PATTERN OF CONSUMPTION, AWARENESS, AND ADVERSE EFFECTS OF CAFFEINE-CONTAINING BEVERAGES AMONG