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Caffeinated Energy Drink Consumption among First Year Medical Students

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ABSTRACT
The consumption of caffeinated energy drinks is one of the coping strategies used by college students in the management of stressful academic situation. Energy drinks are freely available at all places without regulation or proper education for its side effects. The purpose of the study is to determine the association between caffeinated energy drink consumption and student's study habits in relation to self-perceived academic load. The study was done among first year MBBS students using an expert validated questionnaire which covered sociodemographic characteristics, study habits, frequency, pattern and knowledge of caffeinated energy drink consumption. Descriptive statistics were used for presenting the findings. On analysis of the data, caffeinated energy drink consumption was found to be increased for academic purpose among medical students without sufficient knowledge regarding its effects. Whenever academic level perception is more, levels of anxiety increased which leads to increased caffeinated energy drink consumption. Results from this study provide important and novel information regarding energy drink consumption habits among medical students and a need to introduce possible interventions to provide safe consumption.
Keywords-*caffeinated energy drinks, academic load perception, levels of anxiety, knowledge.*

Introduction

An energy drink is a type of beverage containing mainly caffeine which is marketed as mental and physical stimulator [1]. Energy drinks generally contain methylxanthines, taurine, glucuronolone, carbonated water, guarana which are responsible for the possible medical side effects [2]. Prevalence of energy drinks among adolescent and young adults is 30 – 50% [3]. Medical students need to study for extended periods of time especially prior to examination. The academic load associated with the need to perform well and to obtain good grades may promote the use of stimulating beverages to maintain alertness and to extend their study time [4]. The consumption of caffeinated energy drinks is one of the coping strategies used by college students in the management of stressful academic situation [5]. However the continuous use of caffeine, if not correctly monitored could lead to possible dependence accompanied by disadvantageous and even harmful withdrawal symptoms and side effects [6]. Students who consumed more caffeine while studying would exhibit negative and unhealthy study habits [7]. Energy drinks aim to induce performance enhancing effects with non-nutritive stimulants that actually result in more dehydration

[8]. Energy drinks are freely available at all places without regulation or proper education for its side effects [9]. Consequently, a need to determine the use of caffeine by medical students particularly for academic purposes and their knowledge of its effects was identified. The purpose of the study is to determine prevalence and pattern of caffeinated energy drink consumption among first year medical students and to find out their knowledge about its beneficial and side effects and also the factors associated with caffeinated energy drink consumption.

Materials and Methods

This was a cross sectional study done in all students (200) of first year MBBS of 2014 admission. All students who were present during three consecutive sections while taking questionnaire were included and those who were unwilling and absent were excluded. The study was conducted after approval of Institutional Ethics Committee and after written informed consent. Students willing to participate anonymously completed a self-administered expert validated questionnaire after their first MBBS University theory and practical examination to avoid any bias. Questionnaire included information regarding the following variables.

1. Socio demographic data.
2. Caffeinated energy drink consumption – prevalence, quantity and types,reasons for consumption participant's knowledge regarding its beneficial and side effects andassociation between consumption and study habits.
3. Academic load perception - student's perception regarding academic load.

Statistical Analysis

Descriptive statistics were used for presenting the findings. Chi Squared test was used for identifying the factors. Statistical tests were considered to be significant at 0.05 level. For analysis statistics package for social sciences (SPSS) version 16 was used.

Results

1. Sociodemographical Variables

A total of 196 participants out of 200 first year MBBS students participated in this study with a mean age of 19.45 years. (Table 1).

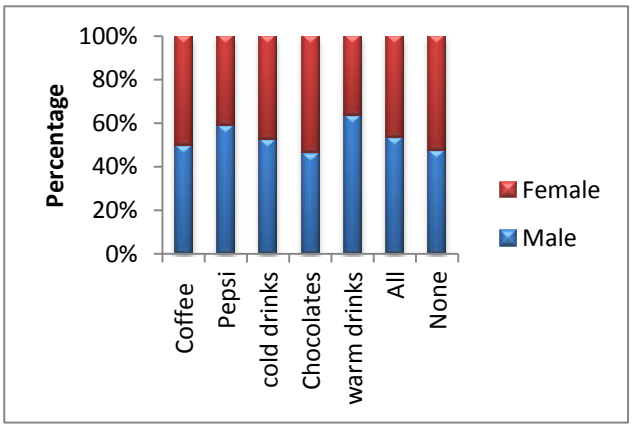
Table 1: Sociodemographic characteristics

