Patterns and Determinants of Cognition-Enhancing Substances Abuse among University Undergraduates of a College of Medical Sciences in North-Eastern Nigeria.

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Abstract

Background: Cognitive enhancers are substances that stimulate central nervous system function, potentially improving cognitive performance. Their use among students, particularly in medical education, is a growing concern. This study aimed to evaluate the use of cognitive enhancers among students at the College of Medical Sciences, University of Maiduguri, Nigeria.

Methods: A cross-sectional, multistage descriptive study was conducted using electronic questionnaires administered to 422 undergraduate students. Data were analyzed using SPSS version 27, with results presented in charts and tables.

Results: The prevalence of cognitive enhancer use was 75.4% (318/422). Caffeine-containing substances were the most frequently consumed (33.0%), with "Fearless" being the most common individual subtype (26.4%). Energy enhancement was the primary motivation for cognitive enhancer use (21.4%). Age and academic level showed statistically significant associations with cognitive enhancer use ($p<0.01$), while gender, marital status, and department did not ($p>0.05$).

Conclusion: There is a high prevalence of cognitive enhancer use among medical students in Maiduguri, primarily driven by the desire for energy enhancement. The findings highlight the need for awareness programs and potential interventions to address the risks associated with cognitive enhancer use in academic settings

Keywords: Cognitive enhancers; Medical students; Prevalence; Energy enhancement; Academic performance

Introduction

Cognitive enhancers are a group of substances that act on the central nervous system to stimulate body function, behavior, and cognition. These substances typically increase alertness, elevate mood, enhance wakefulness, improve speech and motor

activity, and decrease appetite[1]. They are believed to enhance cognitive performance, potentially conferring advantages in specific situations. Cognitive enhancers may include readily available substances such as caffeine and energy drinks, as well as psychostimulants when used to improve cognitive functions[2]. Increasingly, healthy individuals are resorting to prescription-only medications, particularly psychostimulants used to treat attention deficit hyperactivity disorder, such as modafinil, to enhance their cognitive performance[3].

The use of cognitive enhancers in various forms is common among much of the world's population. The popularity of misuse likely stems from the belief that these substances will improve focus, attention, and, consequently, academic performance. Many medical students who report using cognitive enhancers begin during their first year, seeking increased alertness and wakefulness for competitive exams[4].

College studies can be challenging and demanding, particularly for medical students. The vast curriculum, high academic expectations, and competitive nature of the medical field can place immense pressure on students to excel in their studies. In response, some may turn to cognitive enhancers to help cope with this pressure[5].

Students may struggle with early-morning exams and rely on cognitive enhancers to increase alertness in hopes of achieving higher scores. Some studies suggest that the use of cognitive enhancers may provide an unfair advantage through increased attentiveness or academic improvement[6,7]. It is possible that those who take cognitive enhancers are struggling academically, and the focus enhancement from these substances leads to their grade point average (GPA) being average compared to non-users. This aligns with a study showing that while these drugs might increase focus, stimulant users do not have higher GPAs than non-users[8].

A 2016 study among South African medical students reported that 18% of participants used cognitive enhancers for non-medical purposes in their lifetime, with 85% of this group using them within the past year. Additionally, 32% reported using cognitive enhancers to improve performance[9]. Similarly, a multicenter study in North Africa (Egypt, Sudan, and Jordan) found that 88.3% of respondents were cognitive enhancer consumers, with 58.2% reporting daily use. Significant differences in consumption were observed based on the source of acquisition,

nationality, residence status, and gender. Ginkgo biloba was more commonly consumed by males, while females typically took Omega-3 and vitamin B12[10].

A study conducted at Delta State University, Nigeria, showed that 40.1% of respondents reported using at least one performance-enhancing cognitive enhancer (PCE) during their study period. Caffeinated beverages, energy drinks, cigarettes, marijuana, and ginseng were used by 82.5%, 50.4%, 3.1%, and 1.5% of respondents, respectively. The motivation for using beverage drinks was increased study time, concentration, and alertness. Usage was more frequent during examination periods and study time[11]. Another study in Sokoto, north-west Nigeria, recorded a lifetime prevalence rate of energy drink consumption of 55.4%, with 25.7% being current users.

