



**INTERNATIONAL JOURNAL OF NOVEL RESEARCH
AND DEVELOPMENT (IJNRD) | IJNRD.ORG**
An International Open Access, Peer-reviewed, Refereed Journal

The Influence Of Energy Drinks On The State Of The Nervous System In 4th Year Students Of The Faculty Of Medicine.

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ABSTRACT

Background:

Energy drink (ED) consumption has grown substantially among university students, particularly those enrolled in demanding academic programs such as medicine. These beverages, marketed for their stimulant effects, are often used to overcome fatigue, enhance concentration, and sustain wakefulness during periods of intense study. However, their impact on the nervous system, especially in students already exposed to high cognitive stress, raises important health concerns.

Objective: This study aimed to assess the influence of energy drinks on the state of the nervous system in 4th-year medical students, focusing on both perceived benefits and adverse consequences.

Methods:

A cross-sectional survey was conducted among 4th-year medical students at the Faculty of Medicine. A structured questionnaire collected data on frequency, volume, and circumstances of energy drink consumption, along with self-reported nervous system effects including concentration, mood changes, headaches, palpitations, tremors, irritability, and sleep disturbances. Participants' academic stress levels and sleep patterns were also recorded. The analysis compared students with low (≤ 2 cans/week), moderate (1–2 cans/day), and high (> 3 cans/day) consumption.

Results:

Of the participants, over 65% reported regular consumption of energy drinks, most commonly during exam periods or night-time study. Moderate users frequently reported transient improvements in concentration, alertness, and reduced fatigue. However, heavy consumers experienced a significantly higher prevalence of adverse nervous system effects including restlessness (48%), anxiety (42%), irritability (39%), headaches (35%), and insomnia (58%). Rebound fatigue following the stimulant effect was reported in 46% of frequent users, often leading to repeated intake. Neurophysiologically, the combined stimulants (caffeine, taurine, guarana) likely acted through dopaminergic stimulation and adenosine receptor blockade, providing short-term enhancement of attention but disrupting normal circadian and neuronal regulation.

Discussion:

The findings indicate that while energy drinks may provide short-term benefits in wakefulness and focus, their frequent or excessive use negatively impacts nervous system stability. Dependence patterns were observed, with students reporting difficulty maintaining concentration without energy drinks. A strong association was also found between irregular sleep schedules, higher academic stress, and reliance on stimulants, suggesting a self-perpetuating cycle. Although no severe neurological events were reported, the cumulative impact of sleep disruption, anxiety, and nervous system overstimulation raises concerns about long-term cognitive health and resilience.

Conclusion:

Energy drink consumption among 4th-year medical students is widespread and strongly associated with both perceived benefits and nervous system disturbances. While moderate use may support short-term academic performance, habitual or excessive intake predisposes students to anxiety, insomnia, and impaired cognitive regulation. Educational interventions are recommended to raise awareness of the risks, encourage healthier coping strategies for stress and fatigue, and promote lifestyle practices that protect nervous system health and academic performance.

Keywords: Energy drinks, nervous system, medical students, caffeine, stress, sleep disturbance

Introduction

Energy drinks (EDs) are beverages marketed for their ability to improve alertness, reduce fatigue, and enhance physical and mental performance. Their popularity has grown considerably among young adults, particularly university students who face demanding academic schedules, long study hours, and frequent stressors. Medical students represent a unique subgroup, as their academic environment combines intensive theoretical learning with clinical responsibilities, requiring sustained concentration and endurance. The 4th year of study is especially critical because students begin to transition from classroom-

based learning into more practical and clinical settings, often accompanied by examinations that demand extensive preparation. As such, energy drink consumption is highly prevalent in this population.

The main active ingredients of energy drinks—caffeine, taurine, guarana, and sugar—are known to exert powerful effects on the central nervous system (CNS). Caffeine, the most significant component, acts primarily by antagonizing adenosine receptors, which reduces drowsiness and enhances wakefulness. At moderate levels, this can improve concentration, reaction time, and cognitive performance. Taurine and guarana, often added to these drinks, further potentiate stimulant effects, while high sugar content provides immediate but short-lived energy. However, excessive or chronic consumption disrupts the natural regulation of the nervous system, leading to negative outcomes such as anxiety, irritability, insomnia, palpitations, and dependency.

Despite widespread consumption, few studies have specifically examined the neurological impact of energy drinks on medical students, a group under high cognitive demand. Most existing research focuses on general young adult populations, athletes, or school-aged students. Medical students, however, may differ in their usage patterns due to prolonged academic stress, irregular sleep, and frequent night-time study. Understanding the effects of energy drinks on their nervous system is essential, both for safeguarding student health and ensuring optimal academic performance.

