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# The Effects of Energy Drink Consumption on Academic Performance and Cardiovascular Indicators: An Experimental Study Among College Students

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**A B S T R A C T**

*This study aimed to investigate the impact of energy drink consumption on academic performance and cardiovascular indicators among college students. In this study, an experimental design was employed, involving 193 students from a nursing school in Nigeria. These students were initially surveyed to identify energy drink consumers, and 50 participants were randomly selected for the experiment. Data collection instruments included blood pressure monitors, a demographic questionnaire, and academic assessments. Before the experiment, participants abstained from energy drinks and caffeine-containing foods for 48 hours. They were then randomly assigned to either an experimental group receiving an energy drink or a control group receiving water. Measurements included blood pressure, heart rate, academic performance, and drink consumption, with multiple measurements taken to align with caffeine's metabolic timeline. Data analysis utilized descriptive and inferential statistical methods. The study found no significant immediate effects of energy drink consumption on academic performance within the Experimental Group. However, elevated systolic and diastolic blood pressure was observed within the Experimental Group compared to the Control Group post-consumption, aligning with recent research. Pulse rate remained unchanged. This study contributes to understanding the complex relationship between energy drink consumption and academic performance among college students. While no immediate impact on academic performance was observed, the study highlights potential cardiovascular effects associated with energy drink intake. The results emphasize the importance of promoting responsible energy drink use and considering individual differences in response to these beverages.*

Keywords: Energy Drinks, Academic Performance, Physiological Indicators, Blood Pressure, Heart Rate

## Introduction

The consumption of energy drinks has witnessed a remarkable surge among college students in Nigeria, despite the well-documented health hazards associated with these beverages. Such consumptive behavior is fueled by the desire to counteract sleep deprivation, augment energy levels for scholastic pursuits, and facilitate social engagements. This trend is mirrored on a global scale, particularly evident among the youth demographic (Ibrahim et al., 2021). Central to the appeal of energy drinks is their stimulating impact, primarily attributed to constituents such as caffeine. However, the pleasurable effects of these substances can potentially foster addictive behaviors, leading to excessive consumption and eventual abuse (Khan, 2019).

The repercussions of energy drink consumption, even in moderation, encompass a spectrum of adverse outcomes. These include hyperactive behavior, caffeine withdrawal, intoxication, and insomnia, all of which cast a shadow on both physiological and psychological well-being (Tóth et al., 2020). The existing literature reveals a nexus between elevated caffeine levels and heightened propensities for risky behaviors, increased susceptibility to anxiety, and physiological manifestations like vomiting, acid erosion, and dehydration (Khan, 2019).

Despite their widespread popularity, scant research exists pertaining to the impact of energy drinks on academic performance, particularly in the milieu of college students. The lacuna in understanding students' perceptions, consumption patterns, and associated risks is evident (Scuri et al., 2018). Consequently, this study endeavors to bridge these gaps by examining the influence of energy drink consumption on both academic performance and cardiovascular indicators, with a specific focus on the student populace at Plateau State College of Nursing, Vom in Nigeria.

## Objectives

The primary objectives of this study were to:

1. To examine the impact of energy drink consumption on systolic blood pressure among college students.
2. To assess the effect of energy drink consumption on diastolic blood pressure among college students.

3. To analyze the changes in pulse rate among college students after energy drink consumption.
4. To evaluate the relationship between energy drink consumption and academic performance among college students.
5. To compare the cardiovascular indicators and academic performance between the Experimental Group (energy drink consumers) and the Control Group (non-consumers) among college students.

## Research Questions:

1. How does energy drink consumption affect systolic blood pressure among college students?
2. What is the influence of energy drink consumption on diastolic blood pressure among college students?
3. What are the changes in pulse rate among college students following energy drink consumption?
4. How does energy drink consumption correlate with academic performance among college students?
5. What are the differences in cardiovascular indicators and academic performance between the Experimental Group (energy drink consumers) and the Control Group (non-consumers) among college students?

## Hypotheses:

The hypotheses for this study were as follows:

1. There is no significant change in systolic blood pressure among college students after energy drink consumption.
2. There is no significant change in diastolic blood pressure among college students after energy drink consumption.
3. There is no significant change in pulse rate among college students after energy drink consumption.
4. There is no significant difference in academic performance among college students following energy drink consumption.
5. There is no significant difference in cardiovascular indicators and academic performance between the Experimental Group (energy drink consumers) and the Control Group (non-consumers) among college students.

