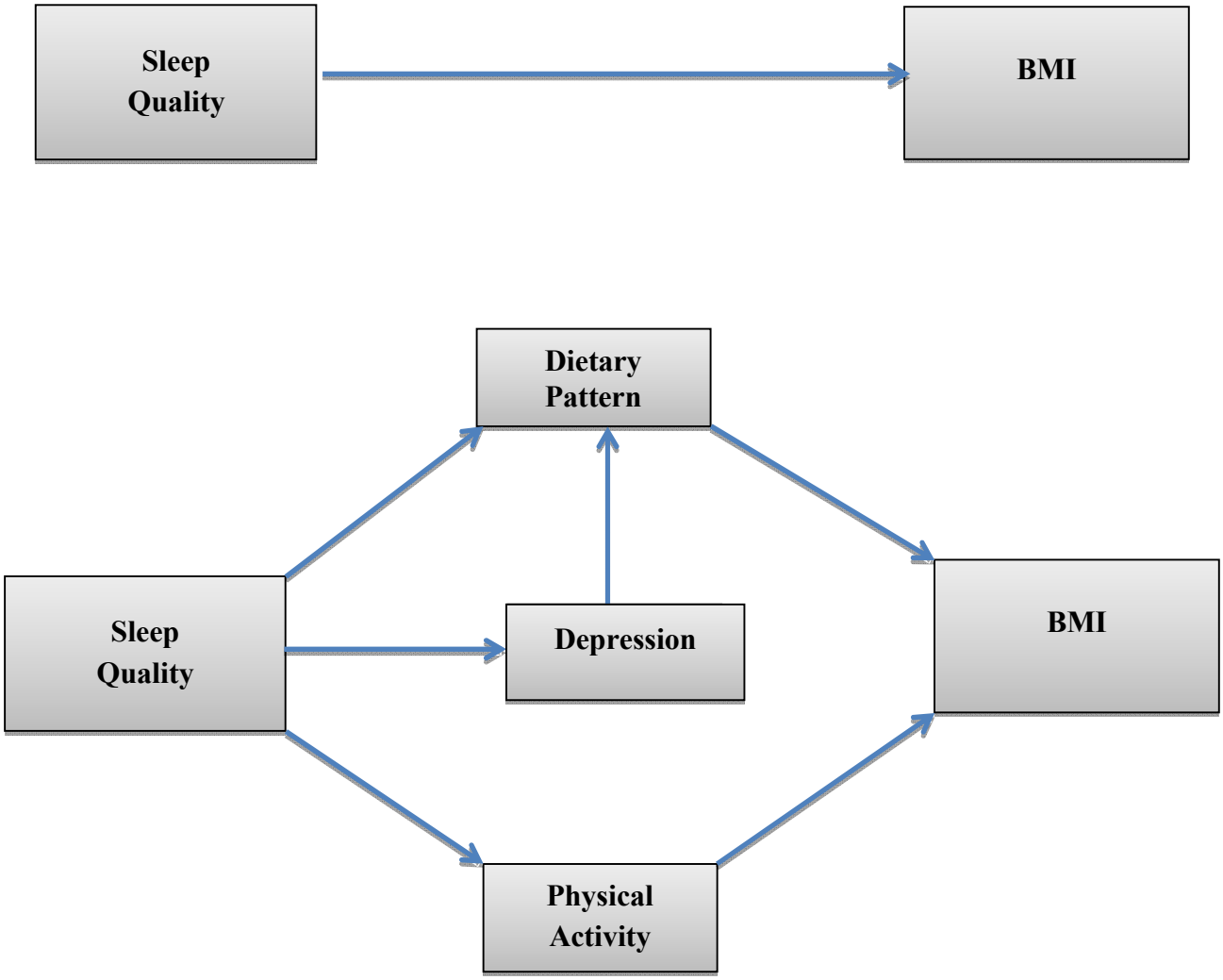

Figure 5 Proposed analytical framework for the association of sleep quality and BMI, May 2019 (n=427)

5.6 Structural Equation Model

A model for the proposed mechanism was specified at first and thus only the path from sleep quality to BMI mediated through depression and diet shows a significant association. The path through which physical activity are proposed as a mediator from sleep quality to BMI, shows marginally significant association with poor sleep quality(β = 0.10, P = 0.032,95% CI (0.01, 0.19)) but insignificantly associated with BMI (β = -0.03, P = 0.493,95% CI (-0.12, 0.06)). Dietary behavior were significantly associated with BMI (β = -0.18, P < 0.001, 95% CI (-0.27, -0.08)). The direct path from sleep quality to dietary behavior in the initial model were not significant (β = -0.04, P = 0.395, 95% CI (-0.15, 0.05)). Adjusting the initial model for age, sex, additional income (rather than monthly income) and diabetes history the second model was generated and the only difference regarding the significance association from the initial model was the insignificance of the path from sleep quality to physical activity (β = 0.11, P = 0.196, 95% CI (-0.05, 0.28)) (Table 6).