Cognitive enhancer users may perceive fatigue as an indication of requiring even more cognitive enhancers; however, this requires further research and evaluation[12]. The danger of these behaviors stems from the fact that most people are unaware of the ingredients in energy drinks and consume them simply for a burst of energy[13]. The high sugar and caffeine content of energy drinks mixed with ethanol minimizes the depressant effects of alcohol and masks signs of intoxication. This dramatically increases the chances of accidents while intoxicated and raises the risk of alcohol dependence with continued exposure[14].

Moderate doses of caffeine and amphetamines can lead to enhanced alertness and concentration. However, significant increases in dosage or frequency elevate the risk of toxicity and adverse effects. The adverse side effects and incorrect dosage often overshadow the positive outcomes from the consumption of cognitive enhancers[15].

Studies have shown that excessive and unregulated consumption of energy drinks can result in deleterious and adverse physiological effects, often prolonged and worsened due to a lack of education and awareness. Increased utilization of energy drinks is associated with a higher likelihood of students consuming substances such as alcohol or drugs marketed to promise cognitive enhancement[16]. Poly-cognitive enhancer use with psychostimulants and other substances offers both synergistic and additive effects, potentially combining cognitive effects with wakefulness, emotional and/or motivational effects, mood-, performance-, and executive functioning-enhancing, and euphoric effects. However,

this comes with health risks ranging from mild to serious dangers, including dependence, tolerance, and neurological, psychological, and cardiovascular disorders, with a risk of overdose potentially leading to death[17].

The availability of substances for non-medical purposes in different countries is influenced by various factors, including legal, social, and ethical considerations. Considering the risk factors and motivations that encourage university students to use CE drugs, it is essential to raise awareness about CE-related harms, counteract myths regarding "safe" CE use, and address cognitive enhancement at an early stage during education as a preventative public health measure[18].

The medical profession requires high levels of cognitive functioning, memory retention, and mental acuity. In a challenging academic environment such as Maiduguri, where resources are limited and the demand for skilled healthcare professionals is high, understanding the factors that influence the academic performance and well-being of medical students is crucial. Exploring the use of cognitive enhancers among medical students in the College of Medical Sciences of the University of Maiduguri can provide valuable insights into the coping mechanisms employed by students in response to academic pressures and the potential risks and benefits associated with the use of cognitive enhancers in this context.

Due to the paucity of research in our region on the use of cognitive enhancers, there is a need to assess their use and the reasons behind their usage among students at the College of Medical Sciences at the University of Maiduguri. Thus, this study evaluated the use of cognitive enhancers amongst students at the College of Medical Sciences of the University of Maiduguri, Nigeria.

Methodology

Place of study

The university is the foremost higher educational institution in the northeastern part of the country. The College of Medical Sciences has five faculties, which comprise a) Faculty of Basic Medical Sciences, b) Faculty of Basic Clinical Sciences, c) Faculty of Clinical Sciences, d) Faculty of Allied Health Sciences, and e) Faculty of Dentistry. The Faculty of Basic Medical Sciences has the Department of Human Anatomy, Human

Physiology; the Faculty of Basic Clinical Sciences has the Department of Human Pathology, Chemical Pathology, Haematology, Medical Microbiology, Clinical Pharmacology and Therapeutics; Faculty of Dentistry has Department of Restorative Dentistry, Preventive and Child Dental Health, Oral Maxillofacial Surgery and Oral Pathology; Faculty of Clinical Sciences has Internal Medicine, Surgery, Paediatrics, Obstetrics and Gynaecology, Orthopaedics, ENT Surgery, Anesthesia, Ophthalmology, Radiology, Psychiatry, Dermatology and Community Medicine; Faculty of Allied Health Sciences has Nursing Science, Physiotherapy/Rehabilitation, Radiography, and Medical Laboratory Science.

Study design

The study design was a cross-sectional multistage descriptive study aimed at assessing the use of cognitive enhancers among students at the College of Medical Sciences, University of Maiduguri.

Study population

The study population consists of undergraduate students from the College of Medical Sciences at the institution. The inclusion criteria involve undergraduate students from the College of Medical Sciences who provided their consent, while those who were absent during the data collection period were excluded.

Sample size determination

The minimum sample size was calculated using Cochran's formula.

$n = Z^2pq / d2$ (72)

$n= (1.96)^2 \times (0.50) \times (0.50) / (0.05)^2 = 384.16$ (~ 384)

The anticipated non-response rate was 10 %; therefore, an adjustment of the sample size estimate to account for the non-response rate = 0.1 x n

= 0.1 x 384 = 38.4 ~38

Adjusted sample size = 384 + 38 = 422

Therefore, the minimum sample size needed for this research is = 422

Sampling technique

A multistage sampling was utilised to select participants from different faculties of the College of Medical Sciences, University of Maiduguri. This ensures representation of all faculties and minimizes bias in participant selection.