		Frequency	Percentage
Age	≤18 years	11	5.6
	19 years	100	51.0
	≥20 years	85	43.4
Gender	Male	105	53.6
	Female	91	46.4
Residence	With family	63	32.1
	Others	133	67.9
Income	Satisfactory	177	90.3
	Unsatisfactory	19	9.7

2. Frequency and Pattern of caffeinated energy consumption

The total percentage of participants who consume caffeinated energy drink was 84.2% (n = 165) of all students. Analyzing the pattern of consumption among the participants coffee was the most commonly consumed product in both male and female as shown in figure 1.

Figure-1: Gender distribution of pattern of caffeinated energy consumption



The frequency of consumption was determined among the participants and it was found that 55.6% used daily, 28.1% weekly, 11.7% monthly, 3.6% sporadically. The reason for consumption was studied and shown in table 2.

Table- 2: Reason for energy drink

Reason for energy drink	Frequency	Percent
Energy	85	43.4
Study	70	35.7
Wakefulness	71	36.2
No sleep	8	4.1
Refreshment	160	81.6
Stress	77	39.3
Ad	4	2.0
Driving	0	0.0
Athletic	4	2.0
Friend	6	3.1
Peer	5	2.6
Habit	1	.5

The questionnaire showed that consumers showed adverse effects like headache being most common 28.1% followed by fatigue 19.9%, dehydration 16.8%, tremor 2%, muscle stiffness 1%, inability to focus 1%, vomiting 0.5%, dental caries 0.5%, weight gain 2% and 27% reported as having no effect. Withdrawal effect is seen immediately in 13.3%, before 12 hours in 25.5%, between 12 to 24 hours in 16.8%, after three days in 6.1%, after a week in 1%, no effect in 28.6% and no specific time in 7.7%.

3. Knowledge

In order to determine participants knowledge regarding the effects of caffeine ten options for benefits, side effects and withdrawal symptoms were listed from which correct options had to be chosen. The average score obtained shown in figure 2 and the graded score were categorized in table 3. (0 = no knowledge, 1 = poor knowledge, 2 to 5 = good knowledge).

Figure-2: Distribution of study group according to knowledge

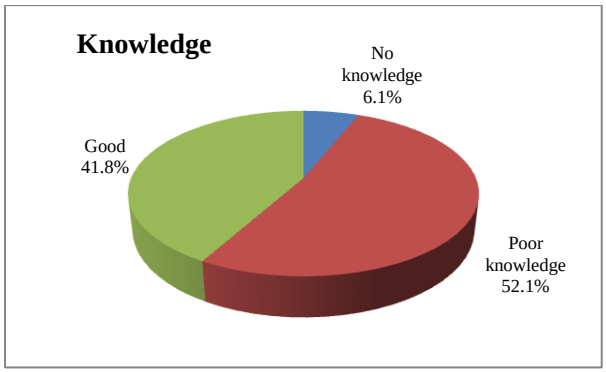


Table-3: Knowledge on benefits, side effects and withdrawals

Knowledge				
Effects	No	Poor	Good	Total
Benefits	33 (16.8%)	125 (63.8%)	38 (19.4%)	196 (100%)
Side effects	89 (45.4%)	30 (15.3%)	77 (39.2%)	196 (100%)
With-drawal	67 (34.2%)	38 (19.4%)	91 (46.5%)	196 (100%)

4. Factors associated with caffeinated energy consumption (Table -4)

Among the caffeinated energy drink consumers 53.3% were males while that of nonusers were 54.8%. Among 90.9% of the users had satisfactory income and corresponding of the nonusers had 87.1%. When the study preparation time was analyzed around 82.4% of the users had less than one week time of preparation while for the nonusers the corresponding figure was around 67.8%. 29% of both users and nonusers had extreme anxiety. A statistically significant difference was observed on academic load perception among the two study categories. 74.5% of the users felt that academic load was a severe burden while only 54.8% responded the same in nonusers. There was not much significant difference observed between users and nonusers on knowledge of caffeinated energy consumption. Around 75% in each group revealed that no change in the retaining capacity of the level of information.