Table 5: Un-standardized and standardized path coefficients for the SEM model, May 2019

Model/construct	B (SE)	β (SE)	P
Model 1			
Sleep Quality[1] → Dietary behavior[2]	-0.02(0.02)	-0.04(0.05)	0.395
Sleep Quality → Physical Activity	0.02(0.01)	0.10(0.04)	0.032
Dietary behavior → BMI	-0.10(0.02)	-0.18(0.47)	<0.001
Sleep Quality → Depression	0.11(0.01)	0.51(0.03)	<0.001
Depression[3] → Dietary behavior	0.76(0.11)	0.43(0.05)	<0.001
Physical Activity → BMI	-0.03(0.05)	-0.03(0.04)	0.493
Model 2 (Model 1+ Covariates)			
Sleep Quality → Dietary behavior	-0.01(0.03)	-0.05(0.11)	0.686
Sleep Quality → Physical Activity	0.02(0.01)	0.11(0.08)	0.192
Depression → Dietary behavior	0.85(0.20)	0.58(0.12)	< 0.001
Dietary behavior → BMI	-0.80(0.29)	-0.22(0.07)	0.005
Physical Activity → BMI	0.32(0.59)	0.04(0.08)	0.584
Sleep Quality → Depression	0.15(0.02)	0.69(0.46)	<0.001

Model 1 was unadjusted; Model 2 was adjusted for age, sex , other income, Diabetes history
[1] Sleep quality were determined Pittsburgh Sleep Quality Index (PSQI)
[2] Dietary behavior was determined using Eating Behavior Pattern Questionnaire (EBPQ)
[3] Perceived depression statuses was determined using DASS-21 short version.

The SEM final proposed model is illustrated in Figure 3 below. The associations between Sleep quality, diet and BMI were not direct, but instead were indirect through depression. Demographic variables such as age, gender, academic rank, marital status perceived stress and perceived work load were included as control variables

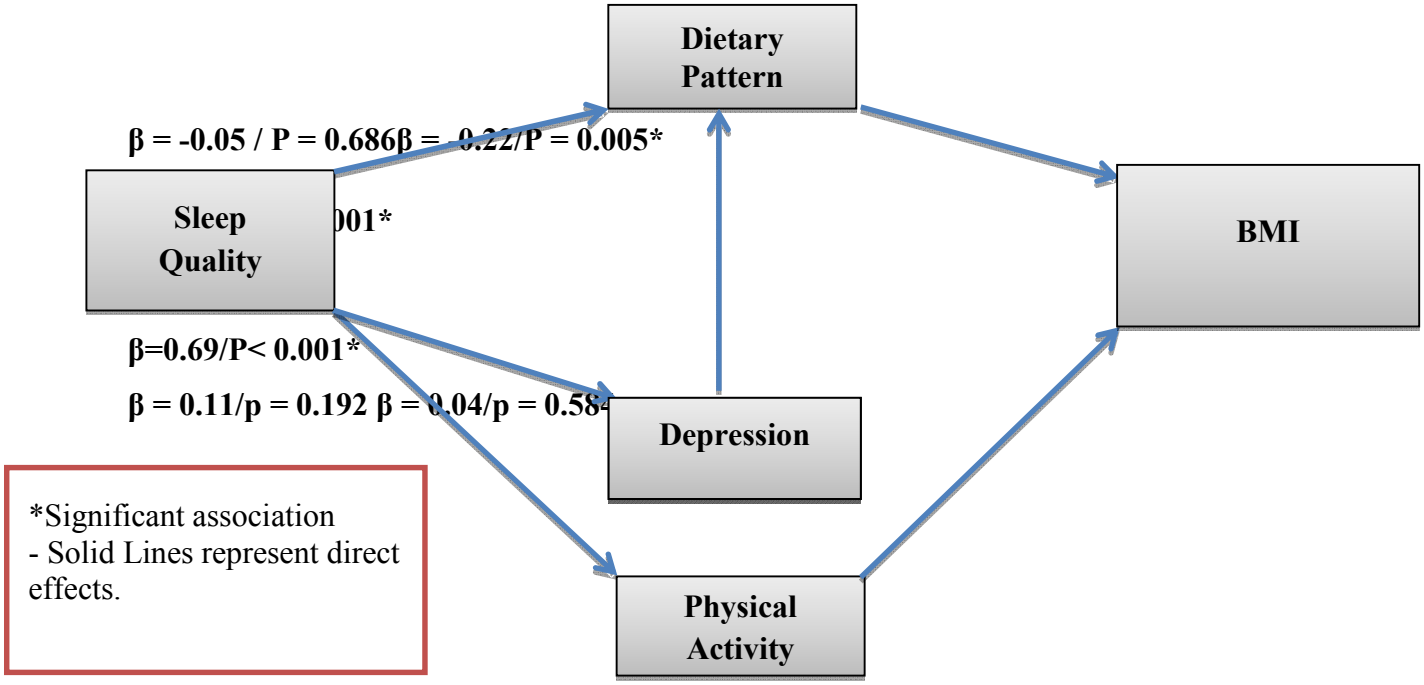

Figure 6: Full structural equation model showing the association between sleep quality and BMI among Jimma University academic staff, May 2019(n=427).

In this adjusted model, the pathway between sleep quality and perceived depression status was statistically significant (β = 0.69, P< 0.001, 95% CI (0.61, 0.78)) after controlling for age. The pathway between perceived depression status and dietary pattern of academicians was also significant (β = 0.58, P< 0.001, 95% CI (0.35, 0.81)) when controlling age and participants yearly cash income other than monthly salary. Though, there was no significant association between sleep quality and dietary pattern (β = -0.05, P = 0.686, 95% CI (-0.28, 0.18)), dietary pattern was seen when significantly associated with BMI (β = -0.22 / P = 0.005, 95% CI (-0.37, -0.06)) after controlling for age and participant diabetes status. Being diabetic was marginally associated with an increase in BMI. The significant association found between sleep quality and physical activity in the initial model was no more significant when adjusted for age (β = 0.11 / P = 0.192, 95% CI (-0.06, 0.28)) and also the path between physical activity and BMI shows no significant association (β = 0.04/ P = 0.584, 95% CI (-0.11, 0.20)) (Figure 6).