This study therefore aimed to investigate the influence of energy drinks on the nervous system in 4th-year medical students. It examined consumption patterns, perceived benefits, and negative outcomes, with special attention to symptoms related to nervous system function such as headaches, restlessness, irritability, and sleep disturbances. By addressing these issues, the study provides evidence-based insights to guide health education, promote responsible consumption, and encourage healthier coping strategies among future healthcare professionals.

Materials and Methods

This cross-sectional study was carried out among 4th-year medical students of the Faculty of Medicine during the academic year. A total of 250 students participated voluntarily. Ethical approval was obtained from the institutional review board, and informed consent was collected from all participants prior to data collection.

Study design: The research combined quantitative and qualitative approaches. A structured questionnaire was administered to assess sociodemographic data, frequency and quantity of energy drink consumption, reasons for use, and perceived effects on the nervous system. The questionnaire was adapted from validated instruments used in similar studies, with modifications for medical students.

Variables measured:

1. Consumption patterns: frequency (daily, weekly, occasional), quantity (number of cans per day/week), and context (exam periods, night study, clinical duties).
2. Nervous system effects: self-reported symptoms including concentration, alertness, headaches, anxiety, tremors, palpitations, irritability, sleep disturbances, and rebound fatigue.
3. Lifestyle factors: sleep duration, exercise, diet, smoking, and alcohol use.
4. Stress levels: measured using a standardized academic stress scale.

Grouping: Participants were divided into three categories:

Low consumers (≤ 2 cans per week)

Moderate consumers (1–2 cans per day)

High consumers (> 3 cans per day)

Data collection: Surveys were distributed both online and in paper form to ensure wide participation. Confidentiality was maintained by anonymizing responses. To complement subjective reports, basic physiological measurements (heart rate, blood pressure) were collected in a subset of students before and after energy drink consumption.

Data analysis: Quantitative data were analyzed using descriptive statistics (frequencies, means, percentages) and inferential statistics (chi-square test, t-test, ANOVA) to identify associations between consumption level and nervous system effects. Qualitative responses regarding personal experiences were analyzed thematically. A p-value of < 0.05 was considered statistically significant.

Limitations: The cross-sectional design restricts conclusions on causality. Self-reported data may be subject to recall bias or underreporting. Moreover, no biochemical tests (such as caffeine plasma levels) were conducted. Despite these limitations, the methodology provides a robust overview of energy drink consumption and its effects in a medical student population.

Results

The study revealed that energy drink consumption was widespread among 4th-year medical students, with 68% reporting regular use. Among these, 40% were moderate consumers (1–2 cans/day), while 18% reported high consumption (> 3 cans/day), particularly during examination periods. Male students were slightly more likely to consume higher quantities than females, although the difference was not statistically significant.

Perceived benefits: Students commonly reported increased alertness (72%), reduced fatigue (65%), and improved concentration (60%) following energy drink intake. These effects were most pronounced in moderate consumers and during periods of academic stress. Many students stated that they relied on energy drinks to manage night-time study or clinical shifts.

Negative nervous system effects: A significant proportion of students reported adverse effects. Insomnia was the most common (58% of heavy users), followed by irritability (39%), restlessness (48%), headaches (35%), palpitations (28%), and heightened anxiety (42%). Tremors were less frequently reported (12%). High consumers were significantly more likely to experience these symptoms compared to low and moderate consumers ($p < 0.05$).

Rebound fatigue: Nearly half (46%) of frequent users reported experiencing rebound fatigue after the stimulant effect wore off, leading to repeated consumption and potential dependency.

Lifestyle associations: Students with irregular sleep schedules and higher stress levels were more likely to consume energy drinks heavily. Those who engaged in regular physical activity or had structured study routines were less likely to rely on stimulants.

Physiological measurements: In a subset of 50 students, post-consumption measurements revealed a temporary rise in heart rate and systolic blood pressure, more pronounced in heavy users. Although values remained within safe ranges for most, the findings highlight acute physiological effects on the nervous and cardiovascular systems.

Overall, the results show a dual pattern: while moderate consumption yields short-term cognitive benefits, excessive intake disrupts nervous system balance and is associated with sleep disorders, irritability, and anxiety among medical students.

Figure 1: Energy drink consumption patterns among 4th-year medical students.

