SCHOOL OF GRADUATE STUDIES

MAGNITUDE OF CAFFEINE CONSUMPTION AND ITS CORRELATION WITH PERCEIVED STRESS, SLEEP QUALITY, AND ACADEMIC PERFORMANCES OF UNDERGRADUATE STUDENTS AT WOLKITE UNIVERSITY

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Acronyms/abbreviation

Ach	Acetylcholine
CEQ	Caffeine Expectancy Questionnaires
CMQ	Caffeine Motivations Questionnaires
CAMP	Cyclic Adenosine Monophosphate
CYP	Cytochrome p450
GPA	Great Point Average
ICH/GCP	International Conference on Harmonization/Good Clinical Practice
NREM	Non-Rapid Eye Movement
PSS	Perceived Stress Scale
PSQI	Petersburg Sleep Quality Index
REM	Rapid Eye Movement
WUCMHS/ERC	Wolkite University College of Medicine and Healt Science /Ethical Review Committee

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ABSTRACT

Background:- *The caffeine consumption rate has increased dramatically due to the perceived benefits of caffeine in staying awake, mood improvement, and concentration. Although a substantial proportion of university students are affected by poor sleep quality and inappropriate caffeine consumption, they tend to use it and cope with their workload and stressful environment in spite of its adverse effects. Therefore, the study aimed to explore caffeine consumption as well as its correlation with perceived stress, sleep quality, and academic performance among undergraduate students at Wolkite University. A comparative cross-sectional study using a multi-stage stratified random sampling technique was applied to Wolkite University undergraduate students. Data was collected from 332 students through a self-administered questionnaire. The caffeine consumption questionnaire (CCQ), perceived stress scale(PSS), and Pittsburgh Sleep Quality Index(PSQI) were used to assess caffeine consumption, perceived stress, and sleep quality sequentially; also, academic performance was assessed based on self-reported cumulative grade point average (CGPA).*

Results:- *83.5% of study participants consume caffeine, with a mean total caffeine consumption of 214.6 ± 152.67 mg/day. High levels of caffeine consumption were found among students of health colleges than engineering colleges, and males consume more caffeine than females. The majority of participants showed moderate stress (67.7%), and 69.4% of them had poor sleep quality, with an average PSQI score of 6.52 ±2.446. The total average CGPA score was 3.19±.40527. A significant negative correlation was found between caffeine consumption and sleep quality (P=0.025) and also between caffeine consumption and academic performance (P=0.012), but the correlation between caffeine consumption and perceived stress is not statistically significant. (p=0.377) there is no difference between health and engineering colleges with respect to perceived stress, sleep quality, and academic performance.*

Conclusion:- *This study revealed a considerable magnitude of caffeine consumption, moderate perceived stress, and poor sleep quality levels among undergraduate students, with a significant positive association between them. Given these findings, it is imperative to design and implement appropriate programs and services to deal with the stressful environment and improve academic success.*

Key words: *caffeine consumption, perceived stress, sleep quality*

CHAPTER ONE

Introduction

Background of the study

Academic and emotional stress, tension, and worry are the most common reasons for the decreased duration and quality of sleep in college students (1). Stress is defined as the ‘‘wear and tear” the body experiences as it adjusts to pressure or a threatening situation(2). When these thoughts are going through a time due to some reason, and recognized as to be true it becomes perceived stress (2, 3). In the college population, stress can occur due to intrapersonal, interpersonal, environmental, and academic reasons (3). Although some studies have found that some level of stress has sound effects on physiological functioning and can facilitate the learning process (favorable stress), it is well documented that high levels of stress have adverse effects on the physical and mental health of students (distress or unfavorable stress). College students who have a high intake of energy drinks also had higher reports of “perceived stress” than their peers with lower “perceived stress.” Specifically, high levels of stress can affect cognitive functioning, level of concentration, sleep quality and academic performance(4). Available evidence suggests that poor sleep quality is highly prevalent among college students across the globe and is an emerging crucial public health problem. This problem has a significant association with stress (5). Inorder to cope with this stress, sleep loss, and be able to fulfill academic duties, students often rely on caffeine (6). Specifically during times of increased academic stress, college students have reported an increase in their caffeine intake (1). It means, students who had a high level of caffeine consumption had significantly higher mean scores of perceived stress than students with a low level of caffeine consumption (7).

Caffeine is a stimulant that acts on the central nervous system(8) and, the most internationally used psychoactive substance consumed daily by approximately 90% of individuals worldwide (9). Also its consumption has continued to increase over time (1). This intake comes from coffee, tea, soft drinks, energy drinks, chewing gum, and Other supplements (9). Their caffeine content ranges from 40 to 180 mg/150 ml for coffee, 24 to 50 mg/150 ml for tea, 15 to 29 mg/180 ml for cola, 2 to 7 mg/150 ml for cocoa, and 1 to 36 mg/28g for chocolate (10). Sources of caffeine

indicate inaccuracies throughout the studies, some claiming energy drinks rise to the top, others showing coffee and tea still being the significant majority(11).Study done in southern Ethiopia, shows the most caffeine source used was coffee and the amount of caffeine in the coffee samples ranged from (450.13 to 579.60 (mg/L) (10).

Caffeine contains several chemical components that may provide a health benefit to improve memory and alertness(12). Also in reducing dementia, insulin resistance in type 2 diabetes mellitus, Parkinson's disease, cirrhosis, and advanced hepatic fibrosis(13). However, FDA recommended to limit caffeine intake to 400 mg caffeine/day(14). But most students consumed three to five times than the recommended amount(15). This increased intake of caffeine for students derived from multiple reasons, such as the desire to feel awake, to enjoy the taste, to engage in the social aspects of consumption, to improve concentration and mood, and to increase physical performance (16). It is evident that the more caffeine people usually consume, the worse they sleep (17). Sleep is essential for basic functioning, including alertness, “handling emotions,” and “cognitive performance.” When an individual is not getting the necessary hours of sleep or has poor quality of sleep, their quality of life is reduced; sleep is a “predictor of illness” for the future (18).

Excessive caffeine consumption and forgoing sleep actually hinder academic achievements(19). However, students were unaware of the potential repercussions of these behaviors, associated with habits of excess caffeine consumption and sleep deficiency in academic achievement(20). Academic achievements are the “extent” of an individual’s success towards particular goals, which were the “focus of activities in instructional environments,” specifically in school, college, and university ((17). Research supports that students who stress and worry about academic performance may be more likely to experience poor sleep quality (21). Although Insufficient and non-restorative sleep has been shown to impact neurocognitive, psychological, and academic well-being; which is contrary to students’ beliefs (22). The poor academic performance associated with short sleep durations was linked to reduced concentration ability on educational matters, lower self-efficacy, and even possible psychological difficulties(23). This indicates that students' habits of caffeine consumption due to perceived stress are found to be an essential factor that requires universities to focus on effective stress management programs that could be useful for achieving better sleep quality and academic performance(24).

1.2 Statement of the problem

University education provides students with opportunities to grow intellectually and actualize their potential for the future(25). However, university life is not only, and certainly not always, stimulating and empowering. It can also be stressful and anxiety-producing(13). Studies indicate that there is a consistent relationship between stress, sleep quality, and academic performance among university students (26). A study in the United States reveals that 39.2% of students acknowledged that they had troubled sleeping because of persistent anxieties and academic stress(27). Tension and stress were found to be impactful factors in predicting sleep quality, with 20.1% of students reporting that stress had interfered with sleep at least once per week. Additionally, when asked to rate psychological factors that negatively influence sleep, college students reported that stress accounted for 64.8% of the factors influencing sleep(24). Specifically, during times of increased academic stress, 63% of college students have reported an increase in their caffeine intake (1). Besides, Factors like extensive curricula, numerous academic requirements, lack of familiarity with the academic system, language barriers, immersion in a new culture, difficulties in finding accommodation, and the loss of closeness to family and friends have been recognized as a risk factor of perceived stress in University students (28).

Do to their perceived stress and other reasons, college students, in particular, tend to consume high amounts of caffeine from numerous sources regularly by perceiving college as a stressful time in order to cope with this stress and meet the demands of their classes(29). In recent years caffeine consumption rate has increased worldwide dramatically due to its perceived benefits to enhance physical performance, boost cognitive functioning, and extend wakefulness (13). Beyond that, students may seek the benefits of caffeine to stay up late at night, study, complete assignments, stay awake in class or decrease physical exhaustion and increase mental alertness. Many studies have found that college students are consuming, on average, higher amounts of caffeine than recommended(12, 14, 20). A study done in north America shows students consume three times more than the recommended one(6) since their belief about caffeine prompts their use of caffeine as a study aid while stressed (7). Studies done on college students in Puerto Rico, Saudi Arabia, and Turkey showed that 49%, 49.5%, and 58.99% of them use caffeine as a coping mechanism for stress, respectively(8). Research in Saudi Arabia, Pakistan, India, and Texas

University students indicate caffeine consumption rates in their respective universities were 69.9%, 70.2%, 67%, and 74.4%, respectively(15). In Ethiopia, the results of the study at Jimma University show that 74% of students consume caffeine, and 49% of them consider caffeine helpful in coping with stress(5). However, This excess caffeine consumption can lead to caffeine intoxication and stress(30). A high level of stress was more evident among students who experienced caffeine intoxication symptoms than asymptomatic students (31).

A study of 120 college students in Northern Indiana about caffeine and wellness indicates the highest agreement for the statement, "Regularly consuming caffeine can have long-term negative effects on health"(6). In the same country, a study of 300 first-year students at a southeastern university found that 83% of students reported at least one indication of caffeine intoxication (17). In another study performed by Taylor at the University of Texas, 40% of college students surveyed had difficulty concentrating with caffeine cessation, 31% of students considered themselves addicted to caffeine, and 29% reported having experienced intense caffeine cravings (9). The crucial role of sleep in maintaining mental health, high-level learning, and general wellbeing has received considerable attention over the past decade (32). College students consume high caffeine as a coping mechanism in stressful times. Consequently, they develop poor sleeping habits, especially in the weeks preceding an examination(28). While sleep-deprived students might believe sleep deprivation is not detrimental to performance, results of studies suggest that sleep loss resulting from poor sleep quality has been associated with decreased visual motor skills, poor cognitive functioning, and false recall of recently learned words(4). It is possible that the frequency and amount of caffeine consumption impact sleep quality and its subscales(33). Notably, investigators have shown that caffeinated beverages have a dose-dependent negative effect on sleep onset, sleep time, and sleep quality(34). High-caffeine users in Massachusetts were found to have shorter sleep duration, more disturbed sleep, longer sleep latencies, more complaints of daytime sleepiness, and poor sleep quality when compared with low users(35).

When the assessment classified the component item of the sleep quality tool, about 136 (23.6%) of the students stated that their subjective experience of sleep quality was very bad. The use of medication for sleep three or more times a week was reported by 49 (8.5%) of the participants. According to this study, among a total of 576 students, 357 (62%) of medical students have poor

sleep quality. Regarding the sleep latency, about 156 (27.1%) of participants had sleep latency of 16-30 min. The median amount of sleep latency was 25 min, and only 65 (11.3%) of participants slept greater than 7 hours per night (36). This problem increases its strength in sub-Saharan Africa countries, in that the prevalence of poor sleep quality in Sudan was 62% which was consistent with the study conducted in Kenya 61.4%(20). Also, this study indicates an association between the consumption of any caffeine-containing beverages and poor sleep quality was statistically significant, in that 53% of students in the study were classified as having poor sleep quality (35).

The prevalence of poor sleep quality in the study among medical students in two different universities in Ethiopia was 74%. This high prevalence of poor sleep quality is comparable to the previous 76%, 77.1%, 78.8%, and 84% among Medical and Nursing students in Saudi Arabia, Iran, Portugal, and Canada, respectively. This high poor sleep quality in the study could be attributed to academic stress, which possibly influences or alters students' sleep habits. The study also indicated that fourth-year students and above had a lower likelihood of poor sleep than students in the second and third years (37).

University students are considered a population that is particularly prone to sleep-related problems, and their academic performances seem to influence and be influenced by sleep(34). Improved sleep quality benefits college students in their daily activities and health status. It has been shown to be a predictor of better academic performance(37). Students with inadequate sleep have a more significant occurrence of missed class related to physical illness and have poorer performance due to “episodes of falling asleep” during class(1). Poor sleep quality before exams has been shown to correlate with worse academic achievement. Similarly, hours of sleep acquired before exam time have been identified as a predictor of exam scores among medical students(38).

In a study done in a southwestern US university, 29% of college students reported grades were weakly (negatively) associated with sleep duration, suggesting that the quality, not as much quantity, of sleep is negatively correlated with academic performance via increased daytime sleepiness(39). Students who were classified as good sleepers were more likely to have higher mean CGPA as compared with those classified as poor sleepers(26). The finding of a study in Ethiopia among medical students in two different universities shows a significant association

between sleep quality score (as measured with PSQI) and academic performance. This is in agreement with prior studies conducted among college students elsewhere. Poor sleepers have more difficulty functioning during the day, and that affects their overall performance and concentration (24). To my knowledge, no data has been found that study this problem in the study area. However, the role of different factors on students' perceived stress, caffeine consumption, sleep quality, and academic achievement can vary from country to country also from university to university. Hence, assessing context-based associated factors is crucial. Moreover, most of the studies have been conducted in populations residing in North America, Europe, and Asia. Besides that, there was lack of data that investigates the relationship between caffeine consumption, stress, sleep quality, and academic performances of students, particularly in low and middle-income countries like Ethiopia (26).

In light of the noted gaps in the literature and given the increased marketing and consumption of caffeine across the globe, more research is needed on caffeine consumption and its effects on stress, sleep quality, and academic performance of university students. Therefore, this study addresses this gap by investigating magnitude of caffeine consumption and its relation with perceived stress, sleep quality, and academic performance among undergraduate students at Wolkite University.

1.3 OBJECTIVES

1.3.1 General Objective

The overall objective of the study will be to investigate the magnitude of caffeine consumption and its correlation with perceived stress, quality of sleep, and academic performance among undergraduate students at Wolkite University**.**

1.3.2 Specific Objectives

To determine the magnitude of caffeine consumption in undergraduate students at wolkite university

To depict the relationship between caffeine consumption and the perceived stress of undergraduate students at Wolkite University.

To ascertain the relationship between caffeine consumption and sleep quality of undergraduate students at Wolkite University

To find out the relationship between caffeine consumption and the academic performances of undergraduate students at Wolkite University

To investigate the difference in caffeine consumption, perceived stress, sleep quality, and academic performances among Health science and Engineering college undergraduate students.

1.4 Research Question

Based on the above-stated problems, the study addresses the following research questions.

1.4.1 What is the magnitude of caffeine consumption in undergraduate students at Wolkite University?

1.4.1.1 Is there a relationship between caffeine consumption and perceived stress among Wolkite University undergraduate students?

1.4.1.2 Is there a relationship between caffeine consumption and quality of sleep at Wolkite university undergraduate students?

1.4.1.3 Is there a relationship between caffeine consumption and academic performance at Wolkite university undergraduate students?

1.4.1.4 Is there a difference between Health and Engineering college students in caffeine consumption and its relationship with perceived stress, sleep quality, and academic performance?