In line with our proposed frame work sleep quality has appeared to have a significant indirect association mediated through depression and dietary behavior with our outcome variable, BMI (β = -0.08 / P = 0.042). Though there is a significant association between poor sleep quality and BMI, the direction of the association was unexpected and appears to have an inverse relationship. The overall fit of the structural model predicting BMI was adequate based on the standard fit criteria (χ (75) = 108.53, P =0.007; RMSEA = 0.06 P close = 0.223; TLI = 0.92; CFI = 0.93; CD = 0.5).

5.6.1 Indirect and Total Effect Estimates

The direct effects between the variables in the model are given but the biggest superiority of SEM to regression and correlation analysis is that we can also see indirect latent effects. The direct, indirect, and total effects between the variables in the model are given in Table 8. When the result is analyzed, it is seen that only diet has a direct effect on BMI (β= 2.26, P = 0.017) while other, sleep quality and depression have a significant indirect effect on BMI (β= -2.03 and β=-0.27, respectively). Therefore, the total effects of having poor sleep quality were shown to have an inverse relation with a unit increase in participant's body mass index.

Table 6: Direct and indirect effect estimates for sleep quality on BMI, May 2019.

	Direct effect (standardized β coefficient)			Indirect effect (standardized β coefficient)			Total effect (standardized β coefficient)		
	β	**Z**	**P>|Z|**	**β**	**Z**	**P>|Z|**	**β**	**Z**	**P>|Z|**
Sleep → Depression	0.69	15.09	< 0.001				0.69	15.09	< 0.001
Depression → Diet	0.58	4.26	< 0.001				0.58	4.26	< 0.001
Diet → BMI	-0.22	-2.79	0.005				-0.22	-2.79	0.006
Sleep →Physical exercise	0.11	1.31	0.192				0.11	1.31	0.192
Physical exercise → BMI	0.04	0.55	0.584				0.04	0.55	0.584
Sleep → Diet	-0.05	-0.40	0.686				-0.05	-0.40	0.686
Sleep → BMI				-0.08	-2.03	0.042	-0.08	-2.03	0.042
Sleep → Diet				0.13	4.16	< 0.001	0.13	4.16	< 0.001
Depression → BMI				-0.68	-4.26	< 0.001	-0.68	-4.26	< 0.001

5.7 Psychometric Property of tools

Reliability of the tool was checked based on the assumption that for every latent variable the Cronbach's alpha value must be equal to or higher than 0.7 for a tool to be valid [58]. So that the Cronbach's alpha outputs for sleep quality assessment, dietary assessment and psychological assessment were0.77, 0.94 and 0.78 respectively. Evidently, all indices are higher than 0.7. Therefore, the research model validity is accepted.

CHAPTER SIX: DISCUSSION

The study indicated that 23.1% of academician in Jimma University had a BMI of greater than 25 kg/m^2 and were thus overweight or obese. Ninety-two (21.5%) of the study participant were overweight and 1.6 % were obese based on WHO cut-off point on BMI. But, according to the recent optimal cut-off point for obesity and markers of Mets for Ethiopian adults, 60.88% and 22.09% of the study participants were overweight and obese, respectively. When using the WHO cut-off point, the finding of this study is consistent in obesity prevalence with the evidence from EDHS data analyzed for the urban setting which was 2.8%, but higher in overweight prevalence from the same study 12.1% [5].The finding of the study is lower than the study in Tanzania in which the prevalence of overweight and obesity among adults were 24.1% and 19.2% [74]. The discrepancy might be due to the disparities in socio-demographic characteristics and dietary habits.

Our study found that the prevalence of poor sleep quality among the study participants was 32.3% which is consistent with a finding in China, 39.4% and USA, 40% [75,76].The significant sex difference in sleep quality was also consistent with other studies conducted. The substantial higher proportion of the prevalence was observed among males (35.6%) unlike the study report conducted in South Africa [77] and China [78].This might be due to higher number of male academic staff being participated in the study than females.

This study revealed that poor sleep quality was higher among the age group of greater than 45 years (41.2%) when compared to younger age group, 25-34. Sleep quality deterioration was linked with an increase in age as it was reported by the study conducted in China [75]. This could be due reduced melatonin levels as age increases comparing with younger ages. The other possible mechanisms can be that lower levels of testosterone are connected to worse sleep consolidation in the form of reduced performance, and increased frequency of awakenings [86].

To my best knowledge, this is amongst the few study to examine the mediation effect of depression induced dietary pattern between sleep quality and BMI in the context of age, co-morbidities, additional income and physical activity patterns. Sleeping well is essential to good health. People who are healthy, in turn, usually sleep well.

However, sleep disruptions, even if minor, can markedly influence one's physical wellbeing as well as their emotional wellbeing and mental health. Understanding how poor sleep might contribute to depression is important given the high social and economic burdens of sleep loss and the alarming increases in depression prevalence [79].