## Literature Review

Energy drinks are popular among college students, yet their potential risks are often underestimated. Developing tolerance to these drinks may lead to increased consumption. Excessive use can result in several health issues, including sleep disturbances due to caffeine's impact on adenosine receptors, potentially leading to missed classes and drowsy driving (Wikoff, Welsh and Henderson, 2017). Ingredients like caffeine and taurine can directly affect the brain, causing anxiety, depression, and disrupted sleep patterns. These drinks are associated with fatigue, headaches, irritability, and stomach discomfort (Kim et al., 2020). High caffeine intake can hinder nerve cell development and worsen anxiety under stress (Al-Shaar et al., 2017).

Energy drinks contain high levels of caffeine, sugar, legal stimulants like guarana, taurine, and L-carnitine, which lead to increased blood pressure, heart rate, breathing rate, alertness, and energy. These drinks pose health risks due to their caffeine and sugar content, as well as additional components like taurine, guarana, vitamins, and herbs, particularly among college students. The global energy drink market is projected to reach $68.1 billion in 2022, growing at a compound annual growth rate CAGR of 7.0% to potentially reach $98.8 billion by 2032. Despite having over 500 trade names, energy drinks share common stimulating ingredients, but their compositions vary significantly. Modern energy drinks typically include caffeine, sugar, high doses of B vitamins, herbal blends (e.g., ginseng, gingko biloba), and amino acids such as taurine and guarana (Yusupova & Firdavs, 2022; Somers & Syatokova, 2020; Globe Newswire, 2022; Ruiz & Scherr, 2019; Tóth et al., 2020).

The allure of energy drinks lies in their capacity to induce euphoria, augment mood, and enhance alertness due to their heightened caffeine content (Ehlers et al., 2019). Scholarly investigations, notably the study by Alford et al., cited by Ehlers et al. in 2019 underscore improved aerobic fitness and cognitive skills in response to these beverages (Ehlers et al., 2019). Furthermore, Thomas et al.'s research reveals heightened mood and cognitive function, even among individuals experiencing sleep deprivation after consuming energy drinks (Thomas et al., 2019). An array of studies demonstrates that energy drinks containing caffeine, glucose, taurine, and vitamins can positively impact attention, driving performance, and cycling proficiency (Ehlers et al., 2019). However, a note of caution is warranted due to the varying caffeine levels and complex ingredient combinations in energy drinks, which can lead to unpredictable interactions (Zahoor et al., 2020). The primary component, caffeine, is frequently associated with adverse effects like anxiety and insomnia (Goodhew, 2018).

The Arousal theory of Motivation, central to this study, suggests that individuals seek situations to maintain or elevate their arousal levels. This gradient of arousal (Charlotte, 2023) influences motivation. Low arousal relates to exhaustion, while high arousal can lead to anxiety. Arousal theory explains that people pursue stimuli when arousal is low but feel unmotivated when it's too high (McManus et al., 2019). Introduced by Henry Murray in 1938, this theory is grounded in desires for achievement, authority, and affiliation, driven by a need to minimize arousal (Charlotte, 2023).

## Methodology

***Design:***

This study employed an experimental design with a two-group pre-test and post-test approach. Data were collected before and after treatment, with the treatment involving the consumption of Predator energy drink (experimental group) or Reindeer bottled water (control group).

***Population of the Study:***

The study was conducted at the School of Nursing, located at the Vom campus of Plateau State College of Nursing and Midwifery, situated in Vom, Nigeria. The population of the school was comprised of 370 students. The sample size of 193 students was determined using the Taro Yamane method. The research was carried out in two stages, starting with a survey of energy drink consumers among 193 randomly selected students in the first stage. Subsequently, the second stage involved an experimental approach, with 50 participants chosen from the group of identified energy drink consumers.

***Instruments for Data Collection:***

Data collection instruments included an Omron automatic blood pressure monitor, a demographic questionnaire, and an academic assessment test question.