Stage I (Selection of Faculty): A simple random sampling method was used to select

three faculty members from the College of Medical Sciences through a ballot.

Stage II (Selection of Department): Random sampling was used to select four departments from each of the chosen faculties in Stage I, as determined by a ballot.

Stage III (Selection of Students): Students were selected proportionately using simple random sampling via balloting.

Instruments for data collection

Electronic questionnaires, comprising both closed-ended and open-ended questions, were administered to respondents in English. The questionnaire was divided into four sections. Section one covered the socio-demographic characteristics of the respondents. Section two covered the prevalence of respondents' use of cognitive enhancers. Section three covered the types of cognitive enhancers used by respondents. Section four covered the reasons respondents gave for using cognitive enhancers.

Data collection method

The researchers administered the questionnaires to individuals selected from various departments after their lectures had concluded. The questionnaire was pre-tested on five undergraduate students from other faculties at the university, and the results obtained from the pre-test were used to finalize the questionnaire.

Data management and analysis

Collected data was manually checked for corrections, missing entries, and incompleteness. The data were then analysed using the Statistical Package for Social Sciences (SPSS), version 27. Results were presented in charts and tables as appropriate.

Ethical consideration

A letter of introduction was obtained from the Department of Community Medicine at the University of Maiduguri, which was used to obtain ethical clearance from the Research and Ethics Committee of the College of Medical Sciences at the University. Written informed consent was obtained from each college undergraduate student respondent who agreed to participate in the study. All participants were assured of complete confidentiality and were free to withdraw from the study at any time.

Results

The mean age of participants was 24.28 ± 3.52 years, with the 21–25 age group representing the majority (55.0%). Participants aged ≥31 years were the smallest

subgroup (4.5%). Most respondents were male (58.8%) and unmarried (84.6%) (Table 1).

Cognitive enhancer (CE) use was reported by 75.4% (318/422) of students, while non-users comprised 24.6% (104/422) (Figure 1). Among CE users, caffeine-containing substances were the most frequently consumed (33.0%), followed by energy drinks (24.5%), tea (20.8%), local remedies (13.8%), plant-based products (4.0%), and pharmaceutical drugs (3.9%) (Figure 2). Notably, "Fearless" (a caffeine-based stimulant) was the most common individual CE subtype (26.4%) (Table 2).

Multimodal reasons for CE use were reported, with energy enhancement cited as the primary motivation (21.4%) (Figure 3). In bivariate analyses, age and academic level showed statistically significant associations with CE use ($\chi^2 = 26.70$, $p < 0.01$ and $\chi^2 = 25.41$, $p < 0.01$, respectively), whereas gender, marital status, and department did not (all $p > 0.05$) (Table 3).

Table 1: Socio-demographic characteristics of participants (N=422).

	Variable	Frequency (n)	Percentage (%)
Age (years)	≤ 20	53	12.5
	21 – 25	232	55.0
	26 – 30	118	28.0
	≥ 31	19	4.5
Gender	Female	174	41.2
	Male	248	58.8
Marital Status	Single	357	84.6
	Married	65	15.4
Department	Anatomy	77	18.2
	MBBS	93	22.1
	Nursing	142	33.6
	Physiotherapy	110	26.1
Level	100 Level	16	3.8
	200 Level	63	14.9
	300 Level	74	17.5
	400 Level	74	17.5
	500 Level	107	25.4
	600 Level	88	20.9
	Total	422	100

