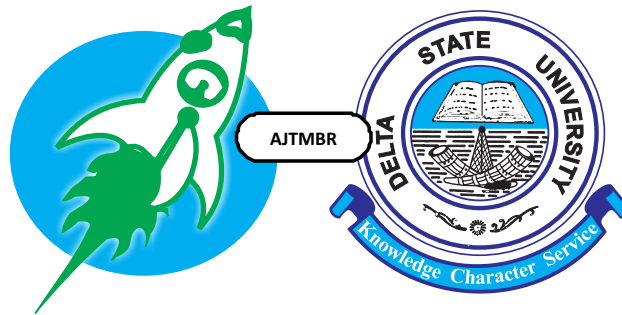


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ISSN: 2141-6397

Vol. 6, No. 1, July 2023

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Use of Cognitive Enhancers among students of Nigerian Tertiary Institutions

Uchendu Adaeze Phina^a, Uchendu Obiora Jude^b

ABSTRACT

Introduction: Nonmedical use of pharmaceutical cognitive enhancers PCE in Universities has been documented in several studies. However, there is paucity of research on this subject among Nigerian University students. This survey hopes to investigate the awareness, use and effect of PCE among undergraduate medical students of a Nigerian University.

Materials and method: The study utilized self-administered questionnaire on the awareness and usage of PCE with respondents composed of 327 medical students at Delta State University, Nigeria.

Results: The respondents have a male to female ratio of 1:0.85 with 99.1% being single. Those living on campus, off campus, family home and dual accommodation, accounted for 65.4%, 30.6%, 2.8% and 0.3% of the participants. In total, 81.7% of the participants are aware of PCE usage for academic purpose. Overall, 40.1% of the respondents reported using one or more of the PCE during the period considered. Caffeinated drinks and beverages, energy drinks, cigarette, marijuana, and Ginseng were used by 82.5%, 50.4%, 3.1%, 1.5% and 1.5% of the users respectively. The motivation for using both caffeinate beverages and energy drinks are for increased study time, concentration and alertness. The more frequent periods of use are during examination period and personal study time. Most of these PCE are self-purchased and choice of usage are mainly influenced by friends. Both set of users reported insomnia, headache, palpitation, dizziness and fatigue as undesirable experience. Among the respondents, 45% are interested in using PCE if there are no undesirable effects; 30% rejected such, while the rest are indifferent.

Conclusion: Our survey showed significant association between the age, male gender and academic level and the usage of PCE. Our respondents used mainly caffeinated beverages and energy drink. Their choice of PCE is strongly influenced by peer pressure and the motivations are mainly to boost studying time, concentration and alertness.

Keywords: Pharmacological cognitive enhancers, Medical students, Caffeine, Nigeria,

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INTRODUCTION

Pharmacological cognitive enhancement is defined as “amplification or extension of core capacity of the mind by improving the internal and external information processing systems by using drugs or substances”.¹ Many of such substances were primarily used to treat neuropsychiatric conditions that are often

associated by cognitive deficit.² These pharmacological cognitive enhancers (PCE) are also taken by healthy individuals to boost energy, and to improve mental alertness, concentration and memory, despite the drawback of its use such as development of dependence and psychiatric disorders.^{2,3,4}

These PCE are broadly classified into prescription and non-prescription drugs or substances. Prescription PCE include methylphenidate, modafinil, piracetam and amphetamine salt mixture; and many other drugs which have not been approved for human use.^{5,6} The non-prescription PCE include caffeine and caffeine containing beverages, vinpocetine, cobalamine (vitamin B12), guarana and pyridoxine (vitamine B6).⁵

Their mode of action have not been fully elucidated. However, most of them, including modafinil, amphetamine salt and methylphenidate are central nervous system stimulants.⁷

There is a rising interest on use of PCE in university setting among researchers. In United Kingdom (UK), among 1614 student respondents, 33% of them have used off-label prescription PCE.⁸ In another study, involving 877 students from Irish and UK Universities, lifetime incidence of use of amphetamine, methylphenidate and modafinil was 2%, 5.9% and 6.2% respectively.⁹ Report from United States (US), showed that misuse of PCE among university students was up to 17%.¹⁰

Scientific data regarding the use of PCE among Nigerian University students is scanty.