***Procedure for Data Collection:***

The experiment spanned a duration of four months, with the study initiation involving the distribution of a questionnaire among 193 students to identify energy drink consumers. Subsequently, 50 participants were randomly selected for the experiment, where they were provided with comprehensive information about the study and required to provide informed consent. Following this, a 48-hour abstinence period from energy drinks and caffeine-containing foods was observed, with each participant assigned a confidential identification number to ensure anonymity. On the designated experiment day, the selected participants were randomly assigned to either the experimental (energy drink) or control (water) group. Blood pressure, heart rate measurements, and academic assessment questions were administered, and the respective drinks were provided to the participants. Throughout the experiment, multiple measurements were taken to closely monitor and track the metabolic timeline of caffeine in the participants' systems.

To address confounding variables, strict participant screening, random group assignment, and standardized experimental conditions were employed. Participants refrained from substances impacting cardiovascular indicators pre-experiment. The research team closely monitored extraneous factors, ensuring the study's validity and reliability.

***Method of Data Analysis:***

Data analysis involved both descriptive and inferential statistical methods, encompassing demographic information, energy drink consumption history, blood pressure, heart rate readings, and academic performance scores.

***Ethical Clearance:***

The study obtained ethical approval from the scientific ethics committees of the College of Nursing, Vom, in accordance with the Helsinki Declaration principles. Informed permission and assent forms were obtained from all participants.

## Results

A total of 193 responses were received from students of College of Nursing, Vom aged 16 to 31 years and above.

**Table 1: Social Demographic Information of participants**

| Variable | Frequency | % |
|---|---|---|
| **Age** | | |
| 16 - 20 | 20 | 10% |
| 21 - 25 | 112 | 58% |
| 26 – 30 | 59 | 31% |
| 31 and above | 2 | 1% |
| Total | **193** | **100%** |
| **Sex** | | |
| Female | 130 | 67% |
| Male | 63 | 33% |
| Total | **193** | **100%** |
| **Marital Status** | | |
| Married | 13 | 7% |
| Single | 180 | 93% |
| Total | **193** | **100%** |

The age distribution (Table 1) revealed that 20 (10%) participants were aged 16-20, 112 (58%) fell within the 21-25 age range, 59 (31%) respondents were aged 25-29, and the remaining 2 (1%) participants were 31 years and older. The gender breakdown indicated that 67% (130) of respondents were females, while 33% (63) were males. Regarding marital status, 13 (7%) participants reported being married, while the majority, 180 (93%), were single.

**Table 2: Participants' Academic Performance History**

| Statement | SA | A | N | D | SD |
|---|---|---|---|---|---|
| I have difficulty focusing on what the teacher is saying when other students are talking. | 17 | 8 | 13 | 12 | 0 |
| | 34.0% | 16.0% | 26.0% | 24.0% | 0.0% |
| It is hard for me to listen for long periods of time in class. | 10 | 17 | 15 | 8 | 0 |
| | 20.0% | 34.0% | 30.0% | 16.0% | 0.0% |
| I get bored easily. | 5 | 12 | 19 | 9 | 5 |
| | 10.0% | 24.0% | 38.0% | 18.0% | 10.0% |
| I make careless mistakes when I take a test. | 2 | 8 | 20 | 19 | 1 |
| | 4.0% | 16.0% | 40.0% | 38.0% | 2.0% |
| I avoid activities that require a lot of effort. | 5 | 9 | 9 | 18 | 9 |
| | 10.0% | 18.0% | 18.0% | 36.0% | 18.0% |
| I go from one assignment to another without completing them. | 1 | 4 | 12 | 20 | 13 |
| | 2.0% | 8.0% | 24.0% | 40.0% | 26.0% |
| I give up quickly when I have difficulty with an assignment. | 1 | 4 | 10 | 19 | 16 |
| | 2.0% | 8.0% | 20.0% | 38.0% | 32.0% |
| I forget things I must do. | 5 | 9 | 17 | 9 | 10 |
| | 10.0% | 18.0% | 34.0% | 18.0% | 20.0% |
| I misplace personal objects. | 11 | 7 | 5 | 19 | 8 |
| | 22.0% | 14.0% | 10.0% | 38.0% | 16.0% |

*(A = Agree, SA = Strongly Agree, N = Neutral, D = Disagree, SD = Strongly Disagree)*