1.5 Significance of the Study

The findings can contribute to the students by providing information about their caffeine consumption, whether it is beneficial or problematic in regards to perceived stress, sleep quality, and academic performances, and providing them with tools to better cope with it.

The study also provides some information for concerned organs found at various levels of management (University/Zonal administration/NGO) to understand caffeine consumption and its relation with perceived stress, sleep quality, and academic performances (positively/negatively) on students. Also, this study would be helpful to academicians and researchers who might be interested in pursuing research in the same area, especially in university students.

Since the topic is an understudied concern in developing countries like Ethiopia and the potential adverse health consequences associated with excessive caffeine consumption, more research is needed on caffeine consumption by college students.

Additionally, this study helped the researcher acquire knowledge and experience in doing a study and learning about the relationship between caffeine consumption on perceived stress, sleep quality, and academic performance.

1.6 Scope of the Study

The study uses institutional-based cross-sectional data to examine the relationship between caffeine consumption and its relation with perceived stress, sleep quality, and academic performance, which means the data was collected at one point in time. The study examined the relationship between caffeine consumption on perceived stress, sleep quality, and academic performance despite other factors that influenced or affected perceived stress, sleep quality, and academic performance. The study focused on dependent variables, perceived stress, sleep quality, academic performance, and the independent variable of caffeine consumption.

1.7 Strength and limitations

The current study contributes to researchers by indicating a relationship between caffeine consumption and perceived stress, sleep quality, and academic performance among university students. The study utilizes a cross-sectional design, Therefore, stress, academic performance, and sleep variables were collected at the same time point and inquired regarding the recent past. This factor limits the ability to draw causal inferences due to the nature of the study design, which cannot establish a temporal relationship between outcome and independent variables, moreover, recall bias may influence the validity of the findings since students had to remember their sleep quality and PSS to reflect on how they felt over the past 30 days. Difficulties in the measurement of caffeine consumption limit both the ability of researchers to accurately measure caffeine consumption from self-reports and to modulate their caffeine use with precision.

1.8 Operational Definitions

Undergraduate students: In this study, undergraduate students comprise all students who enrolled to attend their classes at Wolkite University in 2022/2023. and have at least one-semester grade point average.

Caffeine consumption: the amount of caffeine consumed in a cup/bottle/can from any caffeinated product by students in a given period, typically measured in milligrams per day. According to who recommendation, consumption above 400mg per day is considered excessive /abnormal.

Perceived stress:- the subjective experience of feeling overwhelmed, anxious, and having difficulty coping with the demands of university life and being aware of it. It is measured using the perceived stress scale measurement method and classified as low (0-13), moderate (14-26), and high (27-40) according to the score gained.

Sleep quality: This is how undergraduate students understood having good or poor sleep and perceived it (in regard to time to fall asleep, number of awakenings/ impaired sleep continuity, hours of staying sleep, early-morning awakening, subjective rating of feeling rested in the morning) It is measured using PSQI and classified as good (<5) and poor (5-21) scores.

Academic performance:- undergraduate student's grades in courses overall are measured by their CGPA each semester. Student's GPA is classified according to the grading system at Wolkite University (out of 4.0, the grades 3.5–4.0 are excellent, 3.0–3.49 are very good, 2.5-2.99 are good, 2.0-2.49 pass, below two is fail).

CHAPTER TWO

REVIEW OF LITERATURE

2. Introduction

This chapter aims to provide an overview of studies that have been previously conducted on caffeine consumption, stress, sleep quality, academic achievements, and associated factors.

2.1 Caffeine

Caffeine is a stimulant of the central nervous system and metabolism that is used for recreational and medical reasons, such as decreasing physical exhaustion and increasing mental alertness. Caffeine is present in nearly 100 species in 13 orders of the plant kingdom worldwide. Although it can be synthesized in the lab, caffeine is not an essential nutrient(7). Caffeine is present in many products, such as foods, beverages, and medications. It can be found in Camelia Sinensis, yerba mansa, tea, coffee leaves, cocoa, guarana plant seeds, and kola nuts; furthermore, caffeine can be found in several commercial nonalcoholic beverages, powders and capsules (9).

2.1.1 Absorption, Metabolism, and Excretion of Caffeine

Absorption

With a high bioavailability of 95–99%, caffeine is wholly absorbed in the gastrointestinal tract within 45 minutes; about 20% of caffeine is absorbed in the stomach, the rest in the small intestine, but can also be absorbed directly from the lining of the mouth(18). The half-life of caffeine is approximately four hours, which is related to the dose administered. Doses lower than 10 mg result in a half-life ranging from 2.5 to 10 hours; high doses result in a longer half-life, reaching peak serum concentration in less than two hours, distribution rates differ from person to person, depending on genetic factors and liver function (40).

The liver processes caffeine and allows its absorption into the bloodstream. Once absorbed, the caffeine is circulated throughout the body's "fluid and cells," including the brain, in which it is thought to move freely from blood to the brain, allowing effects on the central nervous system. Specific caffeine sources are absorbed more quickly, such as chewing gum, gel patches for the skin, and "vapor sticks," which are similar to e-cigarettes(16). Caffeine is responsible for the stimulation of gastric acid production as well as the relaxation of intestinal smooth muscles and the lower esophageal sphincter. It induces the small intestine to secrete more water and electrolytes, the main factor in diarrhea(1).

Metabolism

After absorption, caffeine then binds to plasma proteins, peaking approximately 15-120 minutes after ingestion. According to Gropper, caffeine "increases blood flow to the kidneys" and "stimulates" the adipose tissue to release fatty acids." The specific actions of caffeine metabolism are mainly associated with microsomal cytochrome P450 enzymes, which are responsible for clearing 95% of caffeine; the enzyme responsible for metabolizing and carrying caffeine to the liver is called CYP1A2(7). In the liver cell, the first step on the caffeine degradation pathway involves demethylating and transformation into theophylline (1,3 DMX), theobromine (3,7 DMX); the primary metabolite of caffeine is taraxanthine (1,7 DMX), which has potent biological effects via the enzyme CYP1A2 (16).

Excretion

The liver is the organ excreting the caffeine metabolites, with only 11 2% of non-metabolized caffeine being excreted by the kidneys. About 70% of a caffeine dosage is restored in the urine, and 2–3% is excreted unchanged in the urine. In addition, 2–7% is excreted in the feces over 48 hours after caffeine consumption; the compounds excreted with the feces include the following: 1, 7-dimethylxanthine (44%); 1-dimethyluric acid (38%); 1, 3-dimethyluric acid (14%); 1,3,7-trimethyluric acid (6%); and only 2% of caffeine (13).

2.1.2 Action Mechanism of Caffeine

Caffeine is a psychoactive substance with stimulation properties and the capability of reducing adenosine transmission in the brain. It interacts with neurotransmission in various parts of the brain, promoting behavioral functions. After oral ingestion, caffeine is distributed to tissues in the body and broken down into metabolites with pharmacological actions(14).

It can, moreover, easily cross the blood-brain barrier and act as an antagonist to adenosine receptors found in the brain, cardiovascular system, respiratory system, gastrointestinal system, kidneys, and adipose tissues. Adenosine in the brain is an inhibitory neurotransmitter, promoting sleep and suppressing arousal, reducing functions of nervous activity; in the heart, it causes dilation of the coronary blood vessels, increases blood vessel diameter in the peripheral organs, and decreases heart rate. The role of caffeine is to prevent adenosine from inhibiting cAMP production, which increases heart rate and metabolic rate. The overconsumption of caffeine may, therefore, cause serious diseases and even death(41).

2.1.2 Sources of caffeine

Over 60 species of plants contain caffeine, cocoa, coffee beans, and tea are the most "commonly cultivated," while Guarani, kola nuts, and yerba mate generally have their caffeine removed and used as an additive in commercial products (20).

2.1.3 Coffee

The most popular sources of caffeine in colleges are coffee, soda, tea, and chocolate, other sources consumed also energy drinks and other food products. Alcohol mixed with caffeinated beverages is also common in college students, where 41% of college students reported coffee as being the most challenging source of caffeine to give up. The percentages of college students' daily coffee use are sporadic in the literature, ranging from 57 to 71% for 18-24 year olds (1). When comparing genders, a seven-day beverage recall of college students found that females consumed more hot coffee (37% female; 32% male) and more specialty coffee drinks (25% female; 16% male) than males. The actual caffeine content of coffee can vary greatly depending on the environment the coffee was grown and the roasting, brewing, and grounding methods (42). The most popular types of hot coffee drinks are Americano, brewed coffee, espresso, cappuccino, macchiato, latte, flat white, and mocha. One of the brewed coffees is known as decaffeinated, or decaf, which has the lowest caffeine content(16).

2.1.4 Tea

Tea is the second most popular beverage containing caffeine. All types of tea originated from the same plant, the Camellia sinensis plant. Camellia sinensis originated in southern China thousands of years ago. It has two main varietals: camellia Sinensis and camellia Sinensis assmica; the first grows in China, the other in India(8). The wide variety of teas includes black tea, green tea, white tea, matcha tea, oolong tea, pu-erh tea, and purple tea. Each one of these types has its characteristics and processing method(7). The daily caffeinated tea consumption in the college population varies, with sources reporting 12% up to 54%. In a study, 27% of college students drank hot tea, 25% drank flavored iced tea, and 14% drank unflavored tea in the previous seven days. Females tend to consume more hot tea per week than males (22% female; 16% male) (20).

2.1.5 Energy Drinks

The energy drinks market has grown exponentially; many brands are now marketed in a variety of sizes, like teenagers and young adults frequently consume Red Bull, Monster, and Rockstar. They are marketed with claims of providing energy and maintaining alertness, moreover, promoting weight loss through energy expenditure to target primarily young individuals (11). These energy drinks contain caffeine and other legal stimulants, which include B vitamins, panthenol, carbohydrates, glucuronolactone, and others. They contain high doses of caffeine ranging from 50-505 mg per can (2).

Other products that contain caffeine include caffeinated gums, chocolate or mocha-flavored products, or products containing coffee or chocolate. This may include ice cream/frozen yogurt, baked goods, puddings, and candy bars. A seven-day recall shows that 45% of university students consumed cookies/pastries, 38% consumed ice cream/frozen treats, and 32% of students consumed candy bars(33). The caffeinated gum called Stay Alert Military Caffeine Energy Gum is often used in the military to keep soldiers awake and more alert during long

operations/missions, with one pack of gum containing five pieces, each containing 100mg of caffeine. Caffeine in the gum form allows for a much more rapid absorption (five times faster) than caffeinated beverages or foods(19).

2.1.6 Intake of Caffeine Sources in the College Population

Caffeine is not a nutrient, therefore, not essential in the diet. The current Dietary Guidelines state that non-caffeine consumers are "not encouraged" to add caffeine to their regular, daily diet. The recommendation is to limit caffeine to low- moderate intakes(8).

Studies and reports vary in their "classifications" of what is considered "low," "moderate," and "high" caffeine doses and intake. Overall, it is stated that single doses of caffeine <200 mg (two cups of coffee or less) are considered non-harmful in adults(29). Caffeine intake between 20 and 200 mg has been noted to increase "well-being, happiness, energy, alertness, and sociability". Doses up to 2 µg/ml are considered low and stimulate the central nervous system(7). Moderate intake has been described as 250-750 mg/day, Five cups of coffee a day (<400 mg) or five soda or tea beverages that contain caffeine (110-345 mg/day). The general findings are that caffeine can have a positive effect on individuals with the consumption of 200-300 mg/day. In some individuals, caffeine intake greater than 200 mg/day can cause adverse side effects, such as jitteriness, anxiety, nervousness, and upset gastrointestinal discomfort(1).

2.1.7 Performance-related caffeine expectancies

In research done on 418 undergraduate students, sixty percent of students believe caffeine enhances performance and that these beliefs are related to consumption behavior (42). For example, the "acute positive effects" subscale of the CEQ contains three items related to cognitive/performance enhancement: "I pay attention more efficiently," "I think more clearly," "Caffeine helps sharpen my memory" (18). Similarly, the "energy/work enhancement scale" contains various items related to performance enhancement, including "Caffeine helps me work over long periods," and "Caffeine increases my motivation to work"(33). Students engage into regular consumption of caffeine with the expectation that it "Help with study or work," "Improve performance," "Improve concentration." In the study, expectancies of improved performance with caffeine were positively related to average daily caffeine consumption (42).

2.1.8 Benefits of caffeine

2.1.8.1 Caffeine as Stimulant

Caffeine interacts with the neurotransmitters in different regions of the brain, promoting behavioral functions, such as increasing attention, reducing fatigue, enhancing performance in physical and psychomotor tasks, and enhancing mood. It can antagonize adenosine receptors safely and cross the blood-brain barrier easily, in addition to the therapeutic potential in the central nervous system(30).

Its ability to enhance motor activity has received considerable attention because of its effect on neurotransmission within the basal ganglia. A group of subcortical nuclei involved in many aspects of motor control (13). Caffeine acts on striatal medium spiny neurons to stimulate motor activity control. Upon consumption of caffeine, it results in the release of catecholamine, which is a hormone that includes dopamine, epinephrine (adrenaline), and norepinephrine. These neurotransmitters help the body respond to stress and prepare for any "fight-or-flight" reactions(16).

When caffeine and acetylcholine (Ach) precursor choline are "administered together," short-term memory retention increases in rats by "increasing the "synthesis" of the Ach neurotransmitter (1). Besides its stimulation of the central nervous system, caffeine also stimulates other body organs, resulting in specific physiological effects, further mor caffeine impacts peripheral tissues, including skeletal muscles. For that reason, it has been used in the preparation of ergogenic supplements for use during exercise. In addition, direct stimulation results in an effect on the heart upon consumption of substantial doses. Stimulation of motor activities results in faster work and fewer errors, and caffeine can help prolong the stamina needed for more extended periods of exercise at greater power(9).

2.1.8.2 Attention Enhancement

Consuming caffeine has beneficial effects on attention, especially in tasks that involve simple attention, such as simple reaction time, and tasks that require sustained response. Cognitive performance usually involves attention, which appears to be improved by caffeine. Attention is essential for cognitive processes, such as memory and reasoning, because it allows the brain to deal with substantial amounts of information (36).

The information that the brain receives from sensory impressions derives from hearing, vision, and cognitive processes like memory. Several researchers have investigated the effect of caffeine on attention(8). Improvements in vigilance and information processing mediate the effects of caffeine on complex attention because it can improve the processes of motor responses, caffine improves both complex and straightforward task performance (18). A recent review study showed that caffeine consumption has positive effects on accuracy in a variety of simple tasks; moreover, caffeine (200–400 mg) significantly improved simple responses like speed and accuracy at the same time(20).

Caffeine was found not only to have positive effects and increase attention in simple task performance, but it also enhanced high-order processes, active monitoring and behavior, task switching, response inhibition, and interference. Thus, caffeine exerts its effects on brain processes, resulting in improvements in both simple and complex attention tasks (16).

In another study, it has been suggested that caffeine's benefit in task performance is limited to "simple and moderately complex tasks," in which caffeine used for more complex tasks may worsen performance(14).