This study was performed in Delta State University and is hoped to unveil the pattern of PCE usage among medical students, including relationship with age, gender, academic level and place of residence. We hope that results from this study will guide policy makers as well as add to already existing literature.

MATERIALS AND METHOD

The sample comprises of the medical students of Delta State University (DELSU) during the

study period. The participants were asked to complete a self-administered questionnaire about awareness and usage of PCE in their academic environment. The study was conducted from 4th to 16th June 2023 in line with the ethical standard of the institution. Filling of the questionnaire was voluntary, and the participants were assured of anonymity and confidentiality of information provided. Before participating in the study, the framework of the study was explained to the participants. Informed consent was obtained from all participants and the right to withdraw from participation at any time during the survey was reserved.

Demographic information was limited to age, sex, academic year, marital status and nature of residence of the respondents. A 10-item questionnaire was used for this survey to assess: 1) respondents' awareness of the use of PCE; 2) the usage of PCE among participants; 3) reasons for usage of PCE; 4) positive effects of PCE on participants; 5) time of usage of PCE; 6) duration of usage of PCE; 7) source of acquisition of PCE; 8) source of information on the PCE; 9) Undesirable effects during usage of PCE; and 10) their readiness to use PCE if they are assured of minimal side effects and safety.

All the data were analyzed using SPSS for windows, version 24.0 (SPSS Inc, Chicago, IL, USA) and results were summarized using tables and figures. Finding was regarded as statistically significant using $p < 0.05$.

The study was approved by the Research and Ethics Committee in the Faculty of Basic Clinical Sciences, Delta State University, with approval number FBCS/REC/23/01. The authors also secured permission and approval for data collection from the provost, College of Health Sciences, Delta State University.

RESULTS

In total, 327 completed questionnaires were retrieved, which is equivalent to 90% of the expected participants in the study, with a male to female ratio of 1: 0.85. Of all the respondents, ninety-nine-point one percent of them are married. Those living on campus, off campus, family home and dual accommodation, accounted for 65.4%, 30.6%, 2.8% and 0.3% of the respondents. The detail of the socio-demographic profile is shown in Table I.

The awareness of PCE by respondents is shown in Figure I. In total, 81.7% of the respondents are aware of the use of PCE in the university setting. Amongst them, 68.2%, 45.3%, 20.8%, 13.1%, and 5.5% are aware of use of caffeinated beverages, energy drinks, tramadol, marijuana, and kola nut as PCE. There is a significant association between age and academic level and awareness of PCE (as is depicted in Table II).

The usage of PCE is shown in Figure II. Overall, 40.1% of the respondents reported using one or more of the PCE during the period considered.

Caffeinated beverages, energy drinks, cigarette, marijuana, and ginseng were used by 82.5%, 50.4%, 3.1%, 1.5% and 1.5% 2 of the respondents that admitted using PCE respectively. There is also significant association between age, gender and academic level and usage of PCE as is depicted in Table III. Details of impact of use of energy drink and caffeinated beverage is shown in Table IV.

The motivation for using these drugs, in order of frequency are increased study time, concentration and alertness. The more frequent periods of use are during examination period and personal study time. Most of the PCE are self-purchased and the choice of PCE are mainly influenced by friends. Both sets of users reported insomnia, headache, palpitation, dizziness and fatigue as undesirable side effects.

Among the respondents, 45% agreed that they will use PCE if they are guaranteed of its safety, 30% disagreed to its usage while the rest are indifferent.