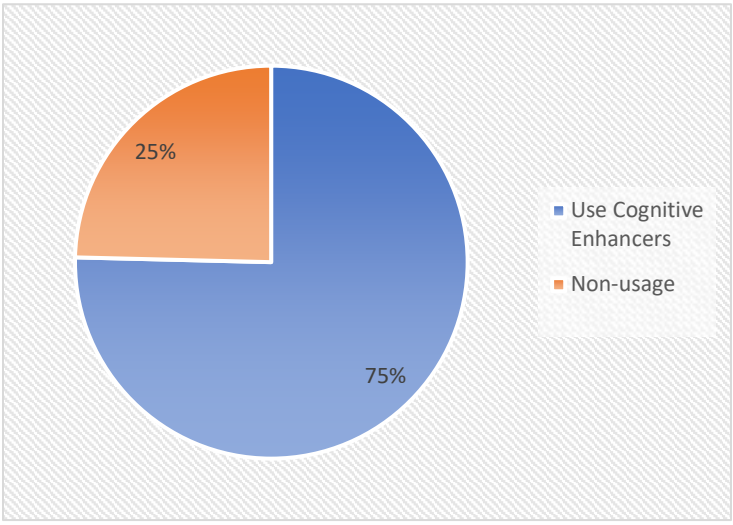

Fig. 1: The prevalence of cognitive enhancer use among the participants

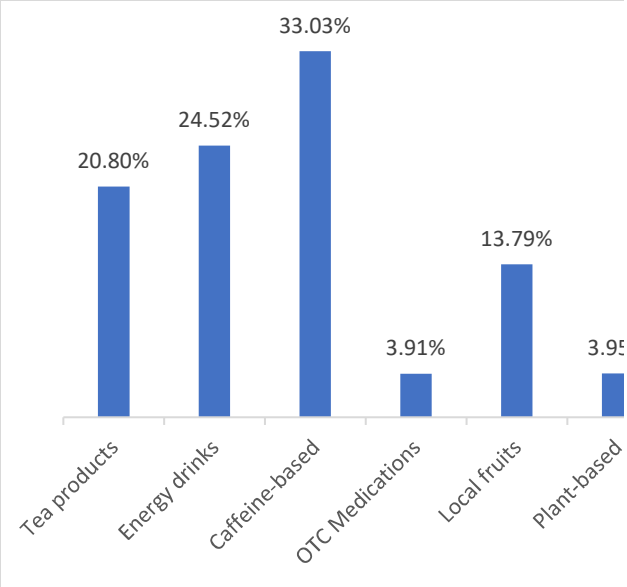

Fig. 2: The six types of cognitive enhancers identified in the study.

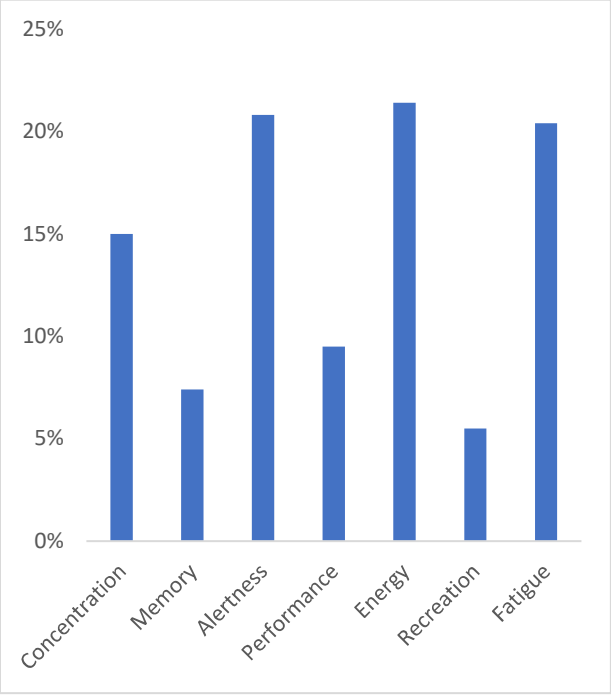

Fig. 3: The determinants of usage among the participants.

Table 2: Cognitive enhancers commonly used amongst the participants (N=318)

Variables	Frequency (n)	Percentage (%)
3/4G spot tea	3	0.9
Bitter Kola	2	0.6
Black tea	57	17.9
Chewing gum	8	2.5
Chocolate	4	1.3
Coca cola	43	13.5
Coffee (Nescafe'/Rizzoli)	21	6.6
Coke zero	1	0.3
Fab biscuit	2	0.6
Fearless	84	26.4
Ginseng (Panax Ginseng)	4	1.3
Green tea	8	2.5
Guarana (Brazilian cocoa)	1	0.3
Herbal tea/ shayi	14	4.4
Ice / DyanavelXR (Amphetamine)	5	1.6
Infinite power	17	5.4
Kola nut	7	2.3
Monster	5	1.6
Power horse	2	0.6
Predator	27	8.5
Reaktor	3	0.9

Discussion

This study found a high prevalence of cognitive enhancer use (75.4%) among university students, with caffeine-containing substances being the most commonly consumed (33.0%), particularly "Fearless" (26.4%). The primary motivation for CE use was energy enhancement (21.4%), and significant associations were observed with age and academic level (both $p< 0.05$).