2.1.8.3 Mood improvement -Some research indicated an improvement in mood and feelings of well-being in moderate doses of caffeine. It has been proposed that this mood improvement may be related to the "anticipated" effects of caffeine or the reversal of withdrawal rather than the actual mechanism of action(16).

Other studies have also found no effect of caffeine on positive mood alterations at 100 and 200 mg dosages. However, individuals who ingested a high dose of caffeine reported positive mood changes. It is suggested that the lack of findings in the elevation of mood during caffeine administration may be due to the "masking of negative moods" as a result of caffeine withdrawal(20).

2.1.8.4 Managing neurological disorder -Caffeine is known as the best psychoactive stimulant, resulting in the improvement of cognitive function as well as protection against cognitive impairment and dementia. It promotes cognitive processes, which involve memory, attention, executive functions, perception, language, psychomotor functions, and arousal (8).

Several researchers have suggested that caffeine intake may protect and reduce the risk of Alzheimer's disease and Parkinson's disease. The Canadian Study of Health and Aging reported that daily consumption of coffee decreased the risk of Alzheimer's disease by 31% during five years of following up, also. Reports from a recent study have also shown that patients who consume (>277.5 mg/day) of caffeine were less likely to have any neuropathy or logical diseases (16). Many studies have shown a positive association between coffee consumption and reduced risk of Parkinson's disease: Regular caffeine consumption is protective against Parkinson's disease(17). This is thought to be caused by the antagonist effect on the adenosine A2A receptor, increasing cortical dopamine to increase motor performance and working memory in those with Parkinson's disease(16).

2.1.9 Adverse effects of caffeine

2.1.9.1 Sleep disturbance: Caffeine has been shown to cause sleep disturbances even in low doses. Sleep disturbances include delayed sleep onset, reduced sleep time, increased amounts of light sleep, and an increased number of spontaneous awakenings(36). Individuals who use caffeine frequently tend to have more sleep disturbances than those who do not use caffeine(33).

2.1.9.2 Caffeine Overdose -High doses of caffeine may lead to overdose and toxicity, with symptoms being restlessness, excitement, sleeping difficulties, frequent urination, and headaches. Approximately 83% of college students reported having one or more of these toxicity symptoms(1). Overconsumption of caffeine can produce adverse outcomes affecting dental integrity, and drinking with high sugar can cause cavities; that, combined with low pH, has been associated with a 2.4-fold increase in erosion of the teeth(18).

2.1.9.3 Caffeineism is when high doses, around 1000-1500mg, of caffeine are consumed, leading to "a pharmacological state of acute or chronic toxicity" and causing a "physical dependence" on

caffeine. Symptoms of caffeinism include difficulty sleeping/insomnia, agitation, excitement, and “rambling thoughts and speech”(43).

2.1.9..4 Caffeine withdrawal:- Research suggests that caffeine may cause dependency because of its natural component as a stimulant, therefore leading to withdrawal symptoms. Individuals who began consuming caffeine daily showed distinct “effects on the body” in less than a week. Common symptoms of caffeine withdrawal include headaches, nausea, vomiting, depression, irritability, inability to sleep, confusion, anxiety, tremors, and fatigue(43). Other symptoms listed included fatigue, drowsiness, unable to concentrate, gastrointestinal disturbance, nervousness, aggression, hot flashes, heart palpitations, and increased blood pressure(3).

In a study performed by Traylor & Summers, 40% of college students surveyed had difficulty concentrating with caffeine cessation, 31% of students considered themselves addicted to caffeine, and 31% reported having experienced intense caffeine cravings. It has been proposed that the relief of this caffeine withdrawal causes the perceived benefit of mood improvement(1). Tolerance may occur in individuals who habitually and chronically consume caffeine (10).

2.1.9.5 Cardiovascular effect -Caffeine may also cause cardiac arrhythmias, headaches, and increased homocysteine levels. High doses of caffeine can result in more severe side effects, including increased heart rate, convulsions, nausea, vomiting, and “increased respiration” (13). A 2014 review of cardiovascular incidents after ingestion of energy drinks from Goldfarb et al. found significant increases in heart rate and arterial blood pressure after energy drink consumption, attributed to the ergogenic effects of caffeine in energy drinks(18).

A study conducted by Passmore, Kondowe, and Johnston found that 360 mg of caffeine administered to healthy male adults resulted in an increased systolic and diastolic pressure and a late increase in heart rate (three to four hours after administration). The increase in systolic pressure was dose-dependent, while the diastolic was not(17). Individuals with no tolerance to caffeine may experience temporary spikes in blood pressure, while regular or chronic users do not experience these same elevations in blood pressure or heart rate. However, there is contradicting evidence of caffeine’s correlation between heart attacks and hyperlipidemia (14).

2.1.9.6 Osteoporosis -Caffeine is also thought to play a role in the development of osteoporosis, especially in cola beverages(18). Calcium’s absorption by the kidney is decreased after caffeine intake, leading to “increased urinary losses.” It is also thought that caffeine consumption may increase the secretion of calcium in the gut, leading to further calcium loss(17).

2.2 Stress

Several international studies showed that students have high levels of stress, which is defined as a state of psychological and physiological imbalance resulting from the difference between situational requirements and the individual‘s ability and motivation to meet those needs (15). A large body of evidence support the rising incidence levels of stress among medical students(8).

Medical fields are considered to be stressful areas of education due to the high academic requirements and demanding professionals. Various factors contribute to this situation, including academic overload, overnight on-call duties, contact with diseases and deaths, frequent examinations, and comprehensive curricula. Furthermore, these students face multiple stressors outside their medical school: physical, social, emotional, and family problems(13).

Poor health behaviors were also related to high-stress levels; students who experienced higher stress consumed more unhealthy food, were less likely to get exercise, and were more likely to get inadequate sleep. Consequently, physical, mental, behavioral, and academic difficulties were the cost of stress for students(6).

Social and academic demands are among the many stressors college students experience, and this stress and worry are associated with irregular sleep-wake patterns(44). In a study looking at 40 potentially stressful situations faced by college students, including academic, environmental, interpersonal, and intrapersonal stressors, results indicate that change in sleeping habits was identified as one of the top five sources of stress(26)

2.2.1 Stress-related caffeine expectancies

Evidence from the literature related to caffeine expectancies suggests that some caffeine users perceive caffeine as instrumental in dealing with stress. A survey of a sample of college students found that 49% considered caffeine valuable for coping with stress, and 42% planned to use caffeine as a stress-coping tool in the future(42).

As Amalgahli explained, Stress relief motives are represented in two of the four subscales of the validated Caffeine Motives Questionnaire. Items “to help deal with stress in my daily life” and “to help deal with anxiety” are the highest loading items in the negative affect relief subscale, which correlated with caffeine consumption(15). The item “to help relax or calm down” is part of the reinforcing effects subscale, which correlated with caffeine consumption. The mood effects subscale of the CEQ also contains three items related to the calming or relaxing effects of caffeine(20).

2.2.2 Stress as a predictor of caffeine consumption

Several cross-sectional and longitudinal studies have examined the link between stress and caffeine consumption in daily life. The cross-sectional studies examined the relationship between typical stress levels and habitual caffeine consumption and have produced mixed results(42). In a study on stress and energy drink consumption among college students, perceived stress during the past month was positively related to many energy drink consumption parameters, including the number of days on which at least one energy drink was consumed during the past month (4).

Two studies have taken a different approach, simply asking participants about changes in their typical caffeine consumption during stress, with just over half reporting increased consumption

during stress in both studies. While laboratory studies have shown little evidence that caffeine has any appreciable effect on perceived stress, research on caffeine expectancies shows that some individuals expect a calming effect from caffeine consumption(44).

2.2.3 Stress as a predictor of sleep quality

Tension and stress were found to be impactful factors in predicting sleep quality, with 20.1% of students reporting that stress had interfered with sleep at least once per week. Additionally, when asked to rate psychological factors that negatively influence sleep, college students reported that stress accounted for 64.8% of the factors influencing sleep. These findings support that academic stress can result in poor sleep quality, which may also result in decreased academic performance. Research supports that students who stress and worry about academic performance may be more likely to experience poor sleep quality (21).

2.3 Sleep

It is a repeated natural state of body and mind, with diminished consciousness inhibited sensory activities of voluntary muscles and reduced external stimuli. It is also deceptively complex behavior. While sleep appears to be a simple process in which individuals lie down, close their eyes, and merely go to sleep, instead, it can be laden with difficulty. It is an indispensable necessity of humankind, imperative for sustaining the quality of life and well-being of all ages(14).

2.3.1 Sleep-related caffeine expectancies

Studies found that students who endorsed caffeine consumption expect social/mood enhancement from caffeine use. For example, “caffeine helps calm me down,” “drinking caffeine is good for dealing with boredom,” “caffeine makes me feel happy,” and “I feel more sociable after having caffeine”(42).

2.3.2 Theoretical Functions of Sleep

According to Hobson 1995,For most healthy humans, about one-third of their lives are spent sleeping. Sleep appears to have restorative properties. Compared to quiet wakefulness, the metabolic rate is about 9% lower, and accumulated tissue restitution and neutralization of neurotoxins appear to occur during sleep(27). However, the exact purpose of sleep remains unclear. Several theories involving nervous system development, neurotransmitter replenishment, and memory reinforcement and consolidation have emerged during the last several decades(30).

Developmental theories suggest that REM sleep facilitates the nervous system. Developmental theorists suggest that REM sleep allows the brain to rehearse future behaviors and increase the strength of neural pathways for future use(38).

According to the neurotransmitter replenishment theory, specific nerve cells obtain a resting period during sleep that allows the regeneration of neurotransmitters (29). Most neurons show a slight decrease in activity during sleep, with some entirely ceasing to fire, particularly during REM sleep. Aminergic neurons stop firing during sleep and release norepinephrine and serotonin, which appear to have a significant function in attentive learning and memory. Neurons continuously fire during waking hours and possibly have limited quantities of neurotransmitters that become depleted(27).

Learning theories postulate that the primary function of sleep is memory consolidation and reinforcement. Though research indicates that learning does not occur during sleep, sleep loss appears to hamper daytime learning(24). While studies have not delineated exactly how memory is organized, learning theorists suggest that new memories result from the creation of new neural pathways in the brain. Neurons that are involved when new information or experience is obtained increase synaptic strength, and as a result, fewer impulses are required for the post-synaptic neuron to fire (23).

2.3.3 Effect of poor sleep on College Students

The effects of poor sleep on college students have been demonstrated in several areas. Graduating from high school and entering college is a significant life transition for young adults. For many, going away to college represents the first time that they, away from family and friends, are responsible for their behavior. No one is there to tell them to get up in the morning, go to class, eat right, or go to bed at night. Many choose to alter lifestyle habits after entering college, and one of the most frequently altered habits is that of sleep (34).

Adjustment to college life can be a difficult transition for some students. The absence of the support and structure of family life can make separation from home particularly difficult, especially if students have not been adequately emotionally prepared by their parents(36). Although most enjoy their new freedom and autonomy, they nonetheless are exposed to significant academic and social demands(32).

In addition, students must adjust to new conditions, such as living in a residence hall for the first time, making new friends, and adjusting to college academic demands, Choices must be made regarding times to eat, study, and sleep(27). With all these new challenges of college life, it is little wonder that students may suffer from sleep difficulties. Research has shown that college students tend to suffer from sleep problems more often than the general population(24).

Although there have been few studies conducted on the sleep difficulties of college students, the findings have been significant (21). A survey of Australian college students found the two most common sleep problems were difficulty falling asleep (18%) and difficulty staying asleep (9%) (22). Almojal revealed only 36% of a college student sample reported being free of sleep disturbances, while over 30% reported sleep difficulties occurring frequently ” or “always’’ (28).

Studies found that 44% of a sample of Taiwanese first-year college students reported sleep difficulties, with insufficient sleep being the most common complaint (3). Class scheduling most often determines wake times. Students with morning classes tended to have more significant changes in wake times from weekdays to weekends with less time spent during the week(33). Students may stay up late at night to socialize or to study. Some students report staying up for 24-48 hours to study for exams; unfortunately, this may backfire on students since sleep deprivation significantly impacts psychomotor performance(29).

Even partial sleep deprivation, in which individuals sleep 5 hours or less, produces functional impairment. When students spend less time sleeping during the week, they may try to "catch up" on their sleep by sleeping later on the weekends(33). This type of sleep pattern may lead to a circadian rhythm disorder and can occur when sleep onset and wake times are delayed by 3 to 6 hours. Students may sleep later on Saturday morning to "catch up" on sleep lost during the week. Then, they may stay up later Saturday night to socialize or simply because they find it difficult to fall asleep due to the late wake time that morning. They may follow a similar pattern on Sunday, and by Monday morning, they likely experience a sleep phase shift. When they return to a regular schedule of getting up for morning classes on Monday, they may experience excessive morning sleepiness and difficulty falling asleep at night(27).

2.3.4 Sleep and Health

Studies have shown associations between sleep difficulties and various physiological illnesses. For example, sleep loss appears to adversely affect the average growth and, development, and maintenance of a healthy immune system. Protein synthesis and growth hormones, which are at their highest levels during REM sleep, have a significant function in physical growth(34). Additionally, a reduction of up to 50% in natural killer T-cells, which are critical to the immune system in combating infection, has been found in individuals who get less than six hours of sleep(27).

Disordered breathing frequently is related to sleep difficulties and physical health problems. Breathing problems during sleep are usually associated with sleep apnea, which involves obstruction of the airway during sleep along with not getting adequate oxygen and consequently waking up several or many times during the night(38).

2.4.5 Insomnia, a subjective complaint of inadequate sleep, is a symptom of underlying problems related to sleep loss. The timing of insomnia is significant and defined by three classifications: (a) delayed sleep onset, (b) impaired sleep continuity, and (c) early-morning awakening. Insomnia is known to be related to various medical conditions, including disorders of the cardiovascular, gastrointestinal, renal, respiratory, and musculoskeletal systems(22).

Insomnia is a common sleep disorder with prevalence estimates ranging from 15% to 20% for chronic insomnia and from 30% to 40% for occasional insomnia. Insomnia has been shown to have a detrimental impact on mood, relationships, physiological health, and general

psychological well-being(27). College students who experience insomnia may be unaware of the stimulant effects of nicotine and may benefit from drug education(31).

Researchers have found associations between sleep habits and social as well as psychological health. For example, poor sleep quality in pre-adolescents has been related to poor mental health and irregular sleep schedules in young adults have been associated with lower sociability, achievement potential, self-control, and intellectual efficiency(24). Moreover, college students rated as psychologically healthy reported more depressive and anxious symptoms, higher interpersonal reactivity, higher social discomfort, increased somatic complaints, and more obsessive-compulsive tendencies following only one night of poor sleep. Fewer mental and social health difficulties have been reported by college students who reported falling asleep faster and having fewer sleep disturbances(32).

2.3.5 Sleep variation, deprivation, and reduction

Studies have revealed numerous detrimental effects of poor sleep quality and habits in college students. While most early sleep research focused on sleep quantity, more recent evidence points to sleep quality as being related more significantly to detrimental effects of sleep disturbances and a more consistent predictor of mental and physical health(5).