Table I: Demographic characteristics of respondents (N=327)

Demographic Parameters	Frequency	Percentage (%)
Age (Years)		
16 – 20	154	47.1
21 – 25	142	43.4
26 – 30	28	8.6
>30	3	0.9
Gender		
Male	177	54.1
Female	150	45.9
Academic Level		
100	57	17.4
200	77	23.5
300	54	16.5
400	39	11.9
500	64	19.6
600	36	11.0
Marital Status		
Single	324	99.1
Married	3	0.9
Residence		
On Campus	214	65.4
Off Campus	100	30.6
Individual home	9	2.8
Family home	3	0.9
Dual accommodation	1	0.3

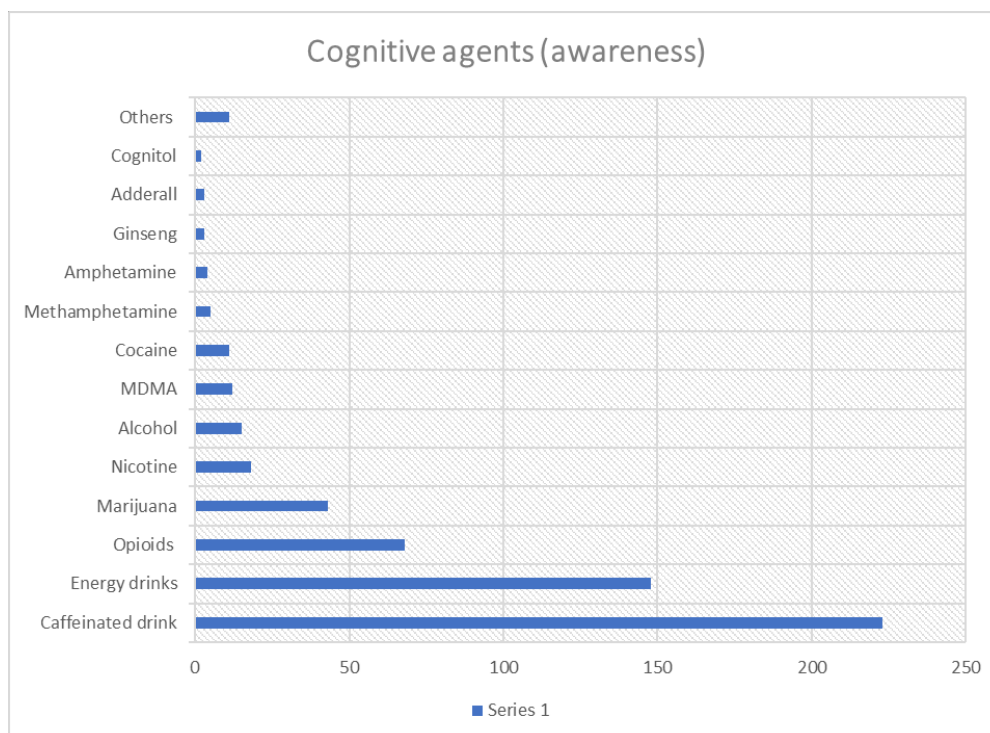


Figure 1: Awareness of the use of PCEs among medical students

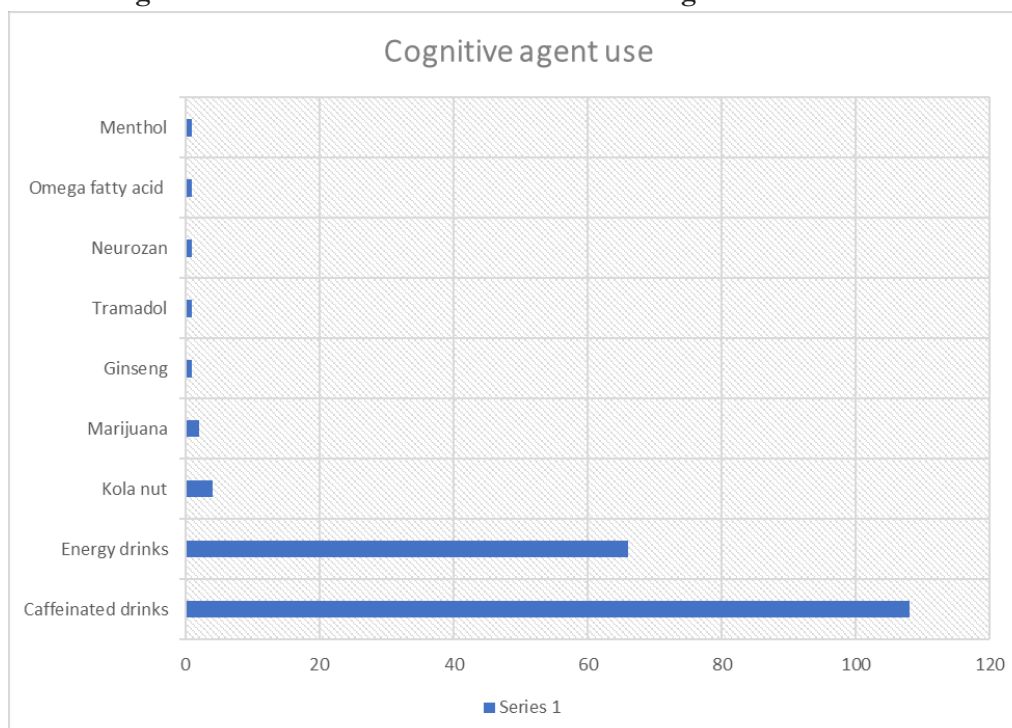


Figure II: The use of PCEs among medical students

Table II. The distribution of students' awareness of PCEs by their demographic features

	Awareness of PCEs			X ²	P value
	Yes	No	Total		
Age (Year)					
16 – 20	116 (43.4%)	38 (63.3%)	154 (47.1%)	0.727	0.033
21 – 25	125 (46.8%)	17 (28.3%)	142 (43.4%)		