Though, little is known about the pathways, by which poor sleep begets depression symptoms, our finding clearly shows the significant mediation effect of depression between poor sleep quality and obsogenic dietary behavior. Our results regarding the mediation effect of depression are consistent with two prospective studies conducted in Dutch parents [80] and mid-life US adults [81] with self-reported anthropometrics. The possible explanation for the mediation role would be that poor sleep levels may decrease one's ability to deal electively with depression encountered on a day to day basis, and inadvertently induce unhealthy dietary behaviors and food intake practices that can raise the chances of becoming obese. Given the rewarding properties of food, it is hypothesized that hyper palatable foods may serve as "comfort food" that acts as a form of self-medication to dispel unwanted distress. Individuals in negative affective states have been shown to favor the consumption of hedonically rewarding foods high in sugar and/or fat, whereas intake during happy states favor less palatable dried fruits [82].

In contrast to our expectations, we did not find evidence that the level of total physical activity would mediate the relationships between sleep deprivation and change in BMI. In the study of the Dutch employees, particularly strenuous physical activity (running, working out) mediated the association of emotional eating with BMI change [83]. A mediator analysis was repeated with dichotomous (38.6% physically active vs. 61.4% not active) and continuous physical activity level, but again did not detect statistically significant interactions. However, this could be at least partly explained by present participants' relatively low levels of vigorous activities.

Reports on the association of sleep and BMI in clinical samples and in community samples are mixed and do not show consistent associations between sleep patterns and body weight/BMI. However, the inverse association between poor sleep quality and BMI found in the present study is unexpected considering the priori made hypothesis and the findings of most studies on sleep deprivation and weight/obesity, which revealed that poor sleeping quality and increase weight/ obesity are associated.

As shown in figure 7 below their association resembles a U-shaped, poor sleep quality being associated with both an increase as well as a decrease in BMI. But the indirect effect of poor sleep quality on BMI through those mediators appears to be an inverse.

Though they are few, there are previous study findings which have shown an inverse association between BMI and sleep difficulty and duration. The findings of present study are consistent with two studies performed on adults in university setting. Soares and his colleague's studies among university students with the different age group [84], and a gender specific studies which is conducted in China, which targeted females rather than males from the general population [85] were amongst the few. A study done in urban African community in Soweto, South Africa found a negative relationship between sleep deprivation and BMI in both sexes [52]**.** But also inconsistent with many of the findings, a study conducted in Pittsburgh University, Pennsylvania revealed a significant relationship between having poor sleep quality and high BMI [34]. These results may also indicate that difficulties initiating or maintaining poor sleep and short sleep duration may not correlate and consequently, their association with weight/obesity may be different.

The possible explanation for the inverse relation would be that participant's may have limited access to food whenever they feel hungry. This is further supported by analyzing participant's night time eating behavior due to sleeplessness and only 14.86% were reported of having the habit. This might indicates that they do have the obsogenic behavior, but something limits them, may be an access to food. From this study, it is assessed how many meals per day they take. 74.47% reported it 3 times and only 17.33% reported 4 times. These suggests that, the main dimensions of obsogenic eating behavior, i.e. frequent snacking and irregular eating behavior, might not apply in this settings.

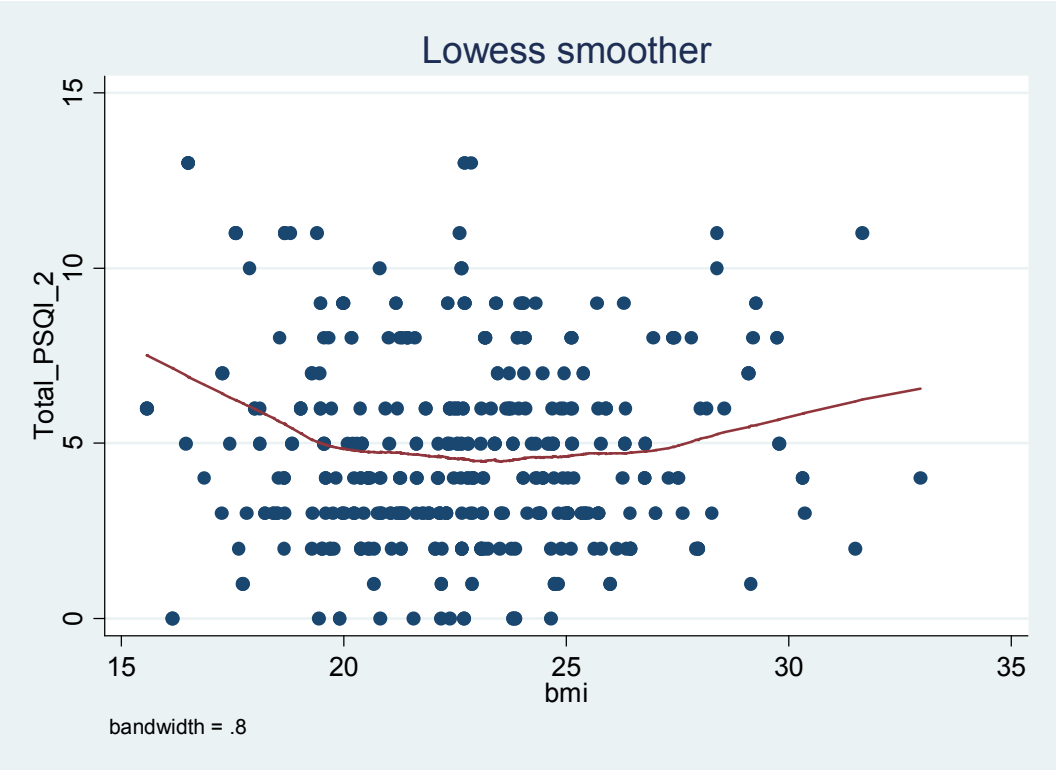

Figure 7: A graph showing the relationship between global PSQI score and BMI, May 2019.