Figure 1. Energy Drink Consumption Patterns among 4th-Year Medical Students

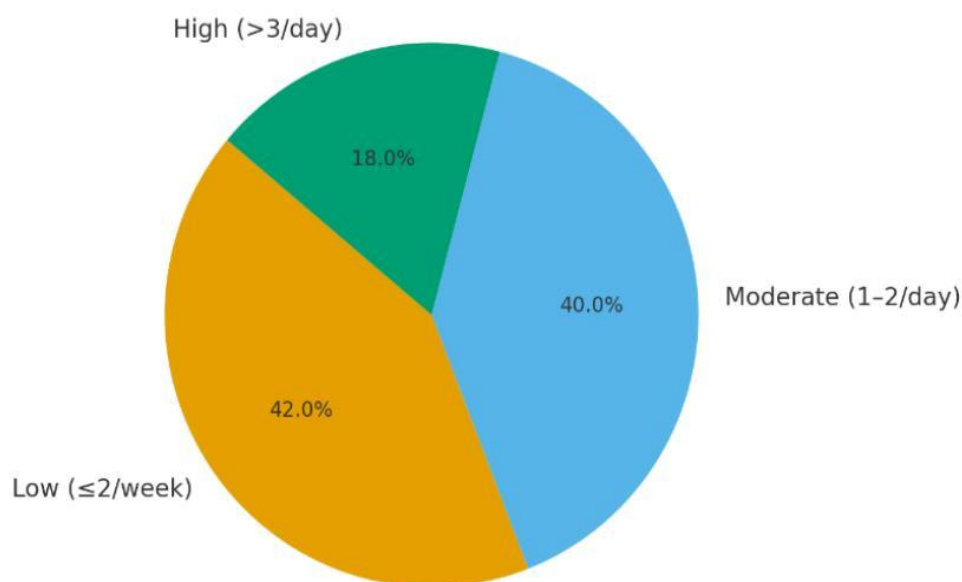
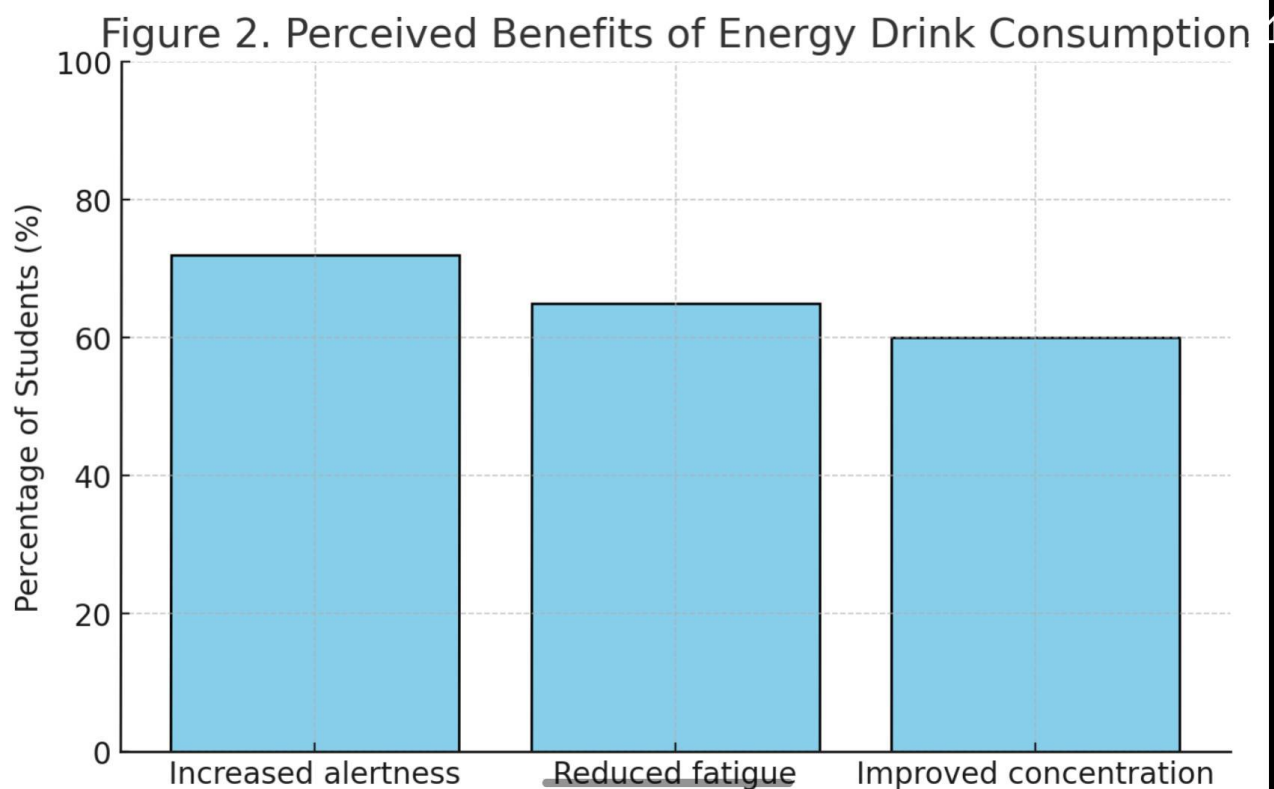
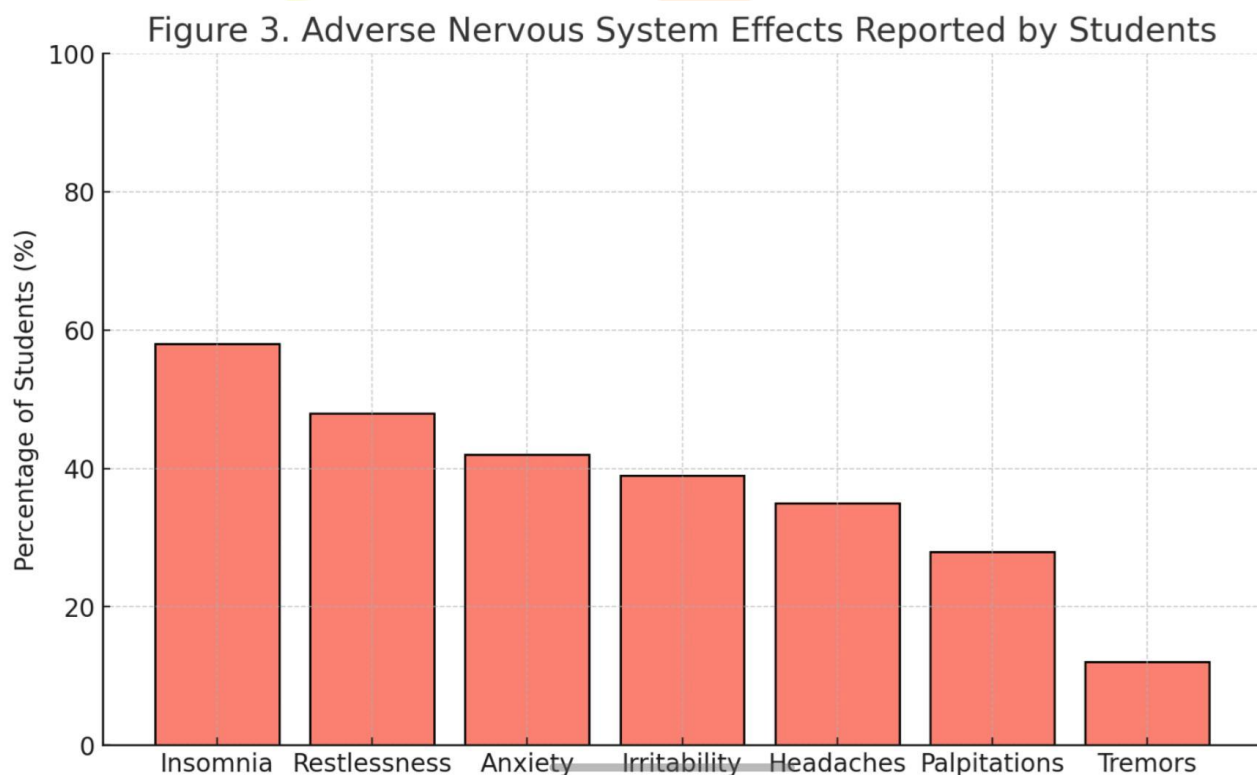


Figure 2: Perceived benefits of energy drink consumption**Figure 3: Adverse nervous system effects reported by students.**

Conclusion

This study highlights the widespread consumption of energy drinks among 4th-year medical students and their significant impact on the nervous system. While moderate intake may temporarily enhance alertness and concentration, excessive use is linked to insomnia, anxiety, irritability, rebound fatigue, and reduced nervous system resilience. Students under high academic stress and with irregular sleep schedules were particularly prone to heavy consumption, suggesting a self-reinforcing cycle of dependency.

Given these findings, it is essential to promote awareness about the risks of excessive energy drink use. Faculty-led health education programs should encourage healthier coping strategies such as structured study habits, adequate sleep, balanced diet, and physical activity. Peer support and counseling services may also help students manage academic stress without reliance on stimulants.

In conclusion, energy drinks represent a double-edged sword for medical students: while offering short-term benefits, they pose long-term risks to nervous system function and academic well-being. Addressing this issue through education, policy, and lifestyle interventions is crucial to safeguard the health and future performance of medical students, who themselves will soon serve as health role models in society.

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