Sleep quality is generally understood as consisting of the components related to a good night's sleep (e.g., time taken to fall asleep, number of awakenings, and subjective rating of feeling rested in the morning). Regardless of the underlying reason for inadequate sleep, humans experience the consequences of poor sleep beyond fatigue and sleepiness. Research has demonstrated that humans of all ages experience adverse physiological, psychological, and cognitive outcomes as a result of inadequate sleep(25).

Adult sleep deprivation studies suggest that the loss of just one night of sleep significantly impacts cognitive functioning, affecting decision-making and logical reasoning in adults(28). Significant declines in cognitive performance have been associated with 24 or more hours of sleep deprivation. Sleep deprivation appears to increase suggestibility and negatively affect psychomotor reactivity, as well as short-term memory(38). Sleep deprivation also appears to harm student metacognition, For example, sleep-deprived students reported significantly higher levels of self-rated concentration and performance on cognitive tasks compared to non-sleep-deprived students(24). For example, sleep-deprived students reported significantly higher levels of self-rated concentration and performance on cognitive tasks compared to non-sleep-deprived students, even though sleep-deprived students performed significantly worse than students not sleep-deprived. While sleep-deprived students might believe sleep deprivation is not detrimental to performance, the results of the study suggest that it is similar(40).

Sleep loss resulting from poor sleep quality has been associated with decreased visual motor skills, poor cognitive functioning, and false recall of recently learned words(22).

2.3.6 Effects of Drugs on sleep

Though sleep medications may help the user fall asleep or maintain sleep, pharmacological treatments have failed to demonstrate effectiveness in treating long-term sleep difficulties(38).

Alcohol is another drug used by college students that impacts sleep. Alcohol use is heaviest within the age range of 18-24 years. College students have been found to consume more alcohol than their nonstudent peers. Over 40% of college students misuse alcohol by engaging in heavy episodic drinking.

Alcohol is likely the most commonly used sleeping aid in the general population. Students who drink alcohol may think it has positive benefits because they fall asleep faster and may sleep longer; however, alcohol inhibits REM sleep. Students who admit to drinking more alcohol also fall asleep in class more often than those who drink less(31).

Instead of taking sleep medications to obtain better sleep, some students use stimulants to stay awake during the day. Caffeine is the stimulant most commonly used found that 42% of a sample of college students drank coffee, while 29% drank tea regularly(33). One cup of brewed coffee contains about 100-150 mg. of caffeine. Tea contains around 60-75 mg/cup. A 12-oz cola contains 40-75 mg. The normal duration of caffeine effects in adults is 3-5 hours; however, some people experience caffeine effects for up to 14 hours. The timing of caffeine intake and individual differences in sensitivity are salient when determining the effects of caffeine(15).

2.4. Sleep and academic performance

Poor sleep is proven to have an impact on students' academic endeavors and general health. Due to the great demands and stresses of college and graduate school, it is not surprising that many students sacrifice sleep and substitute caffeine for the sake of their academic performance (36). Even though some university students are conversant with health repercussions associated with poor sleep quality, a substantial proportion fail to prioritize sleep health over their academic tasks or conclude their health to be at risk(22).

Existing evidence suggests an association between sleep and GPA. Students who obtained more sleep (long sleepers, ≥9 hours) had higher GPAs than short sleepers (≤6 hours): GPAs were 3.24 vs. 2.74 on average, respectively. More evidence exists to support an influence of sleep qualities rather than sleep duration on GPA. High academic performers instead showed earlier bed and rise times, though with similar overall total sleep time. No difference was present between the two groups with regard to morning preference(38).

Bedtimes were also influential, with later bedtimes associated with lower GPAs. Total sleep time or circadian factors were not evaluated. These results do not explain why an earlier rise time was associated with better grades; it could arise from the sleep schedule itself, but many potential confounders exist(36). For example,in some studies early risers may be more motivated or organized. Another possibility is that negative influences arise when students who have a

nocturnal preference are unable to wake up earlier. In a study of medical students, subjects with an evening preference had a more irregular sleep pattern than students with a morning or indifferent-type preference(20).

Despite growing evidence of the relationships between sleep, learning, and memory, a direct connection between learning and GPA has not yet been established(25). A student's GPA is not just an indication of learning but instead involves a complex interaction between the student and their environment. Intelligence, motivation, work ethic, personality, socioeconomic status, health problems, current and past school systems, course load, academic program, and test-taking abilities all may influence GPA(38).

In most studies, stress, sleep disturbances, anxiety, and depression are among the top 5 threats to academic achievement among college students(17). Generally, sleep difficulties have been associated with significantly impaired academic performance(27). The poor academic performance associated with short sleep durations was linked to reduced concentration ability on educational material, lower self-efficacy, and even possible psychological difficulties(23).

2.5 conceptual frame work

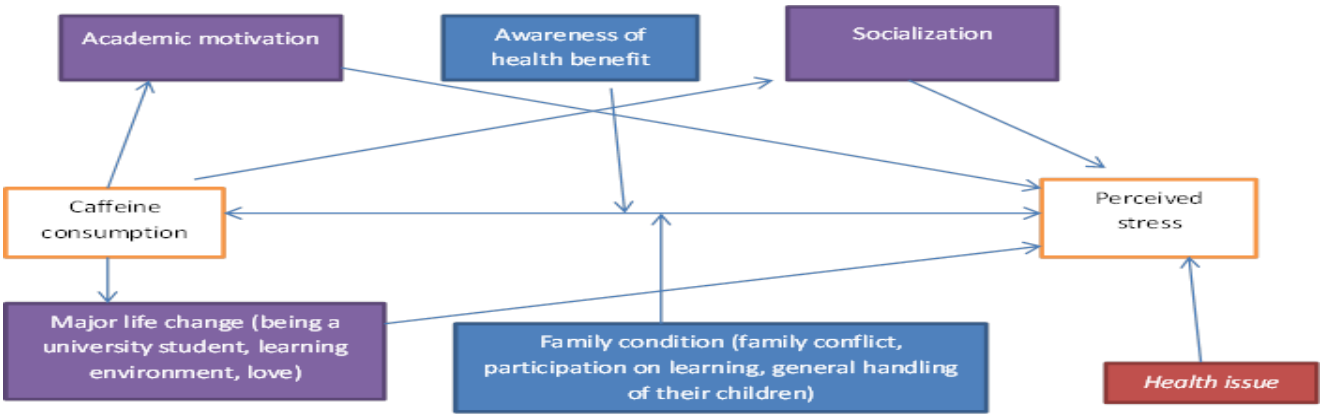


Figure 1 Conceptual framework on the relation of caffeine consumption and perceived stress

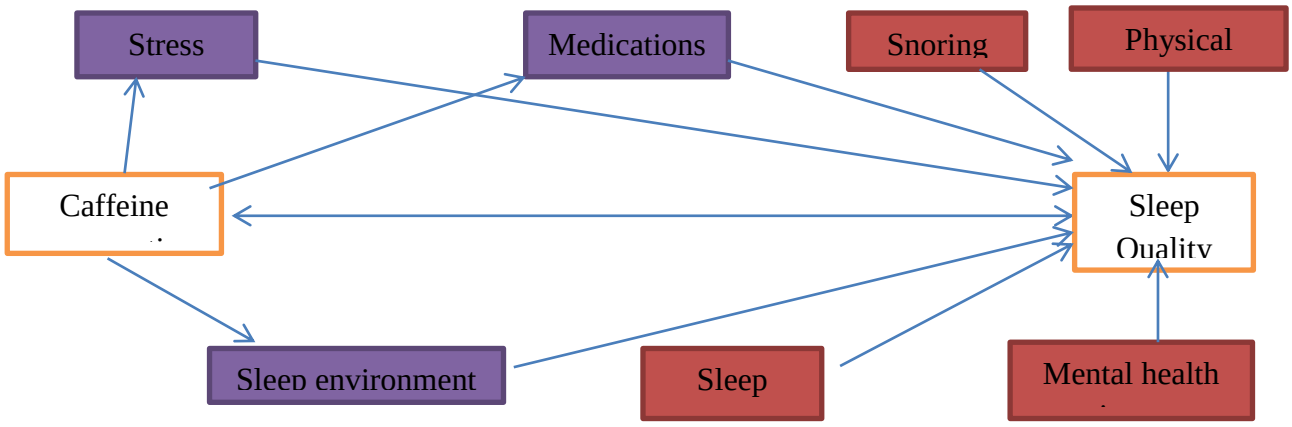


Figure 2 Conceptual framework on the relation of caffeine consumption to sleep quality

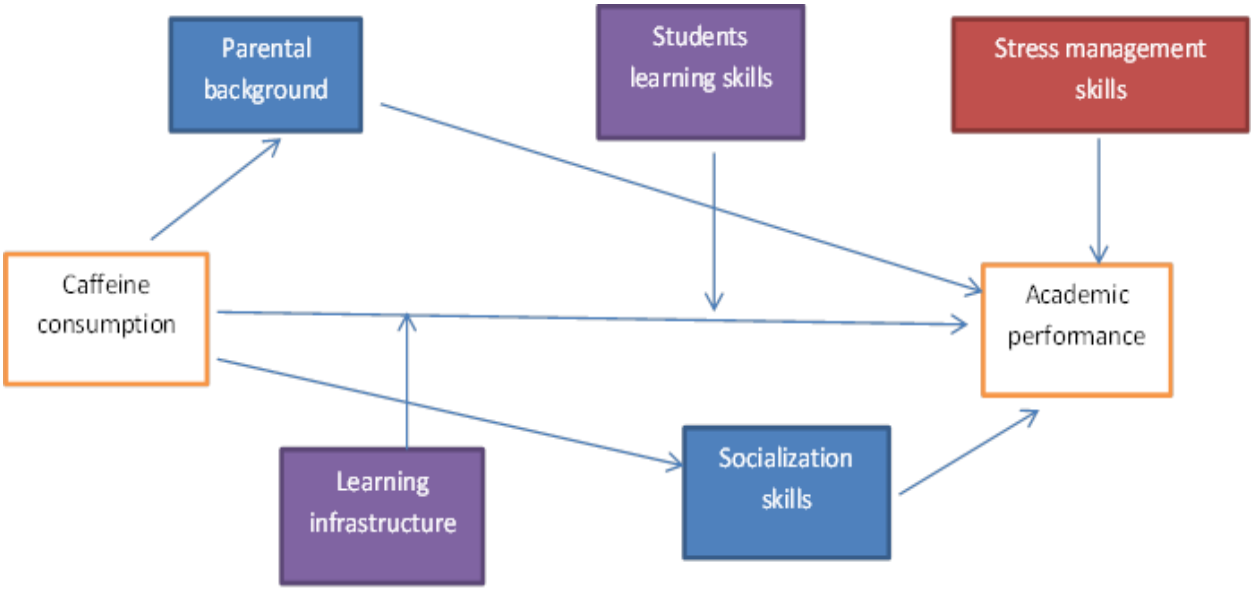


Figure 2 conceptual framework on the relation of caffeine consumption with academic performance

CHAPTER THREE

3. METHODS AND MATERIALS

3.1 Study area and period

The study was conducted at Wolkite University, which was established In November 2011 G.C. in a plain landscape, which is quite ideal for academic pursuit. Wolkite University is located in SNNPR, Gurage Zone, 170 km South West of Addis Ababa on the way to Jimma at Gubrye sub-city, 12 km away from Wolkite town of the Gubreye – Butajira road, in 246 hectares of land. It has three campuses: Gubreye (Main Campus), Wolkite, and Butajira Campus.

The study period was extended from May 15/2023, up to June 30/2023, in the College of Medicine and Health Science and Engineering Technology College.

3.2 Study design

The institutional-based cross-sectional design was implemented in this study. Quantitative and qualitative data collection was utilized to provide data on caffeine consumption, perceived stress, sleep quality, and academic performances among undergraduate students at the College of Medicine and Health Science and the College of Engineering and Technology at Wolkite University. Equal numbers of questionnaires were distributed to health and non-health colleges (medicine and health science, and engineering and technology).

3.3 Source population

All undergraduate students who were attending their classes at Wolkite University will be the source population. The total number of students registered in this academic year was 10,077. The findings may be extrapolated to this population because this is where the source population was selected**.**

3.4 study population

This study targeted 1165 undergraduate students from the College of Medicine and Health Science and 846 undergraduate students from Engineering and Technology in general, 2011 students who were attending their classes at Wolkite University. Both colleges have seven and eleven departments, namely: - Medicine, pharmacy, Nursing, Public Health, Midwifery, and laboratory departments from medicine and health science college and Civil, Garment, Hydraulics, Textile, Chemical, Electrical, Mechanical, Fashion Design, Food processing

engineering, architecture and Construction Technology and Management, in Engineering and technology college

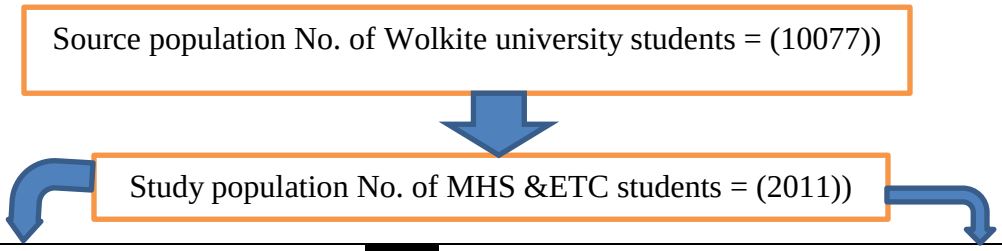
3.4.1 Inclusion criteria

This study comprised of all undergraduate students attending classes at the College of Medicine and Health Science and Engineering and Technology college, registered in the academic year, and who have at least one semester grade point average who agreed to participate and signed consent voluntarily.

3.4.2 Exclusion criteria

All undergraduate students who have known mental illness, Kchat users, also students who don't have at least one-semester grade point average since it is challenging to measure their academic performance.

Table 1 student's statistics



No. of Medicine and health science college students (MHS)=1165						No. of Engineering and technology college students (ETC) =846				
students in no. and sex in each departments						students in no. and sex in each departments				
Department	No. of student	Quota sample	Sex distribution M/F	Sample size in sex M/F		Department	No. of student	Quota sample	Sex distribution M/F	Sample size in sex M/F
Medical lab.	130	17	88	9		Archi tec	75	14	18	7
			42	9					57	7
Midwifery	149	20	91	10		Chemical E	88	17	68	9
			58	10					20	9
Nursing	294	43	166	22		Food E	56	11	37	6
			128	22					19	5
Pharmacy	99	14	62	7		Civil E	118	23	96	12
			37	7					22	12
Public health	223	31	163	15		Electrical	113	22	96	11
			60	15					17	11
Medici	250	35	145	18		COT	93	18	60	9

ne			105	18		M			33	9
Anesthesia	20	3	15	2		Hydraulics	70	14	67	7
			5	1					3	7
College total	1165	166	730	83		Mechanical	89	17	88	15
			435	83					1	1
						Garment	72	14	41	7
									31	8
						Fashion D.	27	5	20	3
									7	2
						Textile E.	45	9	33	5
									12	4
						College T.	846	166	624	91
									222	75

3.5 Sample size determination and sampling technique

3.5.1 Sample size determination

The sample size was derived using a formula employed in cross-sectional studies to determine a comparative two-population proportion formula.

$$N = (z\,{}^{\alpha}/_{2} + z\beta) \times (f1 \times \mathrm{P1}(1 - \mathrm{P1}) + \mathrm{f2} \times \mathrm{P2}(1 - \mathrm{P2})/(P1 - P2)^2$$

.