Table 2 presents participants' responses concerning their academic performance history, gauged through a five-point Likert-type scale encompassing strongly agree, agree, neutral, disagree, and strongly disagree. For the ability to focus amid peer discussions, 50% agreed or strongly agreed, while 54% acknowledged difficulty in sustaining attention during extended class periods. Around 34% admitted to getting bored easily, while 54% showed willingness to engage in challenging tasks. Moreover, a substantial 66% disagreed with shifting between assignments without completion. The majority, 70%, demonstrated commitment to assignments, with only 28% agreeing to occasional forgetfulness. Misplacing personal objects found concurrence among 36%, while a noteworthy 54% disagreed with such an occurrence.

**Table 3: Descriptive Statistics of Physiological Indicator Data for Pretest and Posttest in Treatment and Control Groups**

| Group | Statistical Analysis | Pretest Systolic | Posttest-Systolic | Pretest diastolic | Posttest-diastolic | pretest pulse | posttest-pulse |
|---|---|---|---|---|---|---|---|
| **Treatment** | Mean | 118 | 123 | 69 | 72 | 73 | 75 |
| | Median | 120 | 124 | 68 | 70 | 71 | 78 |
| | Mode | 120 | 130 | 60 | 60 | 79 | 80 |
| | Standard Deviation | 10 | 12 | 9 | 8 | 11 | 7 |
| **Control** | Mean | 121 | 120 | 67 | 66 | 74 | 73 |
| | Median | 120 | 120 | 70 | 66 | 75 | 72 |
| | Mode | 120 | 120 | 70 | 60 | 72 | 72 |
| | Standard Deviation | 10 | 9 | 7 | 9 | 8 | 11 |

In Table 3, the treatment group's systolic blood pressure increased from a pre-test mean of 118 to a post-test mean of 123 after consuming energy drinks. In contrast, the control group's systolic blood pressure remained relatively stable (pre-test mean of 121, post-test mean of 120). The experiment group also showed changes in diastolic blood pressure and pulse rate. These findings suggest that energy drink consumption affected systolic blood pressure and pulse rate in the treatment group.

**Table 4: Paired Samples Test of pre-test and post-test for the Cardiovascular Indicators**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Post-Systolic - Pre-Systolic | 1.920 | 9.646 | 1.364 | - .822 | 4.662 | 1.407 | 49 | .166 |
| Pair 2 | Post-diastolic - Pre diastolic | 1.020 | 7.676 | 1.086 | -1.161 | 3.201 | .940 | 49 | .352 |
| Pair 3 | post-pulse - pre pulse | .820 | 7.909 | 1.119 | -1.428 | 3.068 | .733 | 49 | .467 |

**Table 5: Independent sample t-test of the pretest and posttest for the Cardiovascular Indicators**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | |
|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) |
| Diastolic difference | Equal variances assumed | .554 | .460 | 2.158 | 48 | .036 |
| | Equal variances not assumed | | | 2.158 | 47.927 | .036 |
| Systolic difference | Equal variances assumed | 1.290 | .262 | 2.191 | 48 | .033 |
| | Equal variances not assumed | | | 2.191 | 45.816 | .034 |
| Pulse Difference | Equal variances assumed | 1.212 | .277 | 1.427 | 48 | .160 |
| | Equal variances not assumed | | | 1.427 | 44.780 | .160 |

Table 4 and 5 presents results of the paired sample test and independent t-test for pre-test and post-test measurements of cardiovascular indicators for both the experimental and control groups.

In the Experimental Group, a paired-samples t-test indicated no statistically significant change in systolic blood pressure from pretest (M = 118, SD = 10) to posttest (M = 123, SD = 12), t(df) = 1.407, p = 0.166, suggesting that short-term energy drink consumption among college students in this group did not immediately affect systolic blood pressure. However, when comparing the Experimental Group to the Control Group, an independent-samples t-test showed a statistically significant difference in systolic blood pressure (t(df) = 2.191, p = 0.033), suggesting that energy drink consumption had an impact on systolic blood pressure when comparing the Experimental Group (energy drink consumers) to the Control Group (non-consumers).