Table 3: Socio-demographic factors associated with the use of cognitive enhancers among the participants (N=422)

Variables	Cognitive enhancer		Test Statistics (χ2)
	Yes	No	
Age (Years)			
≤ 20	35	18	26.70*
21 – 25	174	58	
26 – 30	99	19	
≥ 31	4	15	
Gender			
Female	125	49	2.38
Male	193	55	
Marital Status			
Single	269	88	0.06
Married	49	16	
Department			
Anatomy	58	19	1.88
MBBS	101	41	
Nursing	72	21	
Physiotherapy	87	23	
Level			
100	7	9	25.41*
200	44	19	
300	45	29	
400	56	18	
500	91	16	
600	75	13	

* = Statistically significant ($p<0.01$); χ2 = Pearson Chi Square

The mean age of participants was 24.28 ± 3.52 years, predominantly male (58.8%) and unmarried (84.6%), consistent with findings from Delta State University, Nigeria, where the mean age was 23.7 ± 4.8 years and 79.5% were unmarried[11]. This demographic profile aligns with typical undergraduate populations in Nigerian universities, where late adolescence and early adulthood dominate student cohorts.

The 75.4% prevalence of cognitive enhancer use in this study is comparable to findings from Egypt, Sudan, and Jordan (pooled prevalence: 88.3%)[10] but substantially higher than rates reported among Canadian (15%) and Lithuanian (8.1%) medical students[19]. This discrepancy may reflect differences in academic pressures, cultural attitudes toward stimulant use, and the accessibility of cognitive enhancer in Nigeria. The rigorous Nigerian academic environment, characterized by extensive curricula and high-performance expectations, may drive students toward cognitive enhancer consumption as a coping mechanism.

Caffeine-based stimulants were the most frequently used cognitive enhancer (33.0%), similar to findings from Delta State (40.1%)[11]. Notably, "Fearless" (a caffeine-based product) was the predominant subtype (26.4%), contrasting with studies from Saudi Arabia and Jordan, where Red Bull was the most consumed energy drink (46.7–52.3%)[20]. This variation may stem from regional differences in product availability, marketing, and cultural preferences.

The primary reason for cognitive enhancer use was energy enhancement (21.4%),

consistent with findings from Usman Danfodiyo University Sokoto in Northern Nigeria (20.3%)[21] but lower than Delta State University (40%) in Southern Nigeria[11]. Multimodal motivations were reported, aligning with previous studies[10,11,20–22], suggesting that students employ cognitive enhancer for both cognitive and physiological benefits.

Age and academic level were significantly associated with cognitive enhancer use, while gender, marital status, and department showed no significant associations. Male students exhibited higher CE consumption (n = 222 vs. n = 145 females), consistent with findings from Dubai, UAE, where males had higher caffeine intake (232.1 mg vs. 172.8 mg daily)[23]. However, this gender difference was not statistically significant in our study.

Final-year students (500 level) had the highest cognitive enhancer use (n = 91), likely due to heightened academic pressures, aligning with U.S. studies where caffeine consumption surged during exam periods[24]. Academic stress, competition, and sleep deprivation have been identified as key drivers of stimulant use among students[25].

Our findings corroborate prior research indicating that students use caffeine-containing beverages to counteract fatigue, enhance concentration, and prolong study sessions[26]. While some consume cognitive enhancers for performance enhancement, others do so out of curiosity or taste preference[27,28]. The Nigerian university environment, marked by high academic demands, peer influence, and easy cognitive enhancer accessibility, further exacerbates this trend[29]. Peer pressure, in particular, has been linked to increased cognitive enhancer use, as seen in Edo State, Nigeria[30].

Conclusion

In conclusion, this study underscores the high prevalence of cognitive enhancer use among Nigerian university students, predominantly fuelled by academic stress and energy demands, with caffeine-based products being the most consumed and significant associations observed with age and academic level. To address this issue, universities should implement targeted educational interventions to raise awareness about the risks and benefits of cognitive enhancer use while promoting safer alternatives, alongside integrating stress management programs, such as counselling services, to equip students with healthier coping strategies. Additionally, further longitudinal

research is imperative to evaluate the long-term health and academic consequences of cognitive enhancer consumption in this population, ensuring evidence-based policies and interventions.

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