N = sample size for population

z = normal deviation at the desired confidence interval

Zβ = the desired level of power

$P_1$and P_2 = estimated proportion of an attribute that is present in the population (expected population proportion from the previous study)

f_1 and f_2 = the expected proportion in populations one and two

$$f1 = {}^{(N1 - n)}/_{(N1 - 1)} \qquad f2 = {}^{(N2 - n)}/_{(N2 - 1)}$$

F1= (1165-166)/1165-1 f2= (846-166)/846-1

999/1164 =0.86 680/845=0.80

The above-listed parameters determined the sample size and proportion. According to previous studies done at Jimma University prevalence of caffeine consumption was 62.5 %, and the prevalence in the study done in black lion hospital in poor sleep quality was 62% (5). Also prevalence of caffeine consumption in Butajira town is 55% (31).

Assuming a 5% degree of precision, 80% power, and a 95% confidence interval at a 5% margin of error

$N= ((1.96+0.2)^2 * (0.86 * 0.625 (1-0.625) + 0.80 *0.55 (1-0.55)) / (0.625-0.55)^2$

(4.6656 *(0.201885 + 0.198) / 0.005625 =301.441

Non response rate 10 %= 30.1441

301.441 + 30.1441 =331.5851 ≈332

Therefore, the number of students included in the study =332

3.5.2 Sampling technique

A multistage stratified random sampling technique was employed for the study. A simple randome sampling technique was used to select the two colleges. Then a stratified sampling technique was used to stratify all the departments under Medicine and Health Science and Engineering and Technology colleges. Stratified random sampling ensured that each subgroup of the population was proportionately represented within the whole sample population of the research study. This was conducted to upsurge the accuracy of the total estimations of the study by removing the between-strata variation (35). A quota sampling technique was implemented to get equal representative participants from both sexes within each stratum. Subsequently, simple random sampling was employed to select study participants from all the departments at each academic level.

3.6 Data collection techniques and procedures

A structured and pretested self-administered questionnaire was used to obtain information on socio-demographics, perceived stress, caffeine consumption, quality of sleep, and cumulatve great point average of study participants. To assure the quality of caffeine data, the locally available serving sizes of caffeinated products were calibrated and standardized before the datacollection,moreoverthe questionarie was modified based on input from the pretest.

Questionnaires address the following information:-

Variables:-

1. Demographic factors, including age, gender, religion, and years of study

2. Caffeine consumption and its factors (including coffee, tea, soft drinks, energy drinks, espresso, chocolate and other sources of caffeine)

2.1 Other factors that affect caffeine consumption

A. Socialization B. Health benefits (awareness of health benefits) C. Habit (mood) D. Taste

3. Academic performance

Academic performance was measured using the student's current overall grade point average (GPA). Self-reported overall GPA has been frequently used as a measurement of academic performance in similar studies. Self-reported GPA has high reliability and correlation with GPAs reported by the academic registry.

3.1 Others factors that affect academic performance A. Student's learning skills (including study hours) B. Parental condition (background) C. learning infrastructure D. Economic status E. Socializing skills and

4. Perceived stress The Perceived Stress Scale (PSS-10) is used to assess the stress level

PERCEIVED STRESS SCALE (PSS) is a psychometric tool commonly utilized to assess stress perception. The scale comprises numerous direct questions on the current perception of stress. Cohen (1983) constructed the PSS, and is a popular choice for assisting in comprehending peoples' perception of stress and feelings during specific situations(24).

4.1 Other factors that affect perceived stress A. Academic motivations B. Family condition (parental participation in learning, treating their children, and general handling, family conflict) C. Major life change (new job (Eg. being a student), learning environment) D. health issues

5. Sleep quality:- The Pittsburgh Sleep Quality Index (PSQI) used to assess sleep quality

PITTSBURGH SLEEP QUALITY INDEX (PSQI) The PSQI is a validated and pre-tested tool that has been utilized numerous times in sleep health research among university students. The PSQI contains ten components, and this study utilized seven components of the PSQI as follows: sleep latency, duration of sleep, habitual sleep efficiency, disturbance of sleep, usage of sleeping medication, daytime dysfunction, and subjective sleep quality. All students were asked to self-rate each of these seven aspects of sleep using the Likert scale(45**).**

5.1 Others factors that affect sleep quality

A. Physical pain B. Stress C. Mental health issues D. Sleep disorders E. Snoring F. Medications G. Sleep environment and condition (light, jet lag, Sleep schedule)

3.7 Data quality assurance

The data was collected using five trained data collectors. Questionnaires were pre-tested before the actual data collection among 5% of the total sample size in other colleges of Wolkite University to assess the legibility, practicality, and reliability of the questionnaire. Students were informed that their participation was voluntary and their responses were confidential. The Ethical Committee of the College of Medicine and Health Science granted ethical approval. The collected data was checked for consistency and completeness daily.

3.8 Data processing and analysis

After the data collection, plausible checks were conducted, and inconsistent data was cleared appropriately. The data was coded and entered into Epi data version 3.2 for clearance, and then it was exported to SPSS version 25 for further analysis. Descriptive summary statistics were carried out to describe study participants according to different characteristics by using tables & figures.Multi-variate analysis of ANOVA (MANOVA) was performed after adjusting for possible confounders. Kolmogorov Smirnov test was performed to determine the normal distribution of data, and the chi-square goodness of fit test was used to determine data distribution.

3.9 Ethics Approval and Consent to Participate

Before the commencement of the study, ethical approval was obtained from the Wolkite University College of Medicine and Health Science Ethical Review Committee (ERC). After obtaining ethical clearance as well as a support letter from WUCMHS/ERC, permission and approval were sought from Wolkite University. The study was conducted following accepted principles on Ethics in Human Experimentation and the International Conference on Harmonization/Good Clinical Practice (ICH/GCP). Before inclusion into the study, individual informed consent was obtained from the students using the consent form approved by the ethics committee. No name was mentioned during the entire data collection, and identification was based on the unique identification number given for each questionnaire. The researcher and five data collectors clarified and simplified all the information with the participants concerning the nature, purpose, and implication of the research study. Confidentiality of information (results) was kept between the study participants and the data collector/investigator.

CHAPTER FOUR

RESULTS

4.1. Descriptive analysis

4.1.1 Demographic Characteristics

Demographic characteristics of the study participants that were assessed comprised of colleges and field of study, age, sex, religion, and current year of study. This was analyzed to ascertain the demographic characteristics of the respondents used for the current study. The various findings relative to the respondents‟ demographic characteristics are presented with the aid of frequency, percent, tables, and diagrams shown below.

According to the study finding a total of 160 (51.6%) of the participants were from health colleges, whereas the other half 150 (48.4%) were from Engineering colleges (N=310). All seven departments from Health and eleven departments from Engineering college participated in the study. From the Figure below Participants age ranged from 19 to 28 years, with the mean age of 23.09 ± 1.779. The majority of respondents (84.8%) were young adulthoods (22–25 years), 8.4% them were “mid to late twenties” (26-29 years) and 6.8% were “early adulthood” (18-21years).

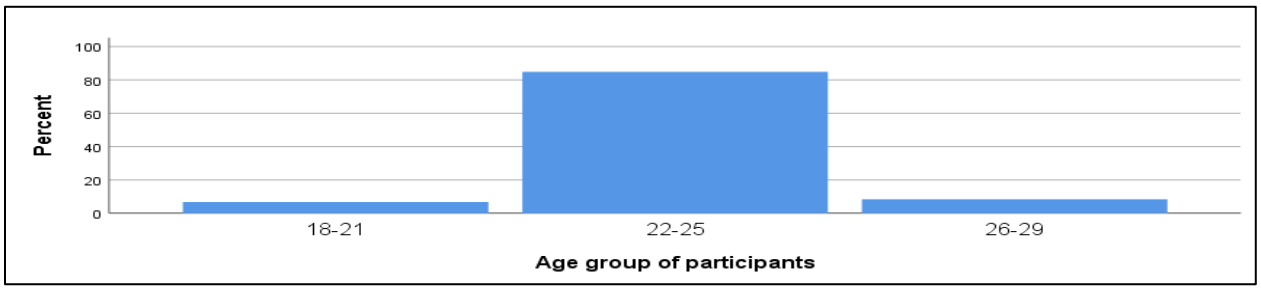


Figure 3 Age group of participants

Regarding participants gender,as depicted in Figure below, half of the participants (51.6 %) were male, and the other half (48.4%) participants were females.

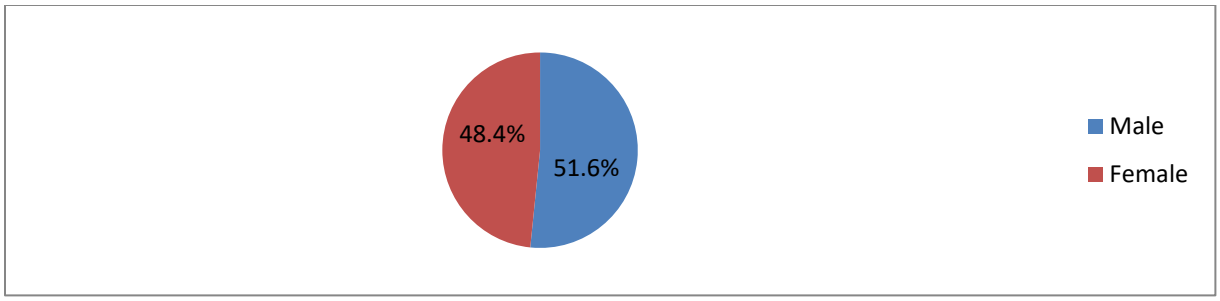


Figure 4 sex of participants

Concerning participants religion, a substantial proportion of the participants (45.5 %) were orthodox Christians, 21.9 % were Muslims, and 20.6 % were Protestants. Catholics, and Adventists contributed 4.5%, respectively and 1.9% of participants preferred not to mention thier religious group.

Table 2 religious group of participants

Religion			
	Muslim	68	21.9
	Orthodox Christian	141	45.5
	Protestant	64	20.6
	Catholic	14	4.5
	Adventist	14	4.5
	Other	3	1.0
	Prefer not to answer	6	1.9
Total		310	100

Regarding students participation in their academic year of study, it addresses all levels of study years, that is, 27.1% were 2nd year, 21.3%, were 3rdyear, 20.6% 4th year students, the other 13.2%,12.6%,4.2%, and 1% were fifth, first, six and seven and above years respectively.

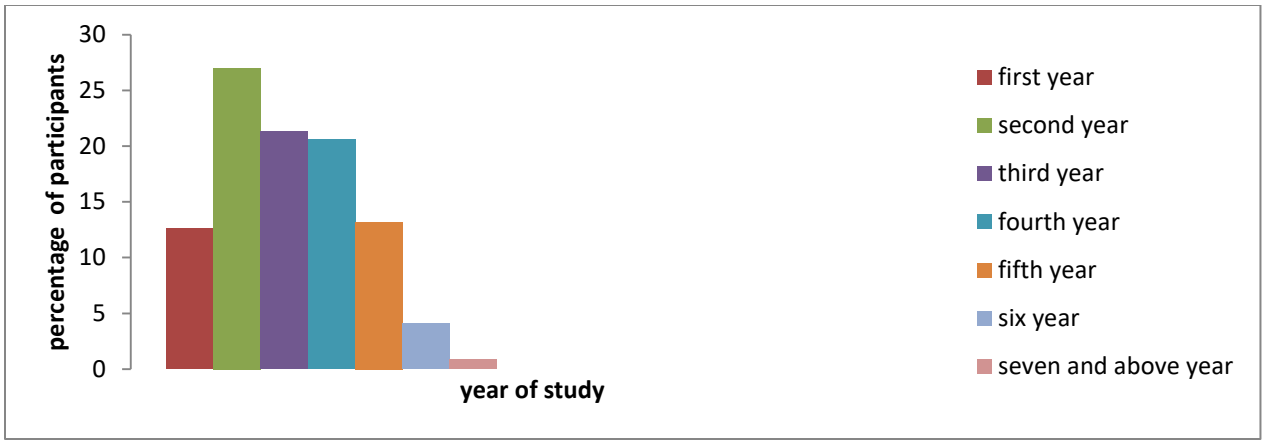


Figure 5 current year of study

Caffeine consumption sourses and reason of respondents

Of 259 caffeine consumers, about 63.6% of students consumed caffeine in the form of black tea, 62.9% as coffee, 17.7% as caffeinated soft drinks. The other 9.4% choose in chocolate form, and 1.9% consume energy drinks as a caffeine sourse. Regarding the reason behind caffeine consumption, 65% reported that it increases overall academic performance, and 60% reported it increases study hours. About half (51%) reported it helps for alertness and increase concentration. 37% improve class and group activities, 17% use it as habitual consumption, and 14% due to its physiological dependency.

Table 3 Caffeine Consumption source and reason of Participants

Caffeine consumption Characteristics	frequency	Percent
Source of caffeine consumption		
coffee	195	62.9
Black tea	197	63.6
Green tea	21	6.8
Caffeinated soft drinks	55	17.7
Energy drinks	6	1.9
Chocolate	29	9.4
Reason behind caffeine consumption		
Increase overall academic performance	202	65%
Increases study hours	186	60%
Increases alertness and concentration	158	51%
Improves class and group activities	115	37%
Habitual consumption (Taste)	53	17%
Physiological dependence	43	14%

Caffeine consumption levels of participants

The study sought to find out the caffeine consumption experiences among the target respondents involved in the study. The finding shows 259 (83.5%) consume caffeine, and 16.5% of them reported do not consume any caffeine.regarding to level of caffeine consumption of participants. The majority of participants (46%) were moderate caffeine consumers,(33%) were low caffeine consumers, the other (4%) were high consumers, and (17%) of respondents don't consume caffeine. According to FDA 71.9 % of respondents were within the range of the recommended level (≤ 400mg/day) and the other 11.3% consume above the recommended level.