Detail observations of the above figure 7further revealed that those who are sleep deprived were seen when having both a lower and a higher BMI. As stated earlier, this variation has something to do with food access and economic status of the participants. This study revealed the economic status of participant with their respective BMI status and the mean monthly income for those whose BMI are lower than 18.5 were 9095 ETB and 14992 ETB for those whose BMI's are greater than 25. This clearly indicates that, though they have the obsogenic dietary behavior their economic status might limits them from accessing food at any time.

The findings of our study should be interpreted in light of some study limitations. First, given the cross-sectional nature of our study, it is difficult to delineate temporal relations or causal pathways, and it is conceivable that a reduction in BMI has an impact on sleep or that there are shared underlying inter individual differences that affect both sleep and BMI in parallel. Second, the use of a self-administered survey that relied on subjective measures of sleep quality and other covariates may have introduced some degree of error in reporting behavioral covariates. The other limit is using self-report questionnaires.

Though PSQI is a reliable and validated instrument, it cannot be used as an accurate diagnostic tool. Furthermore, the studies described include populations of varying age groups, sex, educational level with different lifestyle habits, dietary patterns, which may contribute to inconsistent findings. Finally, there is also potential for reverse causation as obesity leads to many co-morbidities including sleep apnea that can disrupt sleep. Medium and long term interventional studies are needed to evaluate the potential for healthy sleep interventions to help combat the epidemic of obesity.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

7.1 CONCLUSION

The present findings highlight the interplay between sleep quality, depression and negative emotional eating in influencing subsequent development of obesity. This study supports a robust relationship between sleep quality and depression and suggests an important role for depression and dietary pattern in the putative link between weight status and sleep quality. Poor sleep quality in the presence of unlimited food access and higher income might result in an increase in BMI as well as where food access is a problem, poor sleep quality has an association with a decrease in BMI. Future research must ensure that these factors are appropriately controlled for in order to advance understanding of the sleep-weight relationship and properly manage current discussions around the regulation of weight through improvements in sleep quality.

7.2 RECOMMENDATION

For researchers:

The increase in observational and clinical studies examining the link between sleep quality and duration with BMI, will increases the likelihood that we may soon have clearer recommendations and guidelines that will influence clinical practice and public health campaigns. The nature and the direction of this association requires further studies—longitudinal, interventional, or both—and using measures from multiple domains, including objective and subjective, physiological, emotional, and mental and physical health. In addition, more research is needed, and research priorities include the following:

1. Inclusion of more diverse populations in research studies (i.e., minorities, women, and overweight and obese participants)
2. Longer-term follow-up of participants in observational and clinical studies
3. Accurate and objective measures of sleep behavior, along with sleep architecture
4. Development and evaluation of simple sleep behavior screening tools that could be used in clinical or public health settings

For policy makers:

The policy should consider sleep improvement interventions in nationwide which may thus improve mental health and prevent worsening of obesity per se among population.

Jimma University:

The University should develop teachers centered programs that creates cultures on regular physical activity and healthy living practices including the maintenance of proper sleeping habits.

In the meantime, the credibility of our field will be better served if we become comfortable with the suggestion that the obesity epidemic requires a multidimensional approach—that is, stress and depression management, promotion of healthy lifestyle both at an individual and a community level, and, of course, better quality and, in some instances, greater quantity of sleep.

ANNEXES

ANNEX I: REFERENCES

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ANNEX II: TOOLS

Jimma University, Institute of Health, Faculty Of Public Health, Department Of Population And Family Health, Human Nutrition Unit

Part One: Information sheet and consent

I am_____ ,a data collector for '**THE SLEEP DEPRIVATION AND OBESITY'** study which evaluates the association between self-reported sleep deprivation with body mass index and waist circumference. The study is conducted by Mr. Essa Ahmed as a partial fulfillment of the requirement for master's degree in human nutrition. The aim and purpose of the study are to determine the association of sleep deprivation with body mass index and waist circumference among Jimma University academic staff. A successful implementation of the study is expected to contribute to policy makers and other stakeholders by giving relevant information for future planning and interventions on these problems. It also provides base line data to conduct nationwide studies on the related topics.

Your selection to participate in the current study was based on random selection of JU academic staff. You have the full right not to participate in the study or withdraw from the study at any time. If you are willing to participate in the study, you will be expected to do the following things:

1) Your height, weight and waist circumference will be measured and only light clothes will be wearing during measurement of body weight and waist circumference while Height will be measured using measuring board with bare foot.

2) You will be asked to complete self-administered questionnaires that gather information about your general demographic information, dietary pattern, sleeping habit, various health behavior and psychological factors. We estimate that you may need to devote a maximum of 40 minutes to complete all the questionnaires.