26 – 30	24 (9.0%)	4 (6.7%)	28 (8.6%)		
>30	2 (0.7%)	1 (1.7%)	3 (0.9%)		
Sex					
Male	143 (53.6%)	34 (56.7%)	177 (54.1%)	0.191	0.662
Female	124 (46.4%)	26 (43.3%)	150 (45.9%)		
Academic Level					
100	36 (13.5%)	21 (35.0%)	57 (17.4%)	30.938	0.000
200	57 (21.3%)	20 (16.7%)	77 (23.5%)		
300	44 (16.5%)	10 (16.7%)	54 (16.5%)		
400	38 (14.2%)	1 (1.7%)	39 (11.9%)		
500	61 (22.8%)	3 (5.0%)	64 (19.6%)		
600	31 (11.6%)	5 (8.3%)	36 (11.0%)		
Marital Status					
Single	265 (99.3%)	59 (98.3%)	324 (99.1%)	0.454	0.501
Married	2 (0.7%)	1 (1.7%)	3 (0.9%)		
Residence					
On Campus	183 (68.5%)	31 (51.7%)	214 (65.4%)	6.803	0.147
Off Campus	74 (27.7%)	26 (43.3%)	100 (30.6%)		
Individual home	7 (2.6%)	2 (3.3%)	6 (2.8%)		
Family home	2 (0.7%)	1 (1.7%)	3 (0.9%)		
Dual	1 (0.8%)	0 (0.0%)	1 (0.3%)		
accommodation					

Table III. The distribution of students' use of PCE by their demographic features