Table-4: Bivariable analysis of factors associated with caffeinated drink

		Not used caffeinated drinks (N=31)		Used caffeinated drinks (N=165)		$\chi 2$	df	p
Gender		N	%	N	%			
	Male	17	54.8	88	53.3	0.024	1	0.877
	Female	14	45.2	77	46.7			
Residing	Residing with Family	10	32.3	53	32.1	0.000	1	0.988
	Others	21	67.7	112	67.9			
Income	Satisfactory	27	87.1	150	90.9	0.433	1	0.51
	Unsatisfactory	4	12.9	15	9.1			
Study Preparation	2 or more weeks in advance	10	32.3	29	17.6	3.994	3	0.262
	1 week before the test	6	19.4	50	30.3			
	2 or 3 days prior to test	10	32.3	57	34.5			
	Night before day of test	5	16.1	29	17.6			
Duration of study per day	1 hr or less	5	16.1	30	18.2	2.316	3	0.509
	1-2 hrs	7	22.6	57	34.5			
	2-4 hrs	13	41.9	51	30.9			
	>4 hrs	6	19.4	27	16.4			
Anxiety	Extreme	9	29	47	28.5	4.112	3	0.25
	Moderate	11	35.5	81	49.1			
	Somewhat little	11	35.5	34	20.6			
	None	0	0	3	1.8			
Academic load	Moderate burden	14	45.2	42	25.5	4.966	1	0.026
	Severe burden	17	54.8	123	74.5			
Knowledge	Poor	17	54.8	97	58.8	0.167	1	0.683
	Good	14	45.2	68	41.2			
Level of information retained	Very well	6	19.4	37	22.4	0.619	2	0.734
	No change	23	74.2	122	73.9			
	Not well	2	6.5	6	3.6			

In the multivariable analysis the variables which have p value less than 0.3 in the bivariable analysis were included. Academic load was found as the significant risk factor for the use of caffeinated drink (adjusted odds ratio 3.64).

Table- 5: Multivariate analysis of binary logistic regression: Dependent variable caffeinated drink

	B	S.E.	Wald	df	p	OR	95% C.I.for OR	
							Lower	Upper
Preparation (Reference category Two or more weeks in advance)	0.190	0.204	0.865	1	0.352	1.209	0.810	1.803
Anxiety (Reference category "Extreme")	0.215	0.354	0.369	1	0.543	1.240	0.619	2.484
Academic load (Reference category " Moderate Burden")	1.291	0.631	4.186	1	0.041	3.638	1.056	12.534

Discussion

1. Socio demographic variables.

Energy drinks are marketed to young adults and marketing efforts may be particularly appealing among college students as they believe in the veracity of their claims [1]. It has been reported that the consumption of energy drinks especially among young adults between 18-25 years is currently of

great concern as they contain three times the amount present in soft drinks [10]. Personality factors determine the competitiveness of an individual and vigor to achieve success is more predominant in males [10]. This could be the possible reason for consuming energy drinks more often and in higher quantities in males than in females [5]. But the results from the present study indicate a greater prevalence of energy drink consumption among females. Students having a satisfactory income consumed more compared with others in our study.

2. Frequency and Pattern of caffeinated energy drink consumption.

The primary ingredient in energy drinks that has a cognitive function is the caffeine but its amount provided in energy drinks far exceeds the limit to promote cognitive function [11]. The principal source of caffeine are beverages namely cola and mainly coffee, which was confirmed in our study [12]. Caffeine from coffee is absorbed faster than from cold drinks as the lower temperature of the beverage decrease the rate of blood flow within the intestines [11]. The study found that the frequency of caffeinated energy drink consumption among students was found to be high which was consistent with the fact that caffeine was one of the most widely consumed substance [3]. In our study among the students using energy drinks (36.2%) to enhance wakefulness stated that their expectations were met. This can be explained because of the high caffeine content of energy drinks and the finding is compatible with the literature. Caffeine increases the firing rates in mesopontine cholinergic neurons, which participate in the production of arousal mechanisms and thereby increasing alertness and decreases fatigue [11]. These cholinergic neurons are inhibited by adenosine, providing a coupling mechanism that links arousal and caffeine, yielding proof for the role of caffeine in the behavioral state of arousal mechanism [11].