Your personal information will be kept confidential throughout and after the study. The study findings will be communicated only at the level of the JU academic staff and no result will be linked with individual participants. For this purpose, all information will be gathered anonymous and you are not asked to fill your name in any of the questionnaires or forms. Your participation by giving complete information on all the questions and about your actual practice is crucial for the success of our study and its expected contributions to the community.

Now, I would like to ask you if you have further questions. In case you need more explanation, you can communicate the Principal Investigator **Mr. Essa Ahmed (Phone nr: +251917833280).**

Finally, I would like to invite you participate in our study.

Part Two: Socio Demographic Questionnaire

This section asks about your socio-demographic and other relevant information. Would you please encircle the correct response from the listed choices? Responding to all the questions is critical.

#	Variable	Answer
1.	Age	_____years
2.	Sex	1. M 2. F
3.	Marital Status	1. Single 2. Married 3. Divorced 4. Widowed 5. Separated
4.	Religion	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other (specify),_____
5.	Educational status	1. Diploma 2. Bachelor degree 3. Master degree 4. Professional degree (e.g. MD, DDS, DVM) 5. Doctorate and above (e.g. PhD,) 6. Other (specify),_____
6.	What is your academic rank?	1. Assistance 1 2. Assistance 2 3. Assistance Lecturer 4. Lecturer 5. Assistance Professor 6. Associate Professor 7. Professor 8. Others,(specify) _____
7.	Please indicate your perceived level of work load (consider time spent on main work and on other activities like; load from home, family, social and etc.)	1. Excessive 2. High 3. Comfortable 4. Relaxed 5. Under-utilized
8.	On average, how many hours per day you spend on work?	_____hrs./day
9.	Average monthly income (in Ethiopian Birr)	_____ per month
10.	Could you please indicate the approximate value of any other CASH income that you have received from other sources in the past year? (in Ethiopian Birr)	_____ per year
11.	College of study	_____
12.	Main field of your study	_____

Part Three: Dietary information

This section asks information about how often you usually eat the different food items under each food groups. Consuming any one of the food item listed under the food group is enough for you to consider consuming a food group (i.e. you are not necessarily required to eat all/most of the food items listed in the group). As you answer these questions please think of a typical week in the last year (YOUR USUAL CONSUMPTION FREQUENCY).

#	Food groups	Possible choices/Answers
13.	**CEREALS** Like: - Teff, maize, barley, wheat, bread, sorghum/millet, rice, pasta…etc.)	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
14.	**LEGUMES, NUTS and SEEDS** Like:- beans, peas, lentils, nuts, seeds or foods made from these	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
15.	**MEATS and EGGS** Like:- beef, pork, lamb, goat, chicken, fresh or dried fish, eggs	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
16.	**OILS AND FATS** Like: - Pizza, Cheese, Butter, Oil, fried potatoes, cream, margarine …etc.	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
17.	**MILK AND MILK PRODUCTS** Like: - milk, cheese, yogurt or other milk products	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
18.	**GREEN LEAFY VEGETABLES and TUBERS** Like:- Collard green(gomen), cabbage, lettuce(selata), pepper, tomato, onion, carrot, beetroot, garlic, pumpkin, potato, sweet potato	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
19.	**FRUITS** Like:- Avocado, Banana, Mango, Pineapple, Orange, Apple, Lemon, Watermelon, peach, guava and etc.	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
20.	**SUGAR SWEETENED BEVERAGES** Like: - Soft drinks such as, Pepsi, Fanta, Coke, Mirinda, Sprite and the like.	1. Never 2. Less than once a week 3. Once a week 4. Two to four times per week 5. Once per day 6. More than twice per day
21.	How much **COFFE/TEA** do you have a day?	1. None/less than one cup 2. 1-2cups 3. 3-4 cups 4. 5-6 cups 5. More than 6 cups

22.	Which beverages do you usually drink between meals?	1. Water 2. Soft non-sugared drinks (like Ambo) 3. Soft sugared drinks (like Coca Cola) 4. Alcoholic Beverages 5. Fruit Juice

Part Four. Dietary Pattern Questionnaire

This section asks information about your USUAL dietary pattern during the last one year**.** As you answer these questions please think of a typical day in the last year (YOUR USUAL DIETARY PATTERN).

#	Questions	Possible choices/Answers
23.	Please tell us a bit about your USUAL food habit in a typical day?	1. Different every day 2. Different some days 3. Different only during weekend days 4. Very monotonous
24.	How many main meals do you eat per day in a typical day? (Breakfast, lunch, brunch and dinner)	_____ times per day
25.	How often do you eat Breakfast in a typical day?	1. Everyday 2. Most of the days 3. Rarely 4.Never
26.	How often do you eat Lunch in a typical day?	1. Everyday 2. Most of the days 3. Rarely 4.Never
27.	How often do you eat Dinner in a typical day?	1. Everyday 2. Most of the days 3. Rarely 4.Never
28.	How many times do you eat BETWEEN meals (Snacks) in a typical day?	_____ snacks per day
29.	How many meals (both main and snack) do you eat in the evening? (starting from 6 PM to bed time)	1. None 2. 1-2 meals 3. 3-4 meals 4. More than 4 meals
30.	Do you eat at night times because of sleeplessness or any other reason?	1. Yes 2. No
31.	At what time do you usually eat your last meal of the day?	_____ PM/AM _____ local time
32.	Do you have a habit of eating late during the night or between sleeps?	0. NO 1. YES
33.	If yes to above question, how often this happens in a typical week?	1. Everyday 2. At least 5 days 3. At least 3 days 4. Less than 3 days
34.	Do you consider yourself as a binge eater (frequent consumer of snacks)?	0. NO 1. YES
35.	What types of the listed foods do you prefer for snacking?	1. Egg Sandwich 2. Vegetable Sandwich 3. Sweet cookies and biscuits 4. Burger