	Use of PCEs			X ²	P value
	Yes	No	Total		
Age (Year)					
16 – 20	44 (33.6%)	110 (56.1%)	154 (47.1%)	16.969	0.001
21 – 25	70 (53.45%)	72 (36.7%)	142 (43.4%)		
26 – 30	16 (12.2%)	12 (6.1%)	28 (8.6%)		
>30	1 (0.8%)	2 (1.0%)	3 (0.9%)		
Sex					
Male	83 (63.4%)	94 (48.0%)	177 (54.1%)	7.499	0.006
Female	48 (36.6%)	102 (52.0%)	150 (45.9%)		
Academic Level					
100	16 (12.2%)	41 (20.9%)	57 (17.4%)	44.887	0.000
200	20 (15.3%)	57 (29.1%)	77 (23.5%)		
300	11 (8.4%)	43 (21.9%)	54 (16.5%)		
400	24 (18.3%)	15 (7.7%)	39 (11.9%)		
500	42 (32.1%)	22 (11.2%)	64 (19.6%)		
600	18 (13.7%)	18 (9.2%)	36 (11.0%)		
Marital Status					
Single	130 (99.2%)	194 (99.0%)	324 (99.1%)	0.057	0.811
Married	1 (0.8%)	2 (1.0%)	3 (0.9%)		
Residence					
On Campus	90 (68.7%)	124 (63.3%)	214 (65.4%)	3.046	0.550
Off Campus	35 (26.7%)	65 (33.2%)	100 (30.6%)		
Individual home	4 (3.1%)	5 (2.6%)	9 (2.8%)		
Family home	1 (0.8%)	2 (1.0%)	3 (0.8%)		
Dual accommodation	1 (0.8%)	0 (0.0%)	1 (0.3%)		

Table IV. Impact of specific PCE

Descriptions	Energy drink	Caffeine
Reasons for use		
Concentration	13 (20.6%)	24 (19.5%)
Increased study time	49 (77.8%)	74 (60.2%)
Improve academic performance	9 (14.3%)	14 (11.4%)
Relaxation	1 (1.6%)	1 (0.8%)
Effect		
Positive	34 (54.0%)	49 (39.8%)
Negative	8 (12.7%)	16 (13.0%)
Indifferent	21 (33.3%)	58 (47.2%)
Time of use		
Daily	1 (1.6%)	7 (5.7%)
Study period	27 (42.9%)	44 (35.8%)
Exams	34 (54.0%)	48 (39.0%)
Duration of use (months)		
1	9 (14.3%)	14 (11.4%)
1 – 6	9 (14.3%)	11 (8.9%)
6 – 12	5 (7.9%)	5 (4.1%)
13 – 24	11 (17.5%)	11 (8.9%)
>24	14 (22.2%)	27 (22.0%)
Source of acquisition		
Friends	6 (9.5%)	10 (8.1%)
Self-purchased	27 (43.9%)	38 (30.9%)
Prescribed	4 (6.3%)	4 (3.3%)
Others	11 (17.5%)	8 (6.5%)
Cost		
Very expensive		1 (0.8%)
Expensive	1 (1.6%)	4 (3.3%)
Fair	22 (34.9%)	27 (22.0%)
Cheap	30 (84.1%)	53 (43.1%)
How do you learn about them		
Social media	4 (6.3%)	10 (8.1%)
Internet	4 (6.3%)	8 (6.5%)
Friends	37 (58.7%)	43 (35.0%)
Others	5 (7.9%)	16 (13.0%)
Side effects		
Insomnia	8 (12.7%)	16 (13.0%)
Headache	7 (11.1%)	11 (8.9%)
Palpitation	5 (7.9%)	6 (4.9%)
Dizziness	3 (4.8%)	5 (4.1%)
Fatigue	3 (4.8%)	3 (2.4%)
Chest pain	1 (1.6%)	1 (0.8%)
Sweating	1 (1.6%)	
Abdominal pain	1 (1.6%)	1 (0.8%)
Willingness to buy in the future		
Yes	32 (50.8%)	45 (36.6%)
No	9 (14.3%)	19 (15.4%)
Indifferent	22 (34.9%)	59 (48.0%)

DISCUSSION

The usage of PCE in University environment in Nigeria has not been examined scientifically. This survey therefore provides first-hand epidemiological data on this subject in this part of the globe.⁸ The choice of medical students among other University students is in consideration of the relatively higher workload and competitiveness of the course. These medical students may therefore be motivated to use any available means, including use of PCE to ensure better grades.