For diastolic blood pressure, within the Experimental Group, a paired-samples t-test revealed no significant change from pretest (M = 69, SD = 9) to posttest (M = 72, SD = 8), t(df) = 0.940, p = 0.352, indicating that short-term energy drink consumption among college students in the Experimental Group did not lead to immediate alterations in diastolic blood pressure. However, when comparing the Experimental Group to the Control Group, an independent-samples t-test showed a statistically significant difference in diastolic blood pressure (t(df) = 2.158, p = 0.036), implying that energy drink consumption had an impact on diastolic blood pressure when comparing the Experimental Group (energy drink consumers) to the Control Group (non-consumers).

Regarding pulse rate, within the Experimental Group, a paired-samples t-test revealed no significant change from pretest (M = 73, SD = 11) to posttest (M = 75, SD = 7), t(df) = 0.733, p = 0.467, suggesting that short-term energy drink consumption among college students in the Experimental Group did not result in immediate alterations in pulse rate. Furthermore, when comparing the Experimental Group to the Control Group, an independent-samples t-test did not show a statistically significant difference in pulse rate (t(df) = 2.427, p = 0.160), indicating that energy drink consumption did not lead to significant differences in pulse rate when comparing the Experimental Group (energy drink consumers) to the Control Group (non-consumers).

**Table 6: Descriptive data of Academic test scores for Treatment and control groups**

| **Group** | **Statistical Analysis** | **Pretest score (%)** | **Posttest score (%)** |
|---|---|---|---|
| Control | Mean | 80 | 77 |
| | Median | 83 | 73 |
| | Maximum | 100 | 100 |
| | Minimum | 57 | 47 |
| | Standard Deviation | 15 | 18 |
| Treatment | Mean | 88 | 93 |
| | Median | 87 | 100 |
| | Maximum | 100 | 100 |
| | Minimum | 63 | 83 |
| | Standard Deviation | 11 | 8 |

In Table 6, the mean academic pre-test scores for the treatment group were 88%, whereas the control group obtained a mean score of 80%. The highest pre-test scores achieved by participants in both the treatment and control groups were 100%, while the lowest pre-test scores recorded were 63% for the

treatment group and 57% for the control group. These findings suggest that participants in the treatment group achieved higher scores compared to those in the control group.

Regarding post-test scores, as depicted in Table 6, following the consumption of Predator energy drinks in the treatment group and Reindeer bottled water in the control group, the mean scores were 93% and 77%, respectively. The highest scores attained by both groups reached 100%. In contrast, the lowest post-test score in the treatment group was 83%, while in the control group, it was 47%. This substantial difference in academic performance between the two groups indicates that participants in the treatment group outperformed those in the control group.

**Table 7: Paired Samples Test of pre-test and Post-test Scores: Impact of Energy Drinks on Academic Performance**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair | Post Total% - pre Total % | 1.267% | 20.044% | 2.835% | -4.430% | 6.963% | .447 | 49 | .657 |

**Table 8: Independent Sample t-Test of Pretest and Posttest Scores: Impact of Energy Drinks on Academic Performance**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | |
|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) |
| Performance Difference | Equal variances assumed | 12.432 | .001 | 1.401 | 48 | .168 |
| | Equal variances not assumed | | | 1.401 | 34.044 | .170 |

Table 7 and 8 presents results of the paired sample test and independent t-test for pre-test and post-test measurements of academic performance scores for both the experimental and control groups.

In the Experimental Group, a paired-samples t-test was employed to examine changes in academic performance from pretest (M = 88, SD = 11) to posttest (M = 93, SD = 8). The analysis did not reveal a statistically significant change in academic performance over this short time period (t(df) = 0.447, p = 0.657). This suggests that, within the Experimental Group, short-term energy drink consumption did not result in immediate improvements or declines in academic performance.

When comparing the Experimental Group to the Control Group using an Independent-Samples T-Test, no statistically significant difference in academic performance was observed between the two groups (t(df) = 1.401, p = 0.170). This implies that, based on the data collected, energy drink consumption did not have a significant impact on academic performance when comparing the group that consumed energy drinks (Experimental) to the group that did not (Control).

## Discussion of Findings

The present study aimed to investigate the influence of energy drink consumption on cardiovascular indicators and academic performance among college students. This discussion will provide context for the current findings within the existing body of research, highlighting both supporting and contrasting evidence.