		5. Pizza 6. Sugar Sweetened beverages 7. Fruit Juice 8. Injera					
Please read each statement and circle only one of the numbers 1, 2, 3, 4 or 5 which indicates the most accurate reply for the majority of your usual eating behavior. **Rating Scale: 1=Strongly disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree**							
	Low-fat eating						
36.	I am very conscious of how much fat is in the food I eat.	1	2	3	4	5	
37.	I carefully watch the portion sizes of my foods.	1	2	3	4	5	
38.	I choose healthy foods to prevent heart disease.	1	2	3	4	5	
39.	I use low-fat food products.	1	2	3	4	5	
40.	When choosing fast food, I pick a place that offers healthy foods.	1	2	3	4	5	
	Healthy Eating						
41.	Fish and poultry are the only meats I eat.	1	2	3	4	5	
42.	I eat meatless meals from time to time because I think that is healthier for me.	1	2	3	4	5	
43.	I have at least three to four serving of vegetables per day.	1	2	3	4	5	
44.	I try to limit my intake of red meat	1	2	3	4	5	
45.	I have at least three to four servings of vegetables per day.	1	2	3	4	5	
	Eating Out						
46.	I would rather but take-out food and bring it home than cook.	1	2	3	4	5	
47.	I eat out because it is more convenient than eating at home.	1	2	3	4	5	
48.	I hate to cook.	1	2	3	4	5	
49.	When I don't plan meals, I eat fast food.	1	2	3	4	5	
	Snacking						
50.	I snack two or three times a day.	1	2	3	4	5	
51.	I am a snacker.	1	2	3	4	5	
52.	I sometimes snack even when I am not hungry.	1	2	3	4	5	
	Sweet and Biscuits						
53.	To me, cookies are an ideal snack food.	1	2	3	4	5	
54.	I usually keep cookies in the house.	1	2	3	4	5	
55.	I have a sweet tooth.	1	2	3	4	5	
56.	I eat cookies or ice cream in place of dinner.	1	2	3	4	5	
	Emotional Eating						
57.	I eat when I am upset.	1	2	3	4	5	
58.	When I am in a bad mood, I eat whatever I feel like eating.	1	2	3	4	5	
59.	I eat for comfort.	1	2	3	4	5	

60.	If I am bored, I will snack more.	1	2	3	4	5
61.	I associate success with food.	1	2	3	4	5
62.	When I buy snack foods, I eat until I have finished the whole package.	1	2	3	4	5
63.	My emotion affects what and how much I eat	1	2	3	4	5
	Planning A Head					
64.	I take time to plan meals for the coming week.	1	2	3	4	5
65.	My eating habits are very routine	1	2	3	4	5
	Meal Skipping					
66.	If I eat a larger than usual lunch, I will skip supper.	1	2	3	4	5
67.	If I am busy, I will eat a snack instead of lunch.	1	2	3	4	5
68.	If I eat a larger than usual lunch, I will replace with a snack.	1	2	3	4	5
69.	I rarely eat breakfast.	1	2	3	4	5
70.	Instead of planning meals, I choose what is available and what I feel like eating.	1	2	3	4	5
71.	When I am upset I tend to stop eating	1	2	3	4	5
	Cultural/lifestyle Behaviors					
72.	I buy snacks from fast food restaurants.	1	2	3	4	5
73.	I stop for a fast food breakfast on the way to work.	1	2	3	4	5
74.	I have a serving of meat at every meal.	1	2	3	4	5
75.	On Sunday, I eat a large meal with my family.	1	2	3	4	5
76.	A complete meal includes a meat, a starch, a vegetable, and bread.	1	2	3	4	5
77.	I buy meat every time I go to the grocery store.	1	2	3	4	5

Part Five Physical Activity Questionnaire

In this section I am going to ask you about the time you spend doing different types of physical activity in a typical week, please answer these questions even if you do not consider yourself to be a physically active person. In answering the questions **'vigorous-intensity activities'** are activities that require hard physical effort and cause large increases in breathing or heart rate, **'moderate-intensity activities'** are activities that require moderate physical effort and cause small increases in breathing or heart rate.

#	Questions	Possible choices/Answers
	Recreational activities	
78.	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [**running orfootball**] for **at least 10 minutes continuously**?	0. NO 1. YES …..if No please go to 80