Our survey showed that usage of prescription PCE for non-medical reasons in our academic setting is relatively uncommon. This is contrary to reports from western countries, where the lifetime prevalence of use of modafinil, methylphenidate and amphetamine among university students is within the range of 2% to 43%.⁵ This epidemiological difference may be attributed to fear of undesirable effects and unavailability of such prescription drugs. This is however a welcome development, considering the risk of psychiatric problems that may arise from use of these drugs.^{2,4}

The most used non-prescription PCE in our study is caffeinated beverages and energy drinks. This concurs with global view as caffeine remains the most consumed stimulant across the globe which are mainly in form of coffee or energy drink.¹¹ This is likely because they are freely accessible, quite affordable, does not require doctor's prescription before it can be purchased. They have also been known for ages for its use for memory and concentration enhancement. This raises concern of associated health hazards, which includes addiction, anxiety, mood disorder, panic attack, sleeping disorder and cardiovascular problems.¹²

We observed a significant correlation between

male gender and the use of these PCE.

This is consistent with earlier reports.¹³⁻¹⁷ This may be attributed to gender difference in perception of risk, differences in attitude towards substance and drug use and the social stigma associated with drug and substance use among females.

Our survey showed that increased duration of studying, concentration and improved alertness were the most frequently cited reasons for taking PCE. Other reports also concurred with our observation.¹⁸⁻²² Unexpectedly, report from Lengvenyte et al., showed no relationship between grade point average (GPA) and use of PCE among university students.²³ Some studies have even shown that some students that engaged in PCE even had a lower GPA relative to those that abstained from them.²⁴⁻²⁶ There is therefore need to discourage this trend and explore non-pharmacological approaches using nutrition, physical exercise, sleep, meditation, mnemonic strategies, computer training, and brain stimulation.²⁷

Our study showed that major influence or source of information is from friends, showing that most decisions on use of PCE are strongly influenced by peer-pressure. This peer pressure relationship has earlier been demonstrated by Carroll and colleagues.²⁸ Our study showed that most of the PCE used by respondents are self-purchased. This is at variance with report from western countries where most PCE are purchased through online sales.^{29,31} It may however be explained by the choice of PCE in the study environment which are mainly caffeinated products that are readily available and affordable.

The survey also observed that PCE usage among senior medical students is more than usage among junior medical school. This view is supported by earlier report and may be related to addictive

effect as well as relatively higher workload with higher academic levels.³²

Going forward from here, there is need to build a system that reduces peer pressure among students and explore non-pharmacological methods of cognitive enhancement.

There is also need to run campaign in universities that will build students' confidence, so that they can believe more in themselves without depending on PCE.

In conclusion, our survey showed significant association between the age, male gender and academic level and use of PCE. Our respondents used mainly caffeinated beverages and energy drink. Their choice is strongly influenced by peer pressure and the motivations are mainly to increase reading time, concentration, and alertness.

Acknowledgement: The authors wish to acknowledge medical students of Delta State University for accepting to participate in the survey. Dr. Nwogoh Bendict and Dr. Umukoro EK contributed greatly to the success of this project.

Funding: Funding is by self.

Conflict of interest: The authors have no conflict of interest to declare

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How to Cite: This article should be cited as: Uchendu AP, Uchendu OJ. The Use of Cognitive Enhancers among Medical students of Nigerian Tertiary Institutes. *Afr. J. Trop. Med. & Biomed. Res.* 2023; 6(1): 25-35.
<https://dx.doi.org/10.4314/ajtmbr.v6i1.3>