Table 1 provides an overview of the participant demographics. Out of the initial 193 participants, the majority were female (67.36%), which aligns with the higher inclination of females toward the nursing profession in Nigeria. Additionally, a significant portion of the study participants fell within the 21-25 years age group (58%). Among these respondents, 117 (61%) reported consuming energy drinks, while the remaining 76 (39%) had never consumed energy drinks. The most commonly consumed brand among these individuals was Predator energy drink, primarily due to its availability on the College premises. The results also indicated that the expectations of the larger proportion of participants (64%) were met after consuming energy drinks.

In the second stage of this experimental study, 50 participants were randomly selected based on specific inclusion criteria, including a history of consuming energy drinks and being free from underlying medical conditions. The findings from this stage revealed that the majority of participants (68%) consumed energy drinks a few times a month, and half of the study population (50%) reported drinking 5-10 cans/bottles of energy drinks per month. These results suggest that most study participants were light drinkers, which is consistent with the findings of Pavlovic et al. (2023) regarding energy drink consumption among university students in Eastern Croatia. According to their study, the majority of students consumed energy drinks once a month (59.5%), with most of them reporting consumption of 1-5 drinks (81.1%) on a monthly basis (Pavlovic et al., 2023).

The results from this study indicated that within the Experimental Group, there was no significant change in systolic blood pressure from pre-test to post-test. This result aligns with previous research indicating minimal immediate effects of energy drinks on systolic blood pressure (Shah et al., 2016). However, when compared to the Control Group, the Experimental Group displayed higher systolic blood pressure post-consumption, consistent with

recent findings by Mansour et al. (2019) suggesting a link between energy drink intake and elevated systolic blood pressure in young individuals (Mansour et al., 2019).

Similarly, diastolic blood pressure within the Experimental Group showed no significant change following energy drink consumption. This outcome is in line with prior studies reporting limited acute effects on diastolic blood pressure (Kluboito, 2016). Nevertheless, the Independent-Samples T-Test identified higher diastolic blood pressure in the Experimental Group compared to the Control Group. This finding is consistent with recent research indicating an association between energy drink consumption and elevated diastolic blood pressure (Özde et al., 2020).

Pulse rate within the Experimental Group remained unchanged after energy drink consumption, consistent with previous studies suggesting that energy drinks typically do not lead to immediate alterations in pulse rate (Nowak et al., 2018). However, no significant difference in pulse rate was observed when comparing the Experimental and Control Groups. This result is in line with existing literature demonstrating mixed findings regarding the effects of energy drinks on pulse rate (Nowak et al., 2018; Iheanacho et al., 2022).

Regarding academic performance, the study found no significant changes in academic performance within the Experimental Group following energy drink consumption. These findings suggest that, at least in the short term, acute energy drink intake may not be a determining factor influencing immediate academic outcomes. While this aligns with some prior research indicating minimal immediate effects on cognitive performance (Richards, 2016), it contrasts with other studies reporting improved alertness and cognitive function (Erdmann et al., 2021).

Furthermore, when comparing academic performance between the Experimental Group and the Control Group, no significant differences were observed. This result contradicts some previous studies that have reported associations between energy drink consumption and academic performance (Leal et al., 2022; Oglesby et al., 2018). However, the absence of significant differences may suggest that factors beyond energy drink consumption play a more substantial role in academic performance.

## Conclusion and Implications

In conclusion, this study contributes to the ongoing discussion on the effects of energy drink consumption among college students. The findings underscore the complex nature of these relationships, with some evidence of elevated cardiovascular indicators after energy drink consumption. However, the immediate effects on academic performance remain inconclusive. These findings highlight the need for further research to examine long-term effects and consider individual differences, study habits, and external factors that may influence academic performance.

The implications of this study extend to public health and education, emphasizing the importance of awareness campaigns regarding potential cardiovascular risks associated with energy drink consumption among young adults. Additionally, educational institutions may benefit from promoting responsible energy drink use and encouraging holistic approaches to academic success.

Future research should explore the cumulative and long-term impact of energy drink consumption on both physiological and academic outcomes. Moreover, investigations into potential moderators, such as individual sensitivity or habitual consumption, will provide a more nuanced understanding of these complex relationships.

**Disclosure of conflict of interest**

The Author declared no conflict of interest

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