79.	If yes, In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?	_____days
80.	How much time do you spend doing **vigorous-intensity sports**, fitness or recreational activities on a typical day?	_____Hours _____Minute
81.	Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such **as brisk walking, /cycling, swimming, and volleyball/** for **at least 10 minutes continuously?**	0. NO 1. YES …..if No please go to 84
82.	If yes, In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?	_____days
83.	How much time do you spend doing moderate-intensity sports, fitness or recreational *(*leisure*)* activities on a typical day?	_____Hours _____Minute
	Travel to and from places	
84.	Do you **walk or use a bicycle (pedal cycle) for at least 10 minutes continuously** to get to and from places?	0. NO 1. YES
85.	In a typical week, on **how many days do you walk or bicycle for at least 10 minutes continuously** to get to and from places	_____days
86.	In a typical week, how much time did you spend **sitting** on a **week day**	_____hrs./day
	History of Raised Blood Pressure	
87.	Have you ever had your blood pressure measured by a doctor or other health worker?	0. NO 1. YES
88.	Have you ever been told by a doctor or other health worker that you have a raised blood pressure or hypertension?	0. NO 1. YES
	History of Diabetes	
89.	Have you ever had your blood sugar measured by a doctor or other health worker?	0. NO 1. YES
90.	Have you ever been told by a doctor or other health worker that you have a raised blood sugar level or diabetes?	0. NO 1. YES
	History of OSA	
91.	Have you ever experienced a breathing difficulty while you were sleeping?	0. NO 1. YES
92.	Have you ever been told by a doctor that you have an Obstructive Sleep Apnea (a breathing difficulty during sleep)	0. NO 1. YES
93.	If yes to the above question, how often you experienced this over the last one year period?	_____ times during the last year
94.	Weight: |___|___|___|.|___|___| kg	
95.	Height: |___|___|___| cm	
96.	Waist Circumference: |___|___|.|___| cm	

97.	BMI: |___|___|.|___| kg/m^2 (inform the participant about his BMI and WC status using the cutoff below) **BMI cutoffs for males:** Underweight: <18.3; Normal: 18.3 – 21.5 ; Overweight: 21.6 – 22.2 ; Obese: >22.2 **BMI cutoffs for females:** Underweight: <21.9; Normal: 21.9 – 23.0 ; Overweight: 23.1 – 24.5 ; Obese: >24.5 **WC cutoffs for Men:**>83.7 cm **WC cutoffs for Women:**>78.0 cm

Part Six. Behavioral Factors

This section asks information about your healthy behavioral practices**.** This includes things like smoking habit, drinking alcohol, khat chewing habit and electronic media use. Let's start with tobacco.

	Questions	Possible choices/Answers	Remark
	Tobacco Use		
98.	Do you currently smoke any tobacco products? Such as cigarettes, Cigars and shisha.	0. No 1. Yes If No please go to 68	
99.	Do you currently smoke tobacco products daily?	0. No 1. Yes	
100.	Have you smoked at least 100 cigarettes in your life time?	0. No 1. Yes	
	Alcohol Consumption		
101.	Have you ever consumed an alcoholic drink such asbeer, wine, spirits, fermented cider or any other locally available products?	0. No 1. Yes If no please go to 73	
102.	Have you consumed an alcoholic drink within the past 12 months?	0. No 1. Yes	
103.	Have you ever consumed an alcoholic drink within the past 30 days?	0. No 1. Yes	
104.	During the past 30 days, how many times did you have for **men: five or more** for **women: four or more** Standard alcoholic drinks in a single drinking occasion?	_____times	1 standard drink = -1 standard bottle of regular beer (285ml) or - 1 single measure of spirit (30ml) or - 1 medium size glass of wine (120ml) or - 1 measure of aperitif(60ml)
	Khat Chewing		
105.	Have you ever used chewing khat in your life?	-1. No 1. Yes	

106.	Do you currently chew khat?	0. No 1. Yes	
107.	During the past month, how many days did you chewed chat?	_____ days over the past month	
	Time Spent on Electronic Media		
108.	Please indicate how many hours a day do you usually watch TV (including videos)?	1. None at all 2. About half an hour. 3. 1-2 hours 4. 3-4 hours 5. 5-6 hours 6. 7 or more hours	
109.	Please indicate how many hours a day do you usually play PC-Games/TV-Games/Mobile-phone Games?	1. None at all 2. About half an hour. 3. 1-2 hours 4. 3-4 hours 5. 5-6 hours 6. 7 or more hours	
110.	Please indicate how many hours per day do you usually use a PC/Mobile phone for chatting online, surfing internet, writing email?	1. None at all 2. About half an hour. 3. 1-2 hours 4. 3-4 hours 5. 5-6 hours 6. 7 or more hours	

Part Seven: Sleep deprivation

The Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions. During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. When have you usually gotten up in the morning? _____
4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed) _____

5. During the past month, how often have you had trouble sleeping because you…	**Not during the past month(0)**	**Less than once a week(1)**	**Once or twice a week(2)**	**Three or more times a week(3)**
a. Cannot get to sleep within 30 minutes	0	1	2	3
b. Wake up in the middle of the night or early morning	0	1	2	3
c. Have to get up to use the bathroom	0	1	2	3
d. Cannot breathe comfortably	0	1	2	3
e. Cough or snore loudly	0	1	2	3
f. Feel too cold	0	1	2	3
g. Feel too hot	0	1	2	3
h. Have bad dreams	0	1	2	3
i. Have pain	0	1	2	3
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):	0 0	1 1	2 2	3 3
6. During the past month, how often have you taken medicine (Prescribed or "over the counter") to help you sleep?	0 0	1 1	2 2	3 3
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	0	1	2	3
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?	0	1	2	3
	Very good(0)	**Fairly good(1)**	**Fairly bad(2)**	**Very bad(3)**
9. During the past month, how would you rate your sleep quality overall?	0	1	2	3

Global PSQI Score: _____

Part Eight: Psychological Factors

DASS21

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 = Did not apply to me at all
1 = Applied to me to some degree, or some of the time
2 = Applied to me to a considerable degree, or a good part of time
3 = Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3