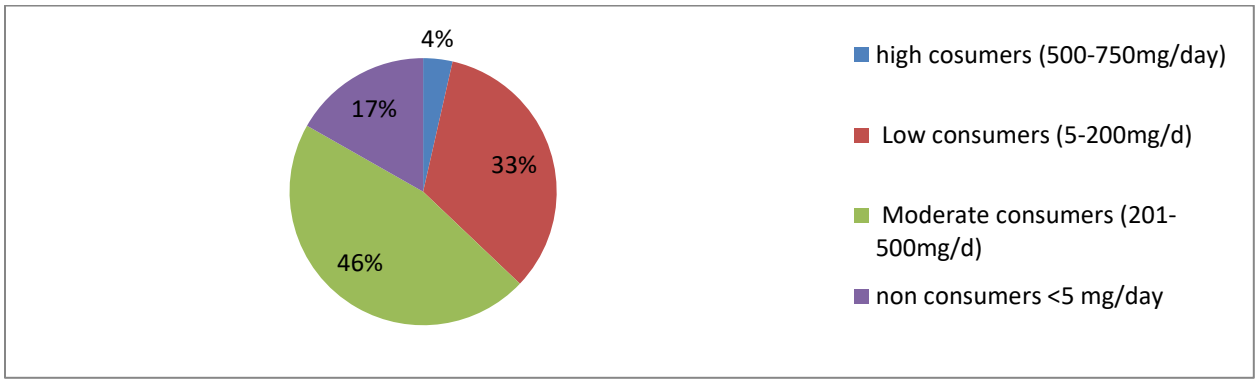


Figure 6 caffein consumption level of participants

Average Perceived stress, sleep quality, and CGPA of caffeine consumers and non-caffeine consumers in respondents

The study tried to compare total caffeine consumers and non-caffeine consumers with the average stress perceived, average level of sleep quality, and mean cumulative GPA they scored, as illustrated in Figure below. The finding of the study shows that the average sleep quality of caffeine consumers was 6.63 (SD± 2.356) was higher than the average sleep quality of non-caffeine consumers (6.41 SD ± 1.2849). Also, the average CGPA (3.23 SD± .392) of caffeine consumers was better than the average CGPA of non-caffeine consumers (3.18 SD ± .470). On the other side, the average perceived stress (15.88 SD ± 5.388) of caffeine consumers was lower than the average perceived stress (16.25 SD± 5.411) of non-caffeine consumers.

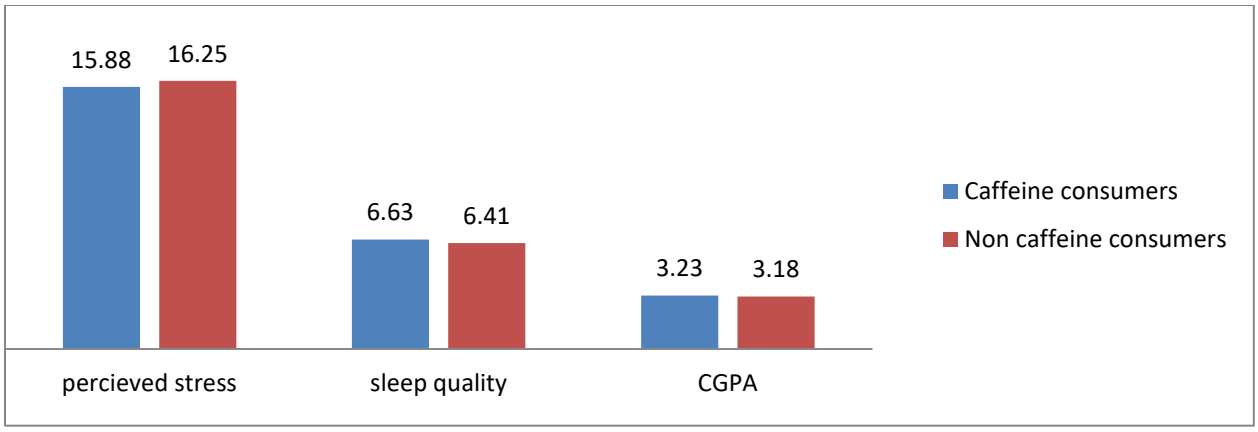


Figure 7 comparsion of caffeine consumption condition and averages of dependent variables

There was much difference in caffeine consumption between the two streams, as depicted in the table. In Health College, the average caffeine consumption (247.6 mg) was greater than the average caffeine consumption (179.4mg) of Engineering College. Also, the average CGPA (3.22) of Health College was better than the average CGPA (3.16) at Engineering College. Regarding the perceived stress and sleep quality, the average perceived stress (16.31) and the average sleep quality (6.61) were higher and poorer in Health College than in Engineering College. Concerning their age and the average caffeine consumption, perceived stress, sleep quality, and CGPA, has a slight difference between the ages in that caffeine consumption (292.5mg), CGPA (3.52) was high in 19 years, the perceived stress (18.5) and sleep quality (7.50) of this age group was higher and poorer than the other age group. On the other side, caffeine consumption (175mg), sleep quality (5) at the age of 28, perceived stress (14.9), and CGPA (3.11) at the age of 27 and 23 were the lower findings, respectively.

Regarding caffeine consumption through sex, Table 5 depicts there were differences between sexes in the amount of caffeine consumed. A study found that males consume (229.91mg) greater amount of caffeine compared to females(198.27mg), and also Males have better CGPA (3.21) than females (3.17), but females have higher perceived stress(16.39) and poorer sleep quality (6.71) than Males (15.52) and (6.34) respectively. With respect to participants' religion, the average caffeine consumption (430mg) and (314.17mg) was higher in the other category. Those who prefer not to answer their religious category also these religious groups have high perceived stress (18.33) and(19.67) and poorer sleep quality (8.67) and (8.33) than the other religious groups. The average CGPA (3.23) and (3.20) recorded in Orthodox Christians and Protestants was better than other religious groups. With respect to respondent years of study time, six six-year students consumed more caffeine (297.31mg) and also scored better average CGPA (3.20) than that of fifth-year students (3.22). Even so, their perceived stress and sleep quality were relatively high and poorer than a student from 1st year to the fifth year.

Table 4 Averages of Caffeine Consumption, Perceived Stress, Sleep Quality, and CGPA with Demographic characteristics of respondents

Demographic characteristics	Average caffeine consumption (mg)	Average Perceived stress	Average sleep quality	CGPA
Stream (college)				
Engineering	179.4	15.55	6.45	3.16
Health	247.6	16.31	6.61	3.22
Total	214.6	15.94	6.52	3.20
Age				
18-21	227.98	16.81	6.90	3.32
22-25	210.82	15.83	6.37	3.18
26-29	216.95	14.83	6.56	3.15
Total	214.60	15.94	6.52	3.19
Sex				
Female	198.27	16.39	6.71	3.17
Male	229.91	15.52	6.34	3.21
Total	214.6	15.94	6.52	3.19
Religion				
Muslim	210.66	14.65	6.66	3.16
Orthodox Christian	179.08	16.60	6.46	3.23
Protestant	242.11	16.33	6.53	3.20
Catholic	357.14	13.07	5.57	3.09
Adventist	234.29	14.57	6.14	3.08
Other	430.00	18.33	8.67	3.19
Prefer not to answer	314.17	19.67	8.33	3.10
Total	214.60	15.94	6.52	3.19
Current years of study				
First year	262.56	16.79	6.69	3.15
Second year	208.39	15.88	6.54	3.12
Third year	221.36	16.41	6.38	3.17
Forth year	207.27	15.03	6.28	3.30
Fifth year	162.32	14.90	6.95	3.22
Sixth year	297.31	17.38	7.00	3.20
Other	128.33	23.33	4.33	3.34
Total	214.60	15.94	6.52	3.19

Study participant's stress level

The study tried to scale participants feelings and thoughts (perceived stress level) during the last month. According to figure 7 below the finding shows that the majority of participants (67.7%) have moderate stress, the other (30%) show low stress, and only (2.3%) have high stress.

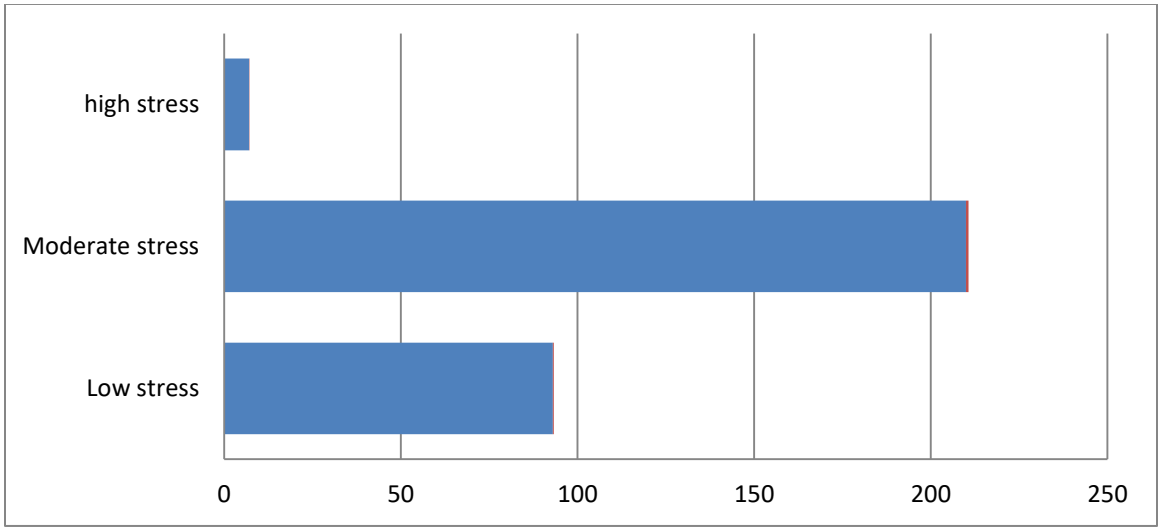


Figure 8 study participants stress level

Sleep quality of respondents

In scoring the seven component scores of sleep quality, each component was scored 0 (no difficulty) to 3 (severe difficulty). As table 4 describes concerning the time it takes to fall asleep (sleep latency), 48.1% of them have some difficulty, and 38.7% feel some difficulty in sleep duration. 65.8% of participants have habitual sleep efficiency difficulty, with most (32.3%) of them feeling some difficulties. 97.1% of respondents have sleep disturbances, of which 80% of them feel some difficulty. Regarding how often participants take medication to help them sleep, 17 (5.4%) take medicine less than once a week, 11 (3.5%) of them consume it once or twice a week, and only 5 (1.6%) use sleep medication three or more times a week. Concerning the day time dysfunction130 (41.9%) have only a very slight problem, 30 (9.7%) have somewhat of a problem, only 6 (1.9%) have a very high problem, while 144(46.5%) of them don't have a problem at all. Regarding the Study participant's overall sleep quality, 209(67.4%) rated it as fairly good, 82(26.5%) rated it as very good, 19(6.1%) fairly bad, and no respondent rated his/her overall sleep quality as very bad. Generally, of the total 310 undergraduate students, the total global PSQI for 215 (69.4%) was poor, and 95 (30.6%) were good. The average PSQI score was 6.52 (SD± 2.446).

Table 5 Sleep Quality of Respondents

Components of sleep quality	scores	Frequency	percent	Mean	SD
Sleep Latency	0	55	17.7	1.23	.819
	1	149	48.1		
	2	85	27.4		
	3	21	6.8		
Sleep duration	0	78	25.2	1.25	.985
	1	120	38.7		
	2	69	22.3		
	3	43	13.9		
Habitual sleep efficiency	0	106	34.2	1.16	1.076
	1	100	32.3		
	2	52	16.8		
	3	52	16.8		
Sleep disturbance	0	9	2.9	1.15	.445
	1	248	80.0		
	2	51	16.5		
	3	2	.6		
Use of sleep medication	0	277	89.4	.27	.605
	1	17	5.4		
	2	11	3.5		
	3	5	1.6		
Day time dysfunction	0	144	46.5	.67	.729
	1	130	41.9		
	2	30	9.7		
	3	6	1.9		
Subjective sleep quality	0	82	26.5	.80	.534
	1	209	67.4		
	2	19	6.1		
Total sleep quality	≤5 (Good)	95	30.6	6.52	2.446
	5-21(Poor)	215	69.4		

Study participants CGPA

The study collected undergraduate students' current cumulative grade point average (CGPA) and classified it into four parts, as illustrated in Figure 7. The finding shows that almost half (47.7%) of study participants have a CGPA of 3- 3.49, and 26.5% of them between 3.5-4.0. The other 20% and 5.8% scored between 2.5-2.99 and 2.0-2.49 respectively.

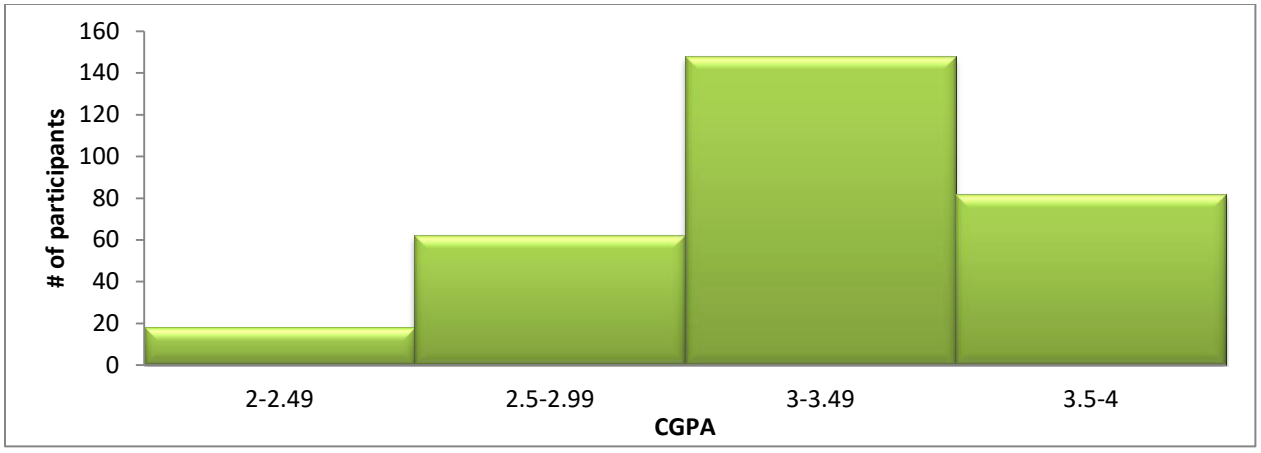


Figure 9 study participants CGPA

Table 6 Correlation between caffeine consumption, perceived stress, sleeps quality and academic performances

Correlations	1	2	3	4	Mean	SD
1.Caffeine consumption	1				214.6	152.67
2. Perceived stress	0.031	1			15.94	5.385
3. Sleep quality	0.026*	0.330**	1		6.52	2.446
4. Academic performance	0.280*	0.046	0.098*	1	3.19	.405

**Correlation is significant at 0.05 levels (2-tailed).

Correlation analyses between caffeine consumption, perceived stress, sleep quality and academic performance

Prior to conducting the multivariate analysis a series of spearman correlation were performed between all the variables in order to test the multivariate test assumption. Caffeine consumption, perceived stress, sleep quality and academic performances were assessed in that a coefficient of ±1 shows a negative or positive correlation. Caffeine consumption was correlated with sleep quality at ($r = 0.026$, $p = 0.025$). Caffeine consumption and academic performance have small to moderate correlation ($r = 0.280$ $p = 0.012$). Sleep quality and perceived stress has moderate significant correlation ($r = .330$ $p = .000$). Sleep quality and academic performance has moderate correlation ($r = .098$ $p = 0.035$) Caffeine consumption and perceived stress have correlation but it was not significant ($r = 0.031$, $p = 0.377$) also perceived stress and academic performance has correlation but statistically not significant as shown in table

As can be seen in the table a meaningful pattern of correlation was observed amongst most of the dependent variable suggesting the appropriateness of a MANOVA additionally the Box's M

value of 24.73 was associated with the P value of 0.174 which was interpreted as non-significant based on (Hubert and Petro sky's (2000) guideline (i.e. P< .005)) thus the covariance matrices between the groups were assumed to be equal for the purposes of the MANOVA.

4.2 correlation and Multivariate analysis (MANOVA) Results

Kolmogorov Smirnov test was conducted to test whether the data follows a normal distribution or deviates significantly from it, So to assess the normality of the variables. Therefore, according to the results, the data was normally distributed.(caffeine consumption P=0.010, CGPA P=0.000, PS P=0.20,and sleep quality P=.000)

The chi-square goodness of fit test was performed to assess whether the observed data fits the expected distribution for variables perceived stress, sleep quality, and academic performance. Therefore, the finding shows the observed data significantly fit the expected data. (P value 0.882,0.228 and 0.276 for PS,sleep quality and CGPA respectively).

Additionally, the Box's M value of 24.73 was associated with the P value of 0.174, which was interpreted as non-significant based on Hubert and Petro Sky's (2000) guideline (i.e., P< .005) thus, the covariance matrices between the groups were assumed to be equal for the MANOVA.

In Univariate tests in the table below, since 0.016 < 0.025, the test is significantfor CGPA, that is caffeine consumers and non-caffeine consumers are different in academic performance. Also, 0.022 < 0.025, the test is significant for sleep quality. This shows caffeine consumers and non-caffeine consumers are different in sleep quality. However, since 0.164 > 0.025, the test is not significantfor perceieved stress so caffeine consumers and non-caffeine consumers are not significantly different in perceived stress.

Table 7 Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Caffeine consumption	CGPA	.826	3	.275	1.688	.016	.016
	Total global PSQI	40.818	3	13.606	2.302	.022	.022
	Total perceived stress score	148.193	3	49.398	1.715	.164	.017
Error	CGPA	49.924	306	.163			
	Total global PSQI	1808.524	306	5.910			

	Total perceived stress score		8811.642	306	28.796

a. R Squared = .016 (Adjusted R Squared = .007) b. R Squared = .022 (Adjusted R Squared = .012) c. R Squared = .017 (Adjusted R Squared = .007)

Multivariate test results in all variables

There was a significant difference between caffeine consumers and non-caffeine consumers when considered jointly on the variables, academic performance, sleep quality, and perceived stress, respectively, i.e., Wilk's Λ =.953, F (9,740) =1.63, P = 0.20 partial η^2 =0.16.

The Levene's test tests the null hypothesis that the error variance of the dependent variable is equal across groups. It should be greater than 0.05. The finding from the study shows the significant value was greater than 0.05 in all the variables, (CGPA, sleep quality and PS with P=0.304, 0.315 and 0.318) so the assumption was fulfilled.

As a separate ANOVA was conducted for each dependent variable with each ANOVA evaluated at an alpha level of .025, there was a significant difference between caffeine consumers and non-caffeine consumers on academic performance, that is F(3,306) = 1.69 P= 0.16, partial η^2 = 0.16 Also there was a significant difference between caffeine consumers and non-caffeine consumers on sleep quality, in that F(3,306) =2.30, P = 0.022, partial η^2 = 0.022. However there was insufficient evidence to express difference between caffeine consumers and non-caffeine consumers on perceived stress, in that F(3,306) = 1.72, P = .164, partial η^2 = 0.17.

Sleep quality difference between caffeine consumers and non consumers

In the line graph below averagely high caffeine consumers have poorer sleep quality than moderate, low and non-caffeine consumers. Although there is no difference between low caffeine consumers and non caffeine consumers concerning sleep quality.

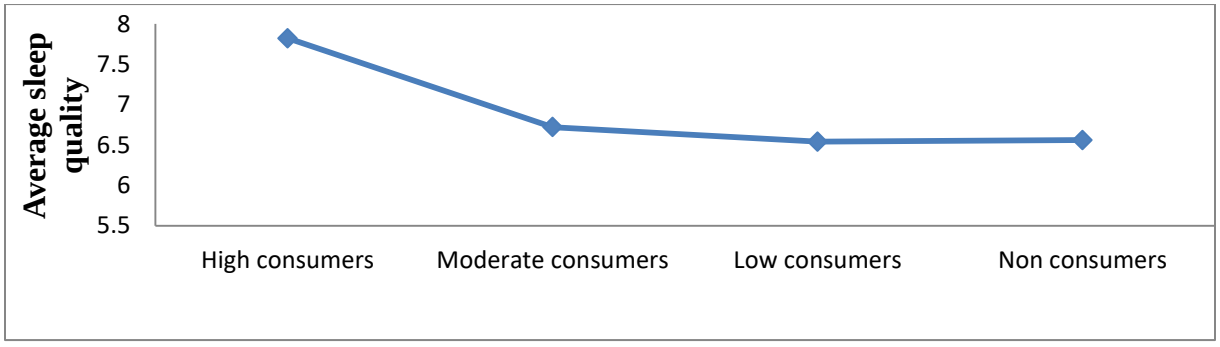


Figure 10 caffeine consumption and average sleep quality

Participants average CGPA difference with caffeine consumption and non caffeine consumers

The study compared average caffeine consumption with academic performance of undergraduate students and it shows moderate caffeine consumers have better CGPA. Also high caffeine consumers relatively score better CGPA than low and non-caffeine consumers, but no difference between low and non-caffeine consumers.

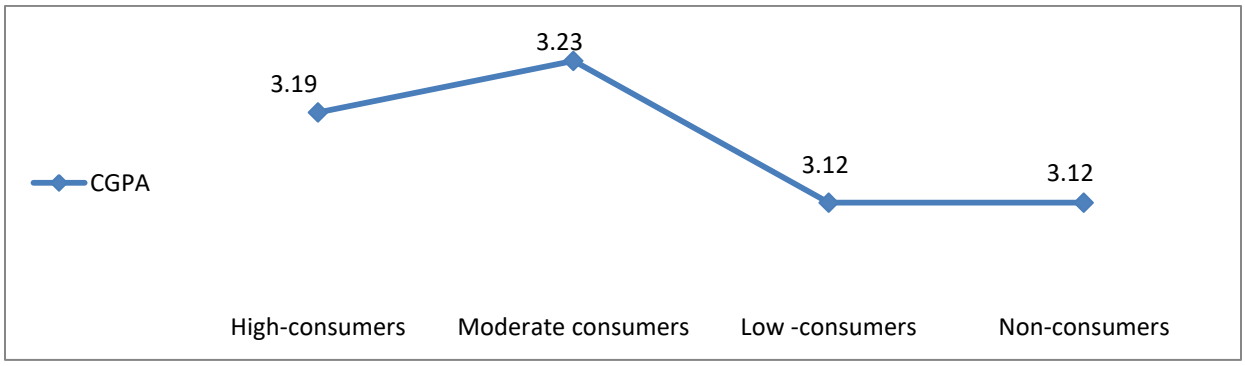


Figure 11 Caffeine consumption and CGPA

Average perceived stress in caffeine consumers and non consumers

The finding in the line graph below shows averagly high caffeine consumers have high perceived stress. There was no difference between low caffeine consumers and non-consumers with respect to perceived stress

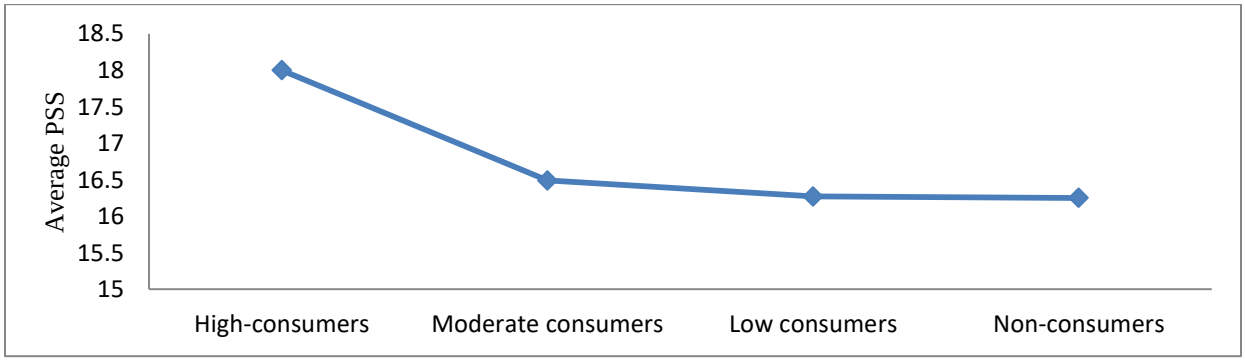


Figure 12 Caffeine consumption and perceived stress

Student's sleep characteristics reported by their roommate or bed partner.

Students asked their roommate or bed partner about their sleep condition in the last month, 23.3% of students have snored while sleeping, and in most (19.4%) of them it is less than once a week. Also, 15.4% of students have long pauses between breaths, while sleep usually takes less than a week in 13.5 % of them. 10.3% of students have leg twitching or jerkin while sleeping, and 19.7% of students show episodes of disorientation or confusion during sleep in most (18.4%) it was less than a week. 16% of students have restlessness while sleeping, and the reason for their restlessness was a different health problem in 15 students, different types of academic load in 18

students, and excessive caffeine consumption in specific particular days was the reason for 19 students in all this 165 of students it occurs less than once a week.

Table 8 Students sleep problem and there occurrences asked from there roommate or bed partner

Characteristics	Frequency and percent	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Loud snoring	N	241	60	6	3
	%	77.7	19.4	1.9	1
Long pauses b/n breaths while sleep	N	262	42	6	-
	%	84.5	13.5	1.9	-
Leg twitching or jerking while you sleep	N	278	29	3	-
	%	89.7	9.4	1	-
Episode of disorientation or confusion during sleep	N	249	57	4	-
	%	80.3	18.4	1.3	-
Other restlessness while you sleep	N	260	44	4	2
	%	83.9	14.2	1.3	0.6

CHAPTER FIVE

DISCUSSION

The main objective of this study was to assess the magnitude of caffeine consumption and its correlation with stress, quality of sleep, and academic performance of Health Science and Engineering College among undergraduate students at Wolkite University.

Caffeine consumption

The over all mean caffeine consumption of the present study was 214.6 mg caffeine /day. This result was comparable with studies at universities in northeastern Ohio,the average daily caffeine consumption of participants at baseline was 226.3mg/day(31). Also, these findings were higher than some of the other research, which found an average, daily caffeine intake of 165 mg in Iran (6), 159 mg/day in Kenya college students (35), and a median daily caffeine intake of 170.5 mg in Butajira-city (15).This may be due to the academic stress that motivates students to increase caffeine consumption. While most of the average caffeine intake in this study did not exceed the recommended level, 11.3% of the participants consumed more caffeine than the WHO's recommended daily dose of 400mg. Although this amount of intake was lower than reported 424.69mg/day,405.47mg, and 374mg/day by Egyptian, Dubai, and Kent State University students respectively(19).

The current study showed the most preferred caffeine choices at baseline across all genders among the study sample was black tea (63.6%) followed by coffee (62,9.3%), caffeinated soft drinks (17.7%), chocolate (9.4%) These findings are consistent with some previous studies black tea 60%, coffee (46%) and green tea (26%) was the main source of caffeine for a group of adolescents in Poland (46). In contrast to this in most studies, coffee was the first source, as coffee, coffee with milk, and Coca-Cola in Butajira (6, 7, 31). This may be easy availability of the sources in the area.

The reason behind caffeine consumption in this study in most students (65%) was to Increase overall academic performance (study hours, alertness, and concentration and also Improve class and group activities). This finding is consistent with previous studies in that numerous factors for caffeine intake among undergraduate university students reported in the USA including improving alertness, concentration, mood, energy, and enjoying the taste(6). Another study revealed that university students may use caffeine as a tool to facilitate their academic performance. Since students assume that these stimulants will help them stay awake to study and therefore improve their academic success (42).

In this study, caffeine consumption was higher in 19 and 26-year-old students and lower at age 28 years. Caffeine consumption is thought to increase with age and so the small age difference used in the present study may be too short to reflect the long-term increases in caffeine noted in other studies.

Previous studies, find a significant difference in caffeine consumption between men and women, with men consuming averagely higher amounts than Females(20). The result of the present study confirms previous research findings that males tend to consume more caffeine than females (229,91mg vs. 198.27mg). The reason may be males typically weigh more than females, and therefore caffeine consumed per body weight may be a factor in why males consume higher amounts of caffeine. On the other side in Dubai Caffeine is more consumed by female undergraduate students than men (6).

When we consider the study participant's religion and their caffeine consumption, the study participants who prefer not to mention their religious group consume a high amount of caffeine (430 mg/day) than the other religious group. This intake also surpasses the WHO recommendation of 400mg/day. In another study students from the Muslim religion consume more caffeine in North America and Lebanon (17, 23).

Current years of study and caffeine

For each year of study, there was a large variability in the amount (mg) of caffeine consumed by students. The present study showed only a slight difference in the amount of caffeine consumed (mg) among 1st, 2nd, 3rd and 4th year students. This does not reflect previous studies that found an increase in caffeine with age and grade levels. One study states that 28% of college students reported an increase in caffeine consumption than the previous year(1). The only reflection of the finding in this study was that six-year students consume (297.31mg/day) which is greater than the other grade levels even if it was in the FDA recommendation range. One justification for this increase is that workloads and difficulty of classes typically increase with grade level, in which caffeine intake has been shown to increase with academic stress (23).

The results of the current study show that caffeine consumption among engineering college students was lower when compared to Health College. Engineering college students consume 179.4 mg/day which is under low consumers, but Health Science College students consume 247.6mg/day which is classified under moderate caffeine consumers. This may be due to the medical field being considered to be a stressful area of education due to the high academic requirements and demanding professionals. Various factors contribute to this situation; including academic overload, overnight on-call duties, contact with diseases and deaths, frequent examinations, and comprehensive curricula. In contrast in other studies, a high level of caffeine consumption was significantly more evident among students of non-health colleges than among health college students (53.50% versus 46.50%, respectively; $p<0.040$) The lower caffeine consumption level reported by students of health colleges could be due to their awareness about the side effects of caffeine(6).

Caffeine consumption and stress

College students are known to experience stress and drowsiness, and their demanding lifestyles may force them to use alternative sources of energy like caffeine, assuming that caffeine intake may correlate with stress levels (44). this was supported by studies in that students who had a high level of caffeine consumption had significantly higher mean scores of perceived stress than students with a low level of caffeine consumption(6) and a high prevalence of psychological stress (53%)(28). However, in this study, Most of (67.7%) of the study participants have moderate perceived stress. In contrast to the above research finding, this study showed no significant correlation between caffeine consumption and stress level ($r = 0.031$, $p = 0.377$). This may be due to the recommended consumption level and accepted Perceived benefit of caffeine consumption towards caffeine consumption. The results of this study were also, consistent with those of previous studies, which showed no association between caffeine consumption and academic stress (16, 20).

Caffeine Consumption and Sleep Quality

This study finds a high poor sleep quality level (69.4%) among study participants. The high prevalence of poor sleep quality in this study is comparable to previous studies that found poor sleep quality among undergraduate medical students at Tikur Anbessa Specialized Hospital was 62% (5). Also, it was consistent with the study conducted in Sudan 61.4%, and Iraq 60.4%. However, the result of the present study was higher than the study reported among non-medical students in Ethiopia 55.8% (30). On the other hand, this study was lower than the previous studies done in Kenya (80%) among undergraduate students, 78% at Lebanese universities,76%.at Saudi Arabia university students(28).

The poor sleep quality in the current study could be attributed to academic stress, which possibly influences or alters students' sleep quality. Findings from the present study demonstrated that 84% percent of students who had moderate stress were categorized as poor-quality sleepers. Students who were moderately stressed were more likely to incur poor sleep quality compared to those who were mildly stressed.

In this study sleep quality was high in the first year, then decreased up to the fourth year, and again increased in the fifth and sixth years this shows an increase in entry and exit time but there was no statistical association in different years of study levels. Conversely, an Ethiopian study among medical students in two different universities, indicated that fourth-year students and above had lower likelihoods of poor sleep than students in the second and third year (5).

Concerning the sex of participants' females have an average higher mean sleep quality than males, but statistically is not significant. In a study done on Tikur Anbessa Hospital medical students, no significant association was found between sex and sleep quality(5).

The present results of this study between Health and Engineering College indicate that high caffeine consumers, moderate caffeine consumers, and low consumers have average sleep quality of 7.82, 6.72, and 6.59 respectively. This shows relative differences in sleep quality between caffeine consumers but, all levels of caffeine consumers have average poor sleep quality statistically. Even if health college students have a bit higher average sleep quality than engineering college (6.61 and 6.45) statistically it is not significant. This shows there is no difference in sleep quality between health and engineering college students. This generally agrees with previous research where caffeine has not only been found to decrease the length of sleep time but also decreases the sleep quality, leading to daytime fatigue but no difference between the two colleges at different universities (3).

Studies concluded that caffeine even in small amounts has been known to affect sleep quality. This can be related to the present findings, where the sleep quality is negatively affected by their caffeine intake, resulting in poor sleep quality than the non-caffeine group. This concept can also be related to the comparison between the five levels of caffeine consumers, where small quantities of caffeine can affect the sleep cycle, it may be predicted that larger doses would interrupt sleep more substantially. However, this notion does not reflect the results of the present study, between non-caffeine consumers and low consumers (34). Given that the non-consumer and low consumers have no big difference in sleep quality (6.54 and 6.59). Caffeine may not start impacting sleep until moderate amounts are consumed, as evidenced by the difference in sleep between moderate consumers and low and non-consumers(1).

Caffeine consumption and Academic performance

In the present study, the average CGPA of the caffeine consumer group was slightly higher than the non-caffeine consumer group. These findings agree with previous studies that found GPA was higher in students who consume coffee and other caffeinated drinks at large public university students in Kentucky (20). From previous research, an explanation for this could be low doses of caffeine (20-200 mg) generally reflect benefits, including increased positive moods, energy, alertness, and sociability"(1).

In other studies, GPA is lower in those who consumed caffeinated beverages (energy drinks) than non-caffeine consumers(2, 39). Present results show that the non-caffeine consumer and the low-caffeine (5-200 mg) consumer group had similar GPAs (3.11).

Results of one study in Saudi Arabia show a significant association between sleep quality and cumulative GPA. The study revealed that the GPA is a significant predictor of sleep quality, where most of the students, whose GPA is greater than 4.25 (out of 5) are poor sleepers (28). CGAP was also another factor associated with quality sleep. As the average grade point of students increases in a unit, poor sleep quality increases/changes (5). Since caffeine had a significant impact on alertness, fatigue, and sleep duration between users and non-users it is widely known to affect academic performance, through indirect impact on academic performance, explaining why the present results showed caffeine consumers had higher GPAs than non-caffeine consumers(1). This shows when caffeine consumption increases academic performance increases up to moderate caffeine consumption. Even if the academic performance of Health College was slightly higher than Engineering College it was between the grade classification of 3.00-3.49 so there was no difference between Health and Engineering College in academic performance.

In general, the study conducted a Multivariate Analysis of Variance (MANOVA) to assess the effects of caffeine consumption on the Dependent variables perceived stress, sleep quality, and CGPA.

The findings indicate that caffeine consumption had a significant effect on CGPA and sleep quality but not on perceived stress. Participants with different levels of caffeine consumption differed significantly in terms of CGPA and sleep quality. However, there was insufficient evidence to suggest a multivariate effect of caffeine consumption on perceived stress.

This study provides preliminary evidence suggesting that caffeine consumption is associated with differences in CGPA and sleep quality. However, further research is warranted to gain a deeper understanding of the relationships between caffeine consumption and these variables. Future studies need to consider other factors that may influence the observed effects.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

CONCLUSION

The primary objective of this study was to investigate the magnitude of caffeine consumption and its correlation with perceived stress, sleep quality, and academic performance of undergraduate students at Wolkite University. The study has been successful in accomplishing its five research objectives. Thus, based on the findings of the study, the following conclusions are drawn:-

Most undergraduate students consume caffeine, and their primary caffeine choices are tea and coffee. Almost half of them were moderate consumers. However, 11.3% were consuming more than the FDA recommendation range of 400mg/day. Although the caffeine consumption rate was in the moderate range in the health stream and low range at engineering and technology colleges, the expectation or reason to consume caffeine in both colleges was to increase their overall academic performance. Concerning gender, males reportedly consumed caffeine more often and in greater quantities than females. In general, caffeine consumption is associated with sleep quality and academic performance of undergraduate students, but it is not associated with perceived stress. According to the study ranked data evaluation, there is no difference in perceived stress, sleep quality, and academic performances between health science and Engineering and technology colleges. 67.7% of undergraduate students have moderate stress, and 69.4% of participants reported poor sleep quality of which 10.5% use sleep medication,51,6% of them develop daytime dysfunction 73.5% of participants rate their sleep quality as fair and below. Therefore, a high prevalence of stress and poor sleep quality was found among the students and the study confirms a strong association between them. Also, sleep quality and academic performance have a moderate association.

RECOMMENDATION

Routine screening of sleep quality and Education may help students reduce their risk of experiencing adverse effects from caffeine consumption, unmanaged stress, and side effects of drugs taken for sleep induction. Establishing an Institution-based academic counseling center focusing on students' caffeine consumption, sleep quality, and coping with their stressful environment is crucial.

It appears that future research is needed to explore additional factors that potentially contribute to caffeine consumption and also the different aspects of sleep quality since one component of sleep quality affects more than the other component among college students.

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APPENDICES

LETTER OF INTRODUCTION

Wolkite University, College of Medicine and Health

Science Department of Public Health

Wolkite

Dear student, (Respondent)

RE: REQUEST TO PARTICIPATE IN A RESEARCH STUDY

This questionnaire is designed by a student of Wolkite University to collect information about magnitude of excessive caffeine consumption and its correlation with percieved stress, sleep quality and academic performanes of undergraduate students at wolkite university. The information will be used as primary data in my study which I am conducting as a Partial Fulfillment of the Requirements for the degree of Master of public health [MPH] in nutrition at Wolkite University.

You are kindly requested to assist in data collection by responding to the questions in the accompanying Questionnaire. The information provided will exclusively be used for academic purposes only and will be treated with utmost confidence. You will also be provided with a copy of the final report upon your request.

Your genuine, honest, and prompt response is valuable input for the quality and successful completion of the project.

General Instructions

- There is no need of writing your name
- In all cases where answer options are available please tick "√" or "X" in the appropriate box.
- For questions that demand your opinion, please try to honestly describe as per the questions in the space provided.

I would like to extend my deep-heart thanks in advance for being a volunteer to spare your most precious time in filling out this academic questionnaire.

Yours faithfully

Dereje Desalegn

Questionnaires

Section A) Demographic questionnaire

Please provide the following information by filling in the blank or circling the appropriate answer

1. How old are you? (Age in years)_____

2. Gender A) Female B) Male

3. Religion A) Muslim B) Orthodox Christian C) Protestant D) Catholic

E) Adventist F) other G) prefer not to answer

4. Current year/status in school?

A) 2nd year B) 3rd YEAR C) 4th year D) 5th year E) 6th year F) other

5. Grade Point Average (G.P. A.) for the last semesters of school you completed----------

Section B) Caffeine consumption questionnaires

1. Do you consume caffeine? (Stated in no. 2) (A) YES (B) No If No Is Selected, Then Skip to End section B Block

2. Below there are Caffeine Source Listed. Write the number of servings of the caffeinated product and the time(s) that you typically consumed in one average day. (Choose all that apply))

Beverages	Beverages in mg	Use Times (X)	**Average number of ounces/ doses/ tablets per day (in cup, bottle, pieces)**	Average total per day
Coffee (6 oz.) (in cup)	125mg	x	_____	_____
*Decaf Coffee (6 oz.) (in cup)	5mg	x	_____	_____
**Espresso (1 oz.) (in cup)	50mg	x	_____	_____
Tea (6 oz.) Green (in cup)	35mg	x	_____	_____
Tea (6 oz.) Black (in cup)	50mg	x	_____	_____
***Cocoa (6 oz.) (in spoon(grams) or in cup	15mg	x	_____	_____
Energy drinks (12 oz.) (in bottle)(Red bull, Horse power & other	~ 20mg	x	_____	_____
Caffeinated Soft Drinks (12 oz.) (in bottle) (Coca-Cola, Pepsi, Mirnda, and others)	40-60mg	x	_____	_____
Chocolate candy bar (in pieces)	20mg	x	_____	_____
TOTAL MG. CAFFEINE PER DAY				

3. Do you consume Over-the-Counter Medications if yes write drug and dosageper day (Anacin, Appetite-control pills, Dristan, Excedrine, Midol, NoDoz, Triaminicin, Vanquish, Vivarin)

4. Do you consume Prescription Medications if yes write the drug and dosage per day (Cafergot Fiorinal)

5. Reason behind caffeine consumption(you can choose all that apply) A. Increases overall academic performance B.increase studyhours C.increase alertness concentration D.improve class and group activities E.Habitual consumption F.physiological dependence

Section C) Stress-related questionnaires (Perceived Stress Scale)

The questions in this scale ask about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate

For each question choose from the following alternatives:

0 - never 1 - rarely 2 - sometimes 3 - fairly often 4 - very often

_____ 1. In the last month, how often have you been upset because of something that happened unexpectedly?

_____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?

_____ 3. In the last month, how often have you felt nervous and stressed?

_____ 4. In the last month, how often have you felt confident about your ability to handle your problems?

_____ 5. In the last month, how often have you felt that things were going your way?

_____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?

_____ 7. In the last month, how often have you been able to control irritations in your life?

_____ 8. In the last month, how often have you felt that you were on top of things?

_____ 9. In the last month, how often have you been angered because of things that happened that been outside of your control?

_____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Figuring PSS Score

Score will be determined by following these directions:

• First, reverse the scores for questions 4, 5, 7, and 8. On these 4 questions, change the scores like this: 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0.

• then scores add up for each item to get a total. The total score is _____.

• Individual scores on the PSS can range from 0 to 40 with higher scores indicating higher perceived stress.

► Scores ranging from 0-13 would be considered low stress.

► Scores ranging from 14-26 would be considered moderate stress.

► Scores ranging from 27-40 would be considered high perceived stress.

The Perceived Stress Scale is interesting and important because your perception of what is happening in your life is most important. Consider the idea that two individuals could have the exact same events and experiences in their lives for the past month. Depending on their perception, total score could put one of those individuals in the low stress category and the total score could put the second person in the high stress category. Disclaimer: The scores on the following self-assessment do not reflect any particular diagnosis or course of treatment. They are meant as a tool to help assess your level of stress.

Section D) Sleep Quality Assessment (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. Question1-5 required describing your answer, for Question.6-10 you are kindly requested to tick with (x) the most appropriate answer among the four options provided. 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. What time have you usually get up in the morning? _____

4. How many hours of actual sleep did you get at night? _____

5. How many hours do you spend in bed? _____

6. During the past month, how often have you had trouble sleeping because you	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning.				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				
F. Feel too cold				
G. Feel too hot				
H. Have bad dreams				
I. Have pain				
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):----------				
7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem
9. During the past month, how much of a problem has it been for you to keep up the enthusiasm to get things done?				
10. Do you have a bed partner or room mate?	No bed partner or room mate	Partner/room mate in other room	Partner in same room, but not same bed	Partner in same bed

If you have a room mate or bed partner, ask him/her how often in the past month you

have had . . .

a) Loud snoring

Not during the past month_____ Less than once a week_____Once or twice a week_____ Three or more times a week_____

b) Long pauses between breaths while asleep

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

c) Legs twitching or jerking while you sleep

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

d) Episodes of disorientation or confusion during sleep

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

e) Other restlessness while you sleep; please describe_____

_____

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

Scoring Pittsburgh sleep quality index results

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates “poor” from “good” sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

In scoring the PSQI, seven component scores are derived, each scored 0 (no difficulty) to 3 (severe difficulty). The component scores are summed to produce a global score (range 0 to 21). Higher scores indicate worse sleep quality.

Component 1: Subjective sleep quality (question 9)

Response to Q9	Component 1 score
Very good	0
Fairly good	1
Fairly bad	2
Very bad	3

Component 1 score: _____

Component 2: Sleep latency (questions 2 and 5a)

Response to Q2	component 2/Q2 sub score
< 15 minutes	0
16-30 minutes	1
31-60 minutes	2
> 60 minutes	3

Response to Q5a	Component 2/Q5a sub score
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Sum of Q2 and Q5a sub scores	Component 2 score
0	0
1-2	1
3-4	2
5-6	3

Component 2 score: _____

Component 3: Sleep duration (question 4)

Response to Q4	Component 3 score
> 7 hours	0
6-7 hours	1
5-6 hours	2
< 5 hours	3

Component 3 score: _____

Component 4: Sleep efficiency (questions 1, 3, and 4)

Sleep efficiency = (# hours slept/# hours in bed) X 100%

Hours slept—question 4

Hours in bed—calculated from responses to questions 1 and 3

Sleep efficiency	Component 4 score
> 85%	0
75-84%	1
65-74%	2
< 65%	3

Component 4 score: _____

Component 5: Sleep disturbance—questions 5b-5j

Questions 5b to 5j should be scored as follows:

Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Sum of 5b to 5j scores	Component 5 score
0	0
1-9	1
10-18	2
19-27	3

Component 5 score: _____

Component 6: Use of sleep medication—question 6

Response to Q6	Component 6 score
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Component 6 score: _____

Component 7: Daytime dysfunction questions 7 and 8

Response to Q7	Component 7/Q7 sub score
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Response to Q8	Component 7/Q8 sub score
No problem at all	0
Only a very slight problem	1
Somewhat of a problem	2
A very big problem	3

Sum of Q7 and Q8 sub scores	Component 7 score
0	0
1-2	1
3-4	2
5-6	3

Component 7 score: _____

Global PSQI Score: Sum of seven component scores: _____