The mesocortico-limbic-dopaminergic system via D2 receptors regulate neural networks that are involved in selective and involuntary attention. Caffeine increases behavior related to dopamine by inhibiting adenosine A2A receptors and increasing transmission via D2 receptors [13]. Caffeine intake increases left frontal activation compared with right suggesting that dopamine function could be linked to fatigue, with caffeine reducing fatigue [11]. Energy drink consumption is a popular practice among college students particularly if the student had insufficient sleep, if they need more energy in general, while studying for exams or working on major course projects [14]. Sleep deprivation is associated with selecting less difficult cognitive tasks and college students who have sleep difficulties report a greater frequency of stress [15]. Evidences suggest that a moderate dosage of caffeine impairs motor skill and may not be an adequate substitute for memory enhancements or day time sleep [11] and our findings were consistent with the present study.

High intake of energy drinks containing high quantity of caffeine can result in the slow downing the rate at which nutrient is absorbed into the blood stream and it also slows down the rate of fluid absorption [16]. Caffeine acts as a diuretic agent and it removes extra fluid from the body and therefore if a person consumes energy drinks or substitute it for water will results in severe dehydration, fatigue and headache [16]. This explains the adverse effects reported in our study which is consistent with the past studies. Excessive caffeine provides a blast of energy enabling the person to feel good initially but when energy is burned up in 30-40 minutes there is sugar crash [16]. The energizing effects were strongest 30-60 minutes after consumption and were sustained for at least 90 minutes [10]. This explains that majority of participants reported effects immediately and before 12 hours.

3. Knowledge about energy drinks

From the results obtained on the individual questions it was found that the participant's had good knowledge on the withdrawal symptoms of caffeine (46.5%), less on side effects (39.2%) and least on benefits (19.4%). These findings could be attributed to the fact that side effects and withdrawal effects of caffeine are more commonly experienced

than its benefits since many of the benefits are associated with long term use of caffeine. 36.2% of the participants correctly identified caffeine as a vigilance enhancer which could partially explain the consumption of caffeine.

4. Factors associated with caffeinated drink consumption.

Studying for an exam has always been a challenge and can be one of the most stressful events in a student's life. When they find that stress and anxiety are overwhelming, they often seek alternate solutions like consuming a stimulant called caffeine to improve their academic performance [6]. The most popular caffeinated beverages among students were soft drinks and coffee and their consumption increased in periods of high stress. A common reason given by respondents regarding why they drink was to reduce sleep and boost energy levels for study and completing their projects. This may be due to the reason that caffeine increase cortisol secretion by stimulating CNS and causes sensitization of a special subset of cannabinoid receptor in the striatum, consistent with the psycho active properties of the compound. This explains why enhanced relaxation and sense of well being occurs during use of caffeine in stressful events [7].

Troyer and Markle found that caffeine consumption among college students was related to higher levels of anxiety [8]. Students usually consume more caffeine and would exhibit negative and unhealthy study habits like minimal studying time, increased anxiety and retaining low levels of information studied [6]. The antagonism of adenosine receptors is the most likely pathway of increased anxiety with caffeine intake [11]. Results showed that there were no significant difference between the amount of information retained and non caffeine consumption. Consuming caffeine and levels of anxiety were related, which could be due to the fact that, when anxiety is present, the decision to drink caffeine increases. However in relevance to caffeinated energy drink consumption and levels of anxiety, there was a relationship. Whenever academic load perception is more, levels of anxiety is increased which leads to increased caffeinated energy consumption .The results of the present study were able to determine that the majority of the participating students self perceive their academic loads and stress levels as being respectively heavy and moderate. In addition, this study shows that the consumption of caffeinated beverages is a popular practice among the college students [4] and there is a positive correlation between participants perceived stress and energy drink consumption [10].

CONCLUSION

The results reveal that caffeine usage especially in the form of coffee for academic purpose is increased among medical students without satisfactory knowledge about its health risks. The findings emphasize the need for stress management programme inside the campus for educating medical students about energy drinks and to make medical training more adaptive to new subjects in the field of nutrition.

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