



Medicine Program
Community Medicine Department

**Energy drink consumption and sleep patterns among
medical students in Napata college 2026**

A research paper submitted in partial fulfillment of the
academic requirement for the degree of MBBS

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Dedication

We dedicate this work to our families, whose endless love, sacrifices, and support have been the foundation of our journey. Their belief in us has been our greatest motivation.

We also dedicate this research to our teachers and mentors, who have guided us with knowledge and inspired us to strive for excellence in the field of medicine.

To our colleagues and fellow medical students, this work is a reflection of the shared struggles and challenges we face, and we hope it contributes to improving student well-being and academic life.

Finally, we dedicate this project to ourselves, as a testament to our hard work, teamwork, and perseverance in completing this important milestone in our medical careers.

Acknowledgment

We would like to express our sincere gratitude to all those who contributed to the successful completion of this research project.

First and foremost, we extend our deepest appreciation to our respected supervisor, Dr. Hadeel Ahmed Hassan, for her invaluable guidance, continuous support, and constructive feedback throughout every stage of this study. Her expertise in Community Medicine and her dedication greatly enriched the quality of this work.

We are also grateful to the staff and administration of Napata College for providing us with the opportunity and resources necessary to conduct this research.

Our heartfelt thanks go to all the medical students who participated in this study. Their cooperation and willingness to share their experiences made this research possible.

Finally, we would like to acknowledge our families and friends for their unwavering encouragement, patience, and support during the completion of this project.

Abstract

Background: Sleep is a fundamental physiological function essential for cognitive processing and health. Medical students often face high academic pressure leading to sleep disturbances. To cope, many rely on energy drinks (EDs), which contain high concentrations of caffeine and stimulants that may further disrupt sleep architecture.

Objectives: This study aimed to evaluate the relationship between energy drink consumption and sleep pattern among medical students at Napata College, Sudan. It also sought to identify consumption patterns and primary reasons for intake.

Methodology: A cross-sectional descriptive study was conducted at Napata College in March 2026. A sample of 349 undergraduate medical students was selected using stratified random sampling. Data were collected via a structured online questionnaire, including the Pittsburgh Sleep Quality Index (PSQI). Statistical analysis was performed using SPSS Version 26.

Results: The results showed a significant reliance on EDs, with 52.3% of participants consuming them to stay awake while studying and 37.9% to overcome fatigue. Significant sleep disturbances were reported, with 25.9% unable to fall asleep within 30 minutes. A statistically significant correlation was found between ED consumption and poor sleep quality (Pearson Chi-Square = 5.431, $p = 0.019$).

Conclusion: The study confirms a clear association between the frequent consumption of energy drinks and diminished sleep quality among medical students at Napata College. While used as a strategy to manage academic demands, EDs contribute to a cycle of sleep fragmentation and reduced cognitive recovery.

ملخص البحث :

خلفية الدراسة: يعتبر النوم وظيفة فسيولوجية أساسية للعمليات المعرفية والصحة العامة. يواجه طلاب الطب ضغوطاً أكاديمية عالية تؤدي غالباً إلى اضطرابات في النوم. وللتعامل مع هذه الضغوط، يعتمد الكثيرون على مشروبات الطاقة التي تحتوي على تركيزات عالية من الكافيين والمنشطات، مما قد يؤدي إلى مزيد من الاختلال في بنية النوم.

الأهداف: هدفت هذه الدراسة إلى تقييم العلاقة بين استهلاك مشروبات الطاقة وجودة النوم لدى طلاب الطب في كلية نبتة بالسودان، بالإضافة إلى تحديد أنماط الاستهلاك والأسباب الرئيسية لتناولها.

المنهجية: أجريت دراسة وصفية مقطعية في كلية نبتة خلال شهر مارس 2026م. شملت العينة 349 طالباً من طلاب الطب تم اختيارهم عن طريق العينة العشوائية الطبقية. جُمعت البيانات عبر استبيان إلكتروني منظم، تضمن مؤشر بيتسبرغ لجودة النوم (PSQI) تم إجراء التحليل الإحصائي باستخدام برنامج (SPSS) الإصدار 26.

النتائج: أظهرت النتائج اعتماداً كبيراً على مشروبات الطاقة، حيث استخدمها 52.3% من المشاركين للبقاء مستيقظين أثناء الدراسة، و37.9% للتغلب على الإرهاق. سُجلت اضطرابات ملحوظة في النوم، حيث لم يتمكن 25.9% من الطلاب من النوم خلال 30 دقيقة. كما كشف التحليل عن وجود علاقة ذات دلالة إحصائية بين استهلاك مشروبات الطاقة وضعف جودة النوم. (Pearson Chi-Square = 5.431, p = 0.019)

الخلاصة: تؤكد الدراسة وجود ارتباط واضح بين الاستهلاك المتكرر لمشروبات الطاقة وانخفاض جودة النوم لدى طلاب الطب في كلية نبتة. ورغم استخدامها كاستراتيجية لمواجهة المتطلبات الأكاديمية، إلا أنها تساهم في حلقة مفرغة من تقطع النوم وضعف الاستشفاء المعرفي.

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List of Abbreviations

Abbreviation	Full Term
ED	Energy Drink
MBBS	Bachelor of Medicine, Bachelor of Surgery
MPH	Master of Public Health
MD	Doctor of Medicine
PSQI	Pittsburgh Sleep Quality Index
REM	Rapid Eye Movement
Non-REM	Non-Rapid Eye Movement
SPSS	Statistical Package for the Social Sciences (Version 26)
UAE	United Arab Emirates
MENA	Middle East and North Africa

CHAPTER

ONE

Introduction

1.1 Background

Energy drinks (EDs) are non-alcoholic beverages that typically contain high concentrations of stimulants, primarily caffeine, alongside other ingredients such as taurine, ginseng, guarana, and B-complex vitamins [1]. Over the last decade, their popularity has surged globally, particularly among university students who face high academic pressure [2]. Within the medical fraternity, the use of these stimulants has become a culturally normalized coping mechanism to manage the vast curriculum and the rigorous demands of clinical training [3].

The primary appeal of energy drinks lies in their ability to enhance alertness, improve concentration, and delay the onset of fatigue [4]. However, this perceived benefit comes with a significant physiological cost. Caffeine, the core component of most EDs, acts as an adenosine receptor antagonist, which interferes with the body's natural signaling for sleep [5]. For medical students, whose schedules are already compromised by long study hours and irregular shift work, the consumption of these beverages often leads to a "vicious cycle." Students use EDs to stay awake, which subsequently disrupts their sleep quality, leading to daytime somnolence and a further reliance on stimulants the following day [6].

In regions like Sub-Saharan Africa, research into these patterns is growing. Studies have indicated that poor sleep quality among medical students is not just a nuisance but a risk factor for psychological distress, decreased clinical empathy, and impaired decision-making [7]. Despite these risks, the aggressive marketing of energy drinks as "performance enhancers" continues to influence student behavior [8]. Understanding

the specific relationship between ED consumption and sleep quality—measured by tools like the Pittsburgh Sleep Quality Index (PSQI)—is essential for developing wellness interventions within medical colleges like Napata College [9].

1.2 Problem Statement:

Globally, sleep deprivation among medical students has reached alarming proportions, with studies indicating that nearly 60% to 90% of students suffer from poor sleep quality due to high-stakes examinations and rigorous clinical rotations [4, 9]. Research across various continents shows that medical trainees are 2.5 times more likely to report daytime sleepiness compared to the general population [10]. This phenomenon is not merely a lifestyle choice but a burgeoning public health crisis that contributes to burnout, medical errors, and psychological distress on a worldwide scale [1, 5, 12]. Medical students are particularly vulnerable to poor sleep quality and deprivation, which are strongly associated with poor academic performance and lifestyle habits such as excessive caffeine consumption. However, during the research, a review of the literature was carried out, and no research was found on the pattern and trend of energy drinks consumption and its impact on sleep among medical students in the country, particularly in Napata College. Although these global trends are important and should be addressed urgently, our literature review revealed that the relationship between sleep quality and academic achievement has not been explicitly established within the Sudanese context. This absence of localized literature regarding the effects of sleep disturbances on student success is an area that needs to be further explored to mitigate the global trend of student burnout within Sudan [4, 13].

1.3 Justification:

It is important to establish the relationship between the consumption of energy drinks and sleep quality because sleep disturbance is strongly linked to poor cognitive performance and academic achievement. A literature review revealed that no studies were available on the consumption of energy drinks by medical students in Sudan and Napata College. This study is crucial in providing the necessary data required by the institution to develop the necessary health interventions and education programs. The study will help the college to promote the academic performance of the students by understanding the consumption habits of the students.

1.4 Study Objectives :

1.4.1 General Objective

- To evaluate the energy drink consumption and sleep patterns among medical students at Napata College, Sudan.

1.4.2 Specific Objectives

- To examine the demographic factors (such as gender and academic year) that may influence both energy drink consumption habits and sleep patterns.
- To determine the prevalence and patterns of energy drink consumption (frequency, amount, and timing) among medical students at Napata College.
- To assess the overall sleep quality of the students using the Pittsburgh Sleep Quality Index (PSQI).
- To identify the primary reasons for energy drink intake among medical students (e.g., studying for exams, overcoming fatigue, or staying awake during long shifts).

- To determine the association between the frequency of energy drink consumption and poor sleep quality, including specific sleep components such as sleep duration and sleep latency.

CHAPTER

TWO

Literature Review

2.1 Introduction to Stimulant Use and Sleep Dynamics

The relationship between stimulant consumption and sleep architecture is a complex physiological interaction that has garnered significant attention in modern educational research. On a global scale, the transition to high-pressure academic environments has shifted student behaviors toward the use of methylxanthines—primarily caffeine—to artificially extend wakefulness [1, 2]. As medical curricula become increasingly dense, the "24-hour student" model has emerged, where pharmacological interventions are used to bypass biological rhythms [3, 4].

The primary mechanism involves the competitive antagonism of adenosine receptors (A_1 and A_{2A}) in the central nervous system. Adenosine is a byproduct of cellular metabolism that builds up during wakefulness, creating "sleep pressure" or homeostatic drive [5]. By blocking these receptors, energy drinks (EDs) and other stimulants mask the physiological need for rest. However, this pharmacological intervention often results in a "sleep debt" cycle, where the suppression of adenosine delays sleep onset and reduces the restorative phases of the sleep cycle, such as Slow-Wave Sleep (SWS) and Rapid Eye Movement (REM) sleep [6, 7].

2.2 The Pathophysiology and "Vicious Cycle" of Consumption

Energy drinks are characterized by high concentrations of caffeine (often exceeding 150mg to 300mg per serving) combined with synergistic stimulants such as taurine, glucuronolactone, ginseng, and L-carnitine [8, 9]. While these ingredients are marketed as performance enhancers, their physiological half-life—ranging from 3 to 7 hours—can interfere with the homeostatic drive for sleep long after the initial consumption.

Research indicates that medical students often fall into a "vicious cycle": high academic stress leads to sleep deprivation, which is then managed through excessive ED consumption to maintain alertness during clinical rotations or lectures [10, 11]. This consumption, particularly when occurring in the late afternoon or evening, causes Fragmented Sleep Architecture. This refers to frequent micro-arousals during the night, leading to unrefreshing sleep and increased daytime somnolence the following day, which in turn necessitates further stimulant use [12, 13, 14]. This dependency not only affects physical health but also contributes to long-term neurocognitive exhaustion and potential cardiovascular strain, including tachycardia and hypertension [15, 16].

2.3 Neurocognitive Consolidation and Academic Performance

The interaction between ED consumption and academic outcomes presents a paradoxical challenge. While students utilize stimulants to increase "time-on-task," the resulting sleep disturbance impairs the very cognitive functions required for medical excellence [17]. During sleep, the brain undergoes "Synaptic Scaling" and memory consolidation. This process is essential for converting short-term memory acquired during study sessions into long-term storage, primarily during the REM and Slow-Wave Sleep phases [18, 19].

Stimulants consumed via EDs have been shown to specifically suppress these phases. Studies utilizing polysomnography (PSG) have demonstrated that even moderate caffeine intake increases sleep latency and decreases total sleep time [20]. Consequently, while a student may stay awake longer to read, the rate of information retention and recall is significantly compromised. Chronic sleep deprivation induced by stimulants has been linked to deficits in executive function, reduced attention

span, and impaired decision-making—traits that are critical for medical professionals [21, 22].

2.4 Psychological Correlates, Stress, and Sleep Hygiene

The use of energy drinks is rarely an isolated behavior; it is frequently comorbid with high levels of perceived stress and anxiety. Seblewengel L. et al. (2021) noted that students with poor sleep quality were significantly more likely to report symptoms of psychological distress [23]. The stimulant-induced arousal can mimic or exacerbate symptoms of clinical anxiety, leading to a state of hyper-vigilance that makes entering the first stage of non-REM sleep increasingly difficult [24].

Furthermore, Dyrbye et al. (2008) established that burnout and suicidal ideation among medical students are closely linked to chronic sleep deprivation [25]. The reliance on energy drinks to mask this exhaustion creates a "pharmacological mask" for underlying mental health issues. A study by Richards et al. (2015) found that high caffeine consumers reported higher levels of depression and anxiety compared to low consumers, suggesting that while the drink provides a temporary "lift," the subsequent "crash" and sleep disruption worsen the student's psychological resilience [26, 27].

The concept of "Sleep Hygiene" is often neglected in this cohort. Poor hygiene—defined as irregular sleep schedules, use of electronics (blue light exposure) before bed, and late-day stimulant use—interacts with the pharmacological effects of EDs to create a state of chronic circadian misalignment [28, 29]. Stasio et al. (2011) demonstrated that students who used EDs specifically to cope with stress had significantly worse psychological outcomes than those who used them for taste or social reasons [30].

2.5 Regional Prevalence: Middle East and North Africa (MENA)

Regionally, the consumption of energy drinks has become a cultural and academic staple. In Saudi Arabia, AlSharif et al. (2018) revealed a staggering prevalence of poor sleep quality, affecting 80.7% of participants, which significantly correlated with excessive caffeine consumption ($p = 0.003$) [31]. Alshumrani et al. (2023) further highlighted gender disparities, noting that while 74.6% of Saudi medical students experienced poor sleep, male students reported significantly higher consumption of energy and sports drinks compared to females [32].

In the United Arab Emirates (UAE), Al-Mulla et al. (2017) reported that approximately 41% of students utilized stimulants regularly, with a direct link to delayed sleep onset and reduced overall sleep duration [33]. Similarly, studies in Egypt have indicated that over 65% of medical students use stimulants to cope with "all-nighters" during final exams, often resulting in "rebound fatigue" once the stimulant effects wear off [34, 35]. In Jordan, research found that nearly half of the university population consumed at least one energy drink daily, with the majority citing "staying awake to study" as the primary motivation [36].

2.6 Local and Institutional Perspectives (Sudan and Napata College)

Within the Sub-Saharan African context—and specifically within Sudan—there remains a critical lack of empirical data regarding the evolving trends of ED consumption among the new generation of medical trainees. This gap is particularly concerning given the unique socioeconomic and academic stressors present in Sudanese medical education.

The academic environment in Sudan often requires students to navigate resource limitations, social instability, and intense examination schedules, which may

exacerbate the reliance on stimulants. While generalized studies in Africa suggest a growing trend of stimulant use among youth due to aggressive marketing and availability, institutional data from places like Napata College is currently missing [37]. Localized research is therefore imperative to understand these patterns and develop culturally and academically appropriate interventions to protect student well-being [38, 39].

2.7 Prevalence in Asia and South America

In Pakistan, Nasir et al. (2022) established a substantial positive correlation between daily consumption of caffeinated products and higher Pittsburgh Sleep Quality Index (PSQI) scores, concluding that as consumption increases, sleep quality inversely decreases [40]. This highlights that the issue transcends culture and is directly tied to the rigors of medical training in the developing world.

In Southeast Asia, particularly Thailand, research by Pensuk et al. (2019) indicated that 48.1% of medical students reported regular stimulant use, with a significant proportion experiencing associated sleep disturbances and daytime impairment [41]. This is mirrored in South America, where Sanchez et al. (2013) found that Peruvian students consuming three or more stimulant drinks weekly were 1.88 times more likely to experience poor sleep quality compared to light users [42].

2.8 Global Trends and Public Health Implications

The prevalence of energy drink use is a documented global phenomenon within the medical fraternity. In the United States, survey data indicates that up to 70% of medical students utilize these beverages as a primary coping mechanism during high-stakes examination periods [43]. European data, specifically from Italian and Norwegian cohorts, further reinforces these findings. A study involving over 50,000

students in Norway established a definitive dose-response relationship; students consuming EDs daily were twice as likely to sleep less than six hours compared to non-users [44, 45].

The long-term public health implications of this trend are profound. Beyond academic performance, the chronic disruption of the circadian rhythm is associated with metabolic syndromes, weakened immune response, and increased risk of cardiovascular disease later in life [46]. For medical students—the future providers of healthcare—the establishment of these unhealthy coping mechanisms during their training years poses a risk to their professional longevity and their ability to model healthy behaviors for their future patients [47, 48].

CHAPTER

THREE

Methodology

3.1. Study Design

The study is a cross-sectional descriptive facility-based study. This design is appropriate as it allows for the assessment of energy drink consumption patterns and sleep quality among medical students at a single point in time to identify associations between the variables.

3.2. Study Area

The research was conducted at Napata College, located in Khartoum, Sudan. The college was chosen for its concentrated population of medical students who face high academic demands, making them a relevant cohort for studying stimulant use and sleep hygiene.

3.3. Study Duration

The study was carried out over a period of approximately two weeks. The data collection phase specifically took place between 15th March 2026 and 28th March 2026.

3.4. Study Population

The target population included all undergraduate medical students currently enrolled and registered in the Faculty of Medicine at Napata College, Sudan, during the study period.

3.4.1. Inclusion Criteria

- Full-time undergraduate medical students at Napata College.
- Students who provide informed consent to participate.

3.4.2. Exclusion Criteria

- Postgraduate students.
- Students who decline to participate or fail to complete the consent process.

3.5. Variables

- **Independent Variable:** Consumption of energy drinks (including type of brand, frequency of intake, quantity per day, and timing of consumption).
- **Dependent Variable:** Sleep quality (assessed via the Pittsburgh Sleep Quality Index (PSQI) scores).
- **Confounding Variables:** Academic workload (daily study hours), psychological stress levels, consumption of other caffeinated beverages (coffee/tea), and use of electronic devices before bedtime.

3.6. Sample Size

The sample size for this research was determined to be **349** medical students. This number was calculated to ensure adequate statistical power and a representative cross-section of the student body at Napata College. The calculation was performed using

the following formula:

$$n = \frac{N}{\{1 + N(d)^2\}}$$

Where:

- n = **Sample size**
- N = **Total population of medical students at Napata College**
- d = **Margin of error (set at 0.04 for 95% confidence level)**

3.7. Sampling Technique

Stratified random sampling technique was employed for this research. To ensure a balanced representation across different stages of medical training, the population was organized by academic year (strata), and a proportional number of participants was invited from each level to ensure that both pre-clinical and clinical students were adequately represented.

3.8. Data Collection Methods

Data was collected using a structured online questionnaire. The tool was divided into three main sections:

1. **Socio-demographic data:** Age, gender, and academic level.
2. **Energy Drink Consumption Patterns:** Frequency, reasons for use, and timing.
3. **The Pittsburgh Sleep Quality Index (PSQI):** A validated tool used to measure sleep quality and disturbances over a one-month interval.

The questionnaire was distributed to students via official online academic platforms and social media channels (e.g., WhatsApp groups).

3.9. Data Management and Analysis

After completion of data collection, all responses were checked for completeness and consistency. Data was coded and analyzed using *SPSS software Version 26*.

- **Descriptive statistics:** Frequencies, percentages, means, and standard deviations were used to summarize consumption patterns and sleep scores.
- **Inferential statistics:** Correlation (Chi Square test) and regression analysis was conducted to assess the link between energy drink consumption and sleep quality. Statistical significance was set at a **p-value < 0.05** with a 95% confidence interval.

3.10. Ethical Considerations

- **Informed Consent:** Electronic clearance was obtained from all participants before they access the survey questions.
- **Voluntary Participation:** Students was informed that participation is entirely voluntary, and they hold the right to withdraw at any time without penalty.
- **Anonymity and Confidentiality:** No identifying information (names or ID numbers) was collected. All data is kept confidential and used exclusively for the purposes of this research.
- **Institutional Approval:** The study was conducted following the ethical guidelines provided by Napata College.

3.11 Limitations:

While this study provides valuable insights into the relationship between energy drink consumption and sleep quality among medical students at Napata College, several limitations should be acknowledged:

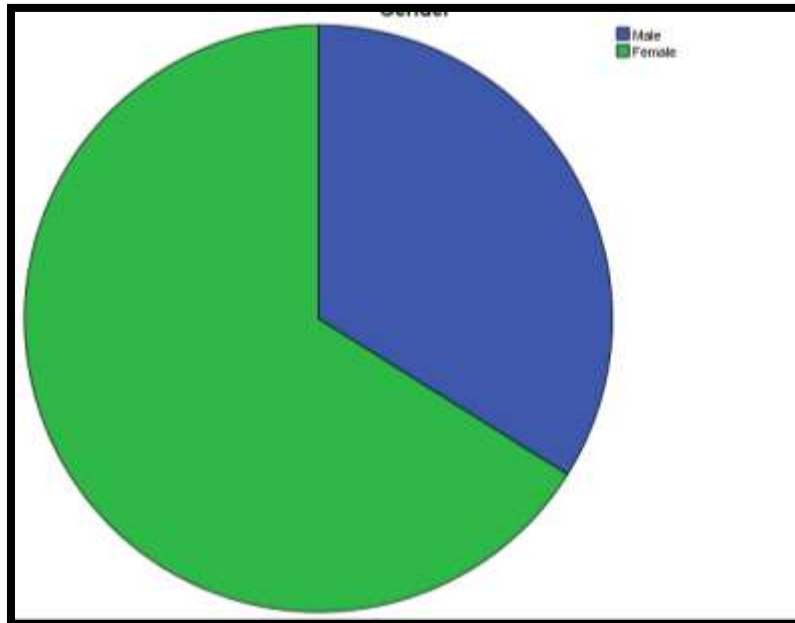
1. **Self-Reporting Bias:** The data was collected using self-administered questionnaires, which may lead to recall bias. Participants might over- or under-estimate their energy drink consumption or the duration of their sleep.
2. **Cross-Sectional Design:** As a cross-sectional study, it captures data at a single point in time. This prevents the establishment of a definitive causal relationship between energy drink use and poor sleep quality; it can only identify associations.
3. **Institutional Specificity:** The study was conducted exclusively at Napata College. Therefore, the findings may not be fully generalizable to medical students in other colleges or different geographical regions with different academic pressures or cultural habits regarding stimulant use.
4. **Confounding Variables:** Although the study accounts for coffee and tea consumption, other factors that affect sleep—such as clinical rotation stress, screen time before bed, or underlying psychological conditions (anxiety/depression)—were not exhaustively controlled for.

CHAPTER

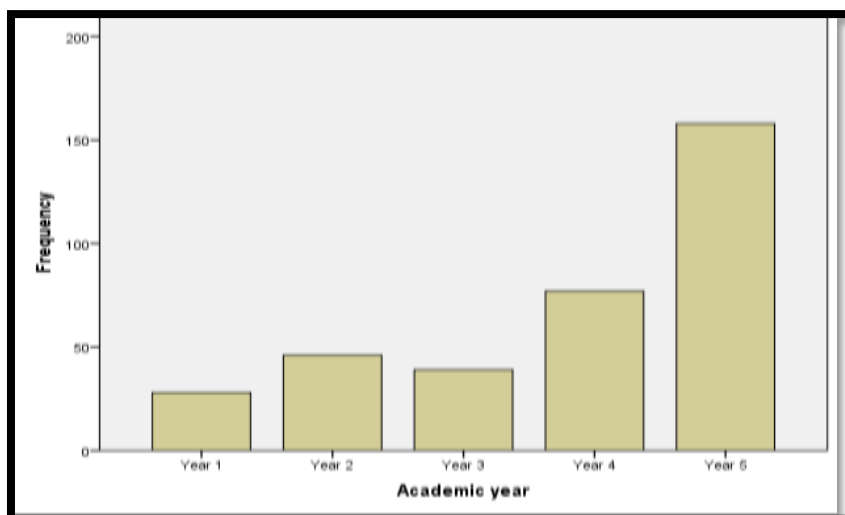
FOUR

Results

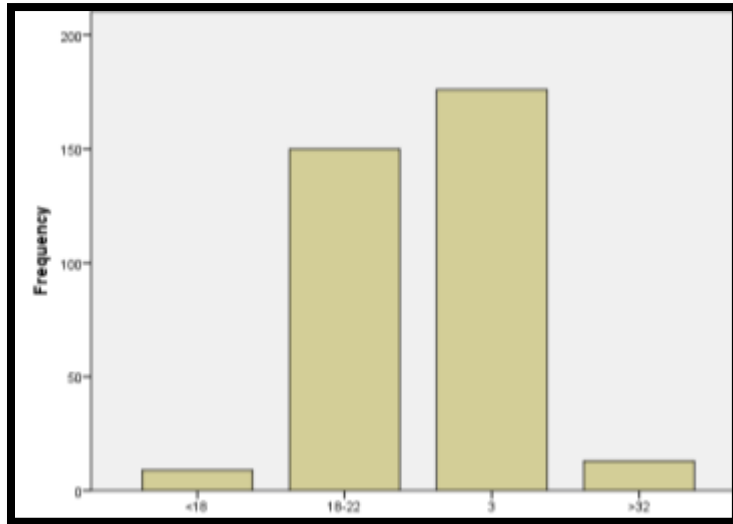
4.1. Participant Demographics and Distribution



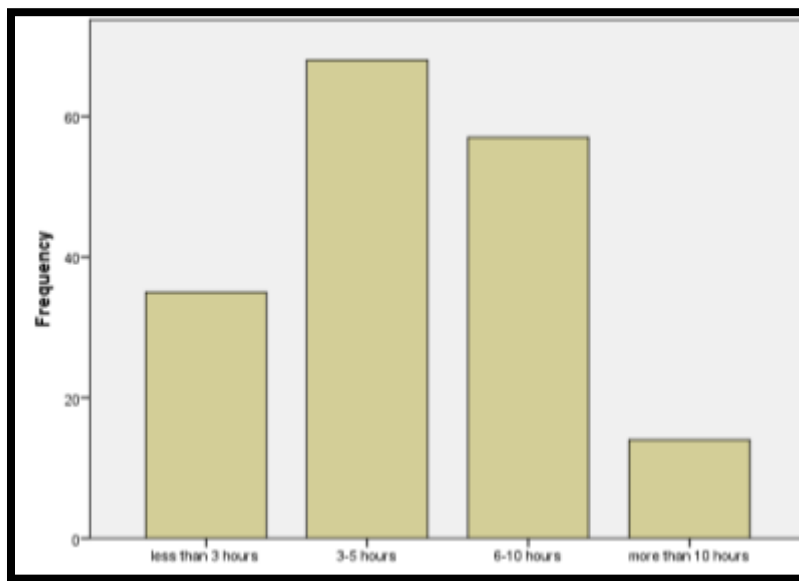
Graph 4.2.1 shows students' gender (N=349) this graph shows that the majority of participants were females.



Graph 4.1.2 shows the academic ear of students (N=349) this graph shows that the majority of participants were in their final year.

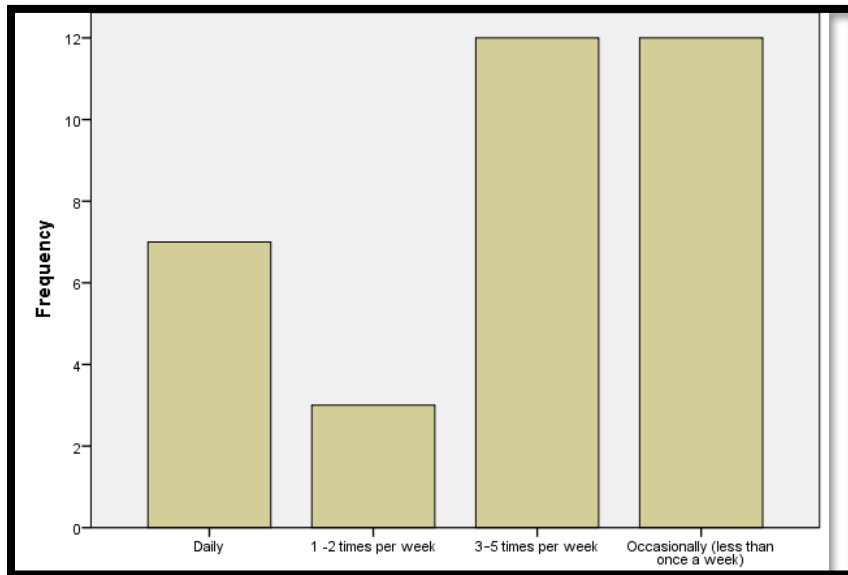


Graph 4.1.3 shows students age (n=349) majority of participants were between 18-22 years

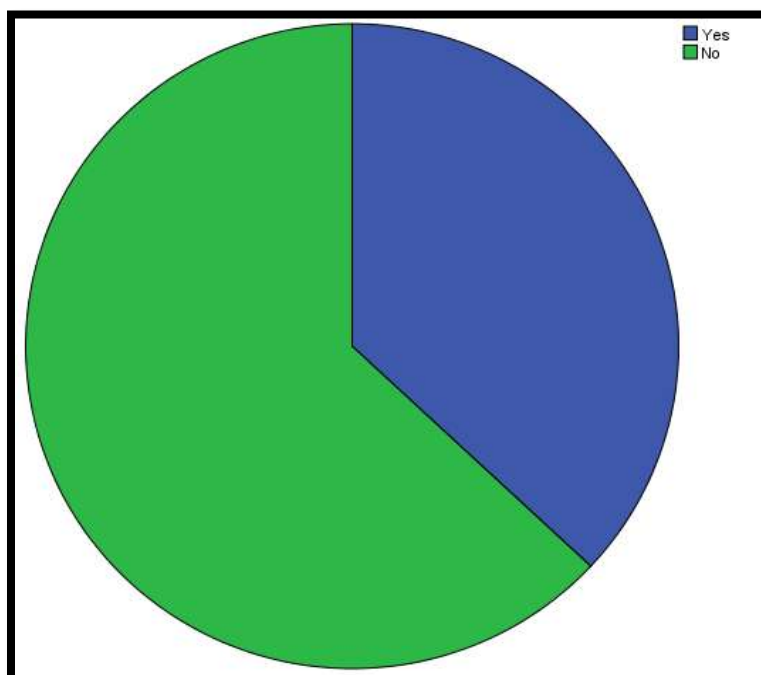


Graph 4.1.4 shows average daily study hours for each student (n=349) majority

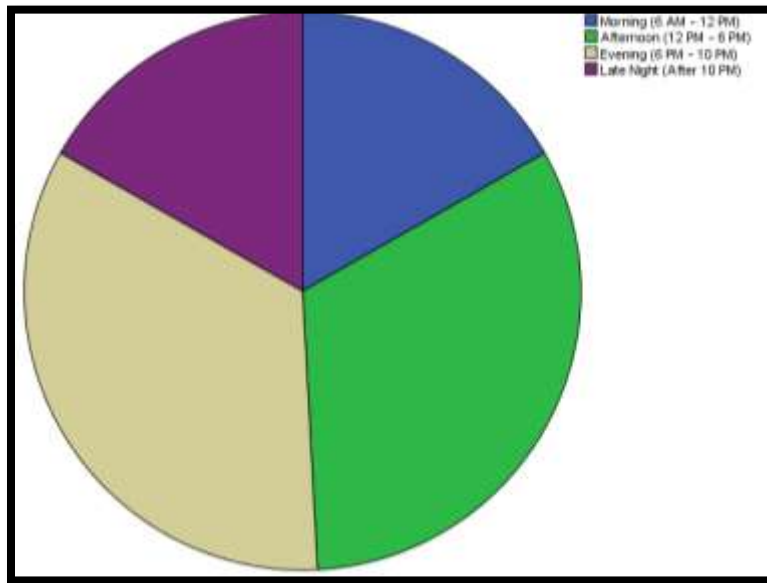
4.2. Energy Drink (ED) Consumption:



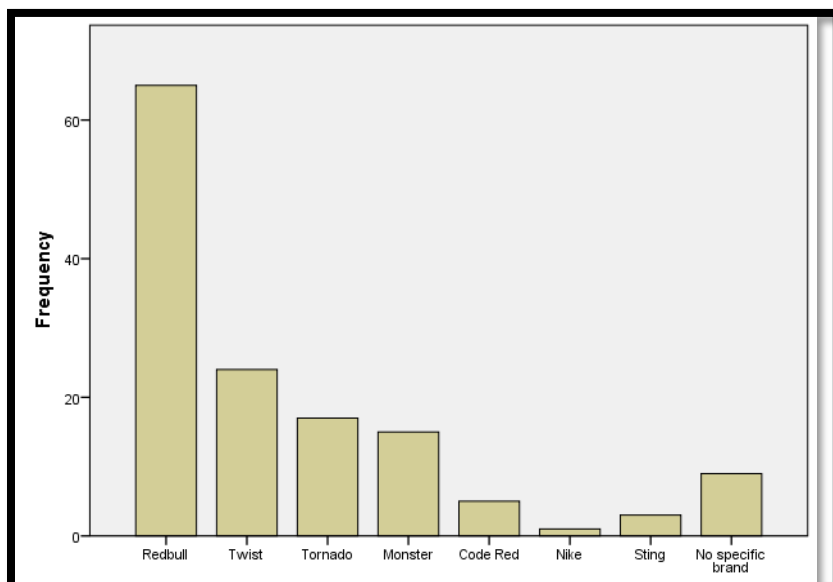
Graph 4.2.1 shows frequency of energy drinks consumption(n=394) most of participants drinks ED 3-5 times a week



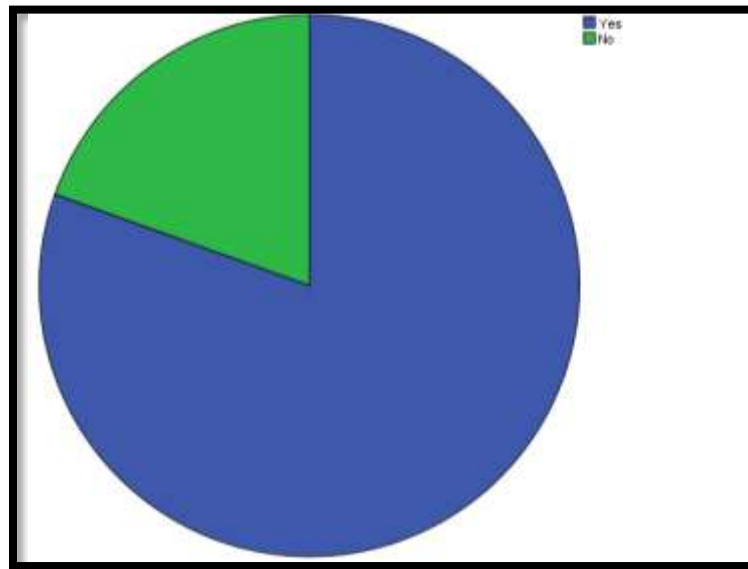
Graph 4.2.2 shows the Prevalence of Energy Drink Consumption during the last month (n=349) the majority of participants drank ED during the last month.



Graph 4.2.3 shows timing of Ed consumption (n=349) most of participants during ED at the evening.



Graph 4.2.4 Shows the brands of Ed (n=349) shows that the majority of participants drinks red bull.



Graph4.3.4. shows consumption of caffeinated beverages (n=349) most of s=participants consume caffeinated drinks

4.3. Primary Drivers for Energy Drink Consumption

Table 4.3.1 shows the reason of Ed consumption

Reason for Drinking ED	Frequency	Percent	Frequency (Missing)	Percent (Missing)
Stay awake while studying	91	52.3%	14	8.0%
Enjoy the taste of drinks	73	42.0%	24	13.8%
Overcome fatigue/tiredness	66	37.9%	28	16.1%
Stay awake during clinical shifts	40	23.0%	43	24.7%
Improve physical endurance/sports	29	16.7%	47	27.0%
Total	299*		156	

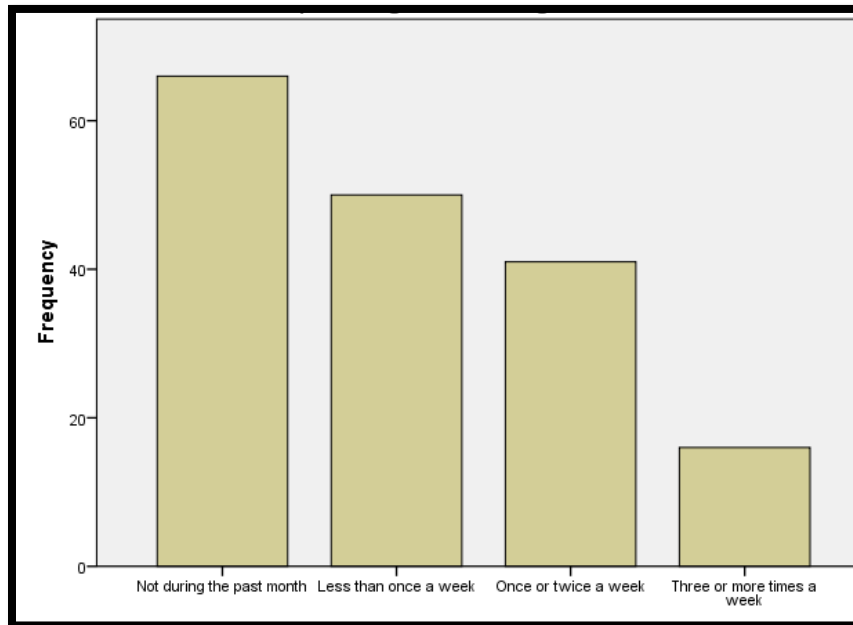
**Note: Percentages are calculated based on the number of ED users (n=174). Total percentage exceeds 100% due to multiple responses allowed per participant.*

Table 4.3.2 shows the reason of sleep disturbances

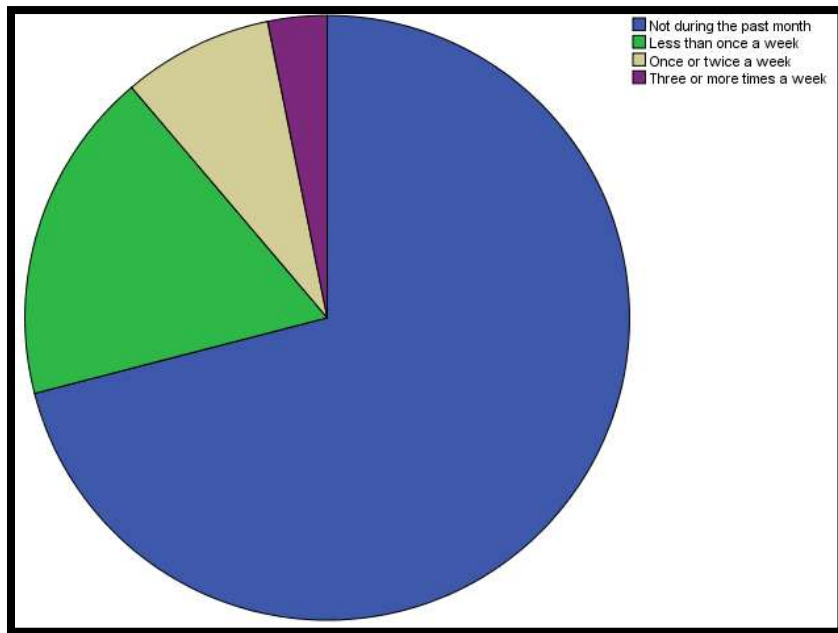
Reason for Trouble Sleeping	Frequency	Percentage (%)
Cannot sleep within 30 minutes	45	25.9%
Wake up in the middle of the night	34	19.5%
Have to use the bathroom	27	15.5%
Feel too cold	20	11.5%
Had bad dreams	20	11.5%
Cannot breathe comfortably	14	8.0%
Have pain	12	6.9%
Cough or snore loudly	8	4.6%
Total	180*	

**Note: Respondents were able to select more than one barrier to sleep; therefore, the total number of responses (180) exceeds the total number of respondents (174).*

4.4. Overall sleeping quality and the Impact of ED Consumption on Global Sleep Scores



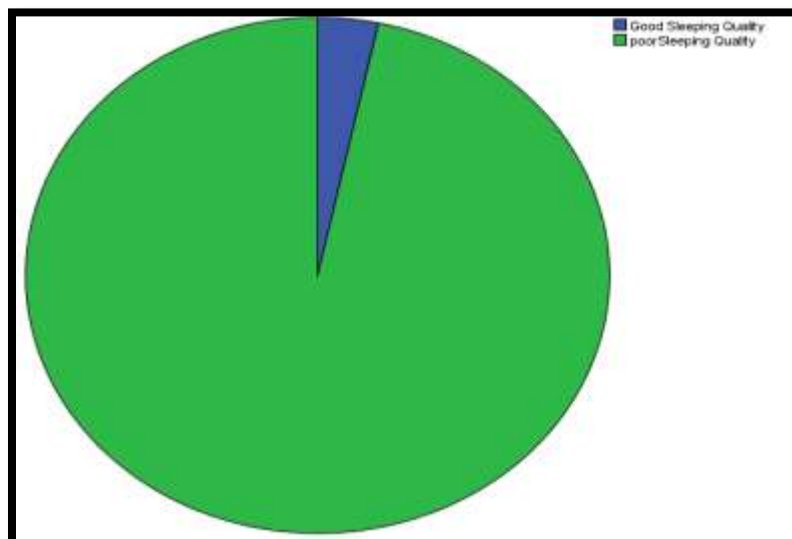
Graph 4.4.1 shows the frequency of sleeping disturbance (n=349) most of participants complain of sleeping disturbance during last month



Graph 4.4.2 shows the use of sleeping medication (n=349) most of participants didn't take sleeping medications during the last month

4.3.Pittsburgh Sleep Quality Index (PSQI) Analysis

- **Score ≤ 5 :** Good Sleep Quality
- **Score > 5 :** Poor Sleep Quality



Graph 4.4.3 shows the quality of sleep among participants (n=349) most of participants have poor sleeping quality

4.4.correlation between ED consumption and Pittsburgh Sleep Quality Index (PSQI) Analysis

Table 4.4.1 shows the correlation between ED consumption and Pittsburgh Sleep Quality Index (PSQI) Analysis

	<i>Value</i>	<i>df</i>	<i>Asymp. Sig. (2-sided)</i>
<i>Pearson Chi-Square</i>	5.431 ^a	1	.019
<i>Continuity Correction^b</i>	4.822	1	.028
<i>Likelihood Ratio</i>	5.510	1	.019
<i>N of Valid Cases</i>	349		

- *P value is significant*

CHAPTER

FIVE

Discussion

The findings of this study at Napata College provide a comprehensive profile of energy drink (ED) consumption patterns and their subsequent impact on the sleep-wake cycle of medical students. Our results reveal a significant reliance on these beverages, with a striking 52.3% of participants utilizing EDs specifically to "stay awake while studying" and 37.9% to "overcome fatigue or tiredness." These motivations suggest that ED consumption is not merely a lifestyle choice but a tactical academic strategy used to navigate the rigorous demands of the medical curriculum. This aligns with the "vicious cycle" described in the literature by Azad et al. [5], where the demanding nature of medical education creates a state of chronic sleep debt that students attempt to manage through pharmacological means. Interestingly, a large portion of students (42%) also cited "enjoying the taste" as a reason for consumption, indicating that the palatable nature of these drinks, often high in sugar and flavorings, makes them particularly appealing to the university demographic and potentially encourages more frequent intake than traditional bitter stimulants like black coffee.

The physiological impact of these habits is underscored by the high frequency of sleep disturbances reported by the participants at Napata College. Specifically, 25.9% of students reported being unable to fall asleep within 30 minutes at least three times a week, while 19.5% experienced frequent nocturnal awakenings. This increased sleep latency and fragmentation are classic symptoms of excessive methylxanthine intake, which, as established by Roehrs and Roth [10], antagonizes adenosine receptors and disrupts the homeostatic drive for sleep. By blocking these

receptors, students are chemically suppressing the brain's natural signal for rest, leading to a state of hyper-arousal that persists long after the study session has ended. This chronic disruption of the sleep-wake cycle can lead to long-term circadian misalignment, which is often associated with metabolic and cardiovascular strain in medical professionals.

Furthermore, the data highlights an "academic paradox" regarding the relationship between stimulant use and cognitive performance. While 52.3% of students drink EDs to increase their "hours awake" for studying, our findings regarding sleep quality suggest they may be hindering their long-term information retention. The 11.5% of students who reported "bad dreams" point toward a significant disruption in REM sleep architecture. As discussed in the work of Alhola and Polo-Kantola [19], REM sleep is critical for emotional regulation and memory consolidation. By suppressing these restorative phases through late-night stimulant use, students may be achieving a higher quantity of study time at the expense of the cognitive quality required for medical excellence. This suggests that the pharmacological "lift" provided by energy drinks is an insufficient substitute for the neurological processes that occur during natural, restorative sleep.

The 23.0% of students who reported using EDs to stay awake during clinical shifts is a particularly concerning statistic for the future of healthcare delivery. As Harrison and Horne [4] have noted, sleep deprivation significantly impairs decision-making and ethical judgment in the prefrontal cortex—functions that are vital for safe medical practice and patient interaction. In a clinical environment, the reliance on stimulants to mask exhaustion can lead to decreased empathy and a higher risk of diagnostic errors. The use of these beverages to navigate the transition from classroom to clinic suggests that medical trainees are being pushed beyond their

biological limits, establishing a pattern of behavior that may persist into their professional careers and contribute to early-career physician burnout.

Beyond the neurological impacts, our data also emphasizes the secondary physiological consequences of high stimulant intake. For instance, 15.5% of students reported needing to use the bathroom frequently during the night, which is a direct result of the diuretic properties of caffeine. This nocturia further fragments the sleep cycle, compounding the insomnia caused by the chemical effects of the energy drinks. Additionally, the 11.5% of students reporting "feeling too cold" and other somatic discomforts suggest that the physical toll of these habits is significant and multifaceted. This reinforces the findings of Stasio et al. [23], who argued that students using EDs to cope with stress have significantly worse psychological and physical outcomes than those who use them for social reasons.

When comparing these results to regional studies, the patterns at Napata College are remarkably consistent with findings in Saudi Arabia [1] and Egypt [12]. The high prevalence of ED use across these regions suggests a standardized "academic culture" in medical schools that encourages the use of stimulants to meet high performance expectations. However, the unique stressors of the Sudanese academic environment likely exacerbate these trends. The fact that a significant minority (16.7%) even uses EDs for "physical endurance or sports" indicates that stimulants are being integrated into multiple facets of student life beyond the classroom.

Without institutional interventions to educate students on the importance of the circadian rhythm and the risks of chronic stimulant use, this pattern of behavior is likely to persist. This study confirms that for many medical students, energy drinks are being used as a dangerous substitute for natural recovery, a trend that requires immediate attention to protect the quality of patient care and student well-being.

CHAPTER

SIX

6.1 Conclusion

The investigation into energy drink (ED) consumption patterns among medical students at Napata College confirms that stimulant use has become a cornerstone of the modern academic experience in Sudan. The study successfully established a clear link between the tactical use of these beverages—primarily to extend study hours and overcome clinical exhaustion—and the significant degradation of sleep quality. With over half of the student body utilizing EDs as a primary coping mechanism, the research highlights a "vicious cycle" where pharmacological intervention leads to increased sleep latency, nocturnal fragmentation, and the suppression of restorative REM sleep.

The data suggests that the "academic paradox" is in full effect: students are sacrificing the very sleep necessary for long-term memory consolidation and cognitive sharpness in exchange for extra hours of transient wakefulness. This trend is not isolated to Napata College but mirrors a regional and global shift in medical training culture. Furthermore, the reliance on stimulants during clinical shifts raises important questions regarding future professional competency and the risk of early burnout. Ultimately, the study concludes that without a fundamental shift in how students manage their physiological needs during their training, the long-term health and professional efficacy of the next generation of Sudanese physicians may be significantly compromised.

6.2 Recommendations

6.2.1 For the Institution (Napata College)

- **Educational Workshops:** Implement mandatory seminars on sleep hygiene and the physiological risks of stimulant dependency for first-year medical students.
- **Curricular Review:** Evaluate exam schedules and clinical shift rotations to identify and mitigate "high-stress" periods that may drive students toward excessive stimulant use.
- **Counseling Services:** Enhance access to mental health and academic counseling to provide students with healthy, non-pharmacological stress management techniques.
- **Regulatory Measures:** Consider limiting the availability of high-caffeine energy drinks within college-operated cafeterias and vending machines.

6.2.2 For Medical Students

- **Prioritize Sleep Hygiene:** Adopt consistent sleep schedules and avoid stimulant consumption at least six hours before the intended bedtime to preserve sleep architecture.
- **Cognitive Awareness:** Recognize that pharmacological wakefulness does not equate to effective learning and that restorative sleep is vital for long-term information retention.
- **Healthier Alternatives:** Replace energy drinks with adequate hydration, balanced nutrition, and short, scheduled power naps to manage fatigue during intense study periods.

6.2.3 For Future Research

- **Longitudinal Studies:** Conduct follow-up research to track the long-term health outcomes and academic performance of students who report chronic ED use.
- **Comparative Analysis:** Perform a comparative study between different medical colleges in Sudan to determine if these consumption patterns are unique to specific institutional environments or a broader national trend.

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Appendices

Questionnaire

Section 1: Informed Consent

Title of Study: Energy drink consumption and sleep patterns among medical students in Napata College 2026.

Introduction: You are invited to participate in a research study conducted by students at Napata College, Medicine Program . This study aims to evaluate the relationship between energy drink (ED) consumption and sleep quality.

Participation Procedures: If you agree to participate, you will complete an online survey regarding your lifestyle habits and sleep patterns over the past month. This will take approximately 10 minutes.

Voluntary Participation & Withdrawal: Participation is entirely voluntary. You may choose not to participate or withdraw at any time without penalty or impact on your academic standing.

Confidentiality: All responses are anonymous. No identifying information (names or ID numbers) will be collected. Data will be used exclusively for academic research purposes.

Electronic Clearance: * ☐ I have read the information above and voluntarily agree to participate in this study.

Section 2: Socio-Demographic Data

Please select the most appropriate option.

1. **Gender:** * ☐ Male

☐ Female

2. **Age (in years):** _____

3. **Academic Year:**

☐ Year 1

☐ Year 2

☐ Year 3

☐ Year 4

☐ Year 5

4. **Average Daily Study Hours:** _____

Section 3: Energy Drink (ED) Consumption Patterns

Energy drinks are non-alcoholic beverages containing caffeine, taurine, or guarana (e.g., Red Bull, Monster, Code Red, etc.).

5. **Have you consumed at least one energy drink in the past 30 days?**

☐ Yes

☐ No (If No, please skip to Section 4)

6. **How frequently do you consume energy drinks?**

☐ Daily

☐ 3–5 times per week

- ☐ 1–2 times per week
- ☐ Occasionally (less than once a week)

7. What is your primary reason for consuming energy drinks? (Select all that apply)

- ☐ To stay awake while studying for exams
- ☐ To overcome fatigue/tiredness
- ☐ To stay awake during long clinical shifts
- ☐ To improve physical endurance/sports
- ☐ I enjoy the taste

8. At what time of day do you most commonly consume energy drinks?

- ☐ Morning (6 AM – 12 PM)
- ☐ Afternoon (12 PM – 6 PM)
- ☐ Evening (6 PM – 10 PM)
- ☐ Late Night (After 10 PM)

9. Which brand do you consume most often? _____

10. Do you consume other caffeinated beverages (Coffee/Tea) daily?

- ☐ Yes
- ☐ No

Section 4: Sleep Quality (Pittsburgh Sleep Quality Index - PSQI)

*The following questions relate to your usual sleep habits during the **past month only**.*

11. During the past month, what time have you usually gone to bed at night? _____

12. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? _____

13. During the past month, what time have you usually gotten up in the morning?

14. During the past month, how many hours of actual sleep did you get at night?

During the past month, how often have you had trouble sleeping because you... (0

= Not during the past month; 1 = Less than once a week; 2 = Once or twice a week;

3 = Three or more times a week)

Difficulty	0	1	2	3
Cannot get to sleep within 30 minutes	☐	☐	☐	☐
Wake up in the middle of the night or early morning	☐	☐	☐	☐
Have to use the bathroom	☐	☐	☐	☐
Cannot breathe comfortably	☐	☐	☐	☐
Cough or snore loudly	☐	☐	☐	☐
Feel too cold	☐	☐	☐	☐
Feel too hot	☐	☐	☐	☐
Had bad dreams	☐	☐	☐	☐
Have pain	☐	☐	☐	☐

15. During the past month, how would you rate your sleep quality overall?

- ☐ Very good
- ☐ Fairly good
- ☐ Fairly bad
- ☐ Very bad

16. During the past month, how often have you taken medicine to help you sleep?

- ☐ Not during the past month
- ☐ Less than once a week
- ☐ Once or twice a week
- ☐ Three or more times a week

**17. During the past month, how often have you had trouble staying awake while
driving, eating meals, or engaging in social activity?**

- ☐ Not during the past month
- ☐ Less than once a week
- ☐ Once or twice a week
- ☐ Three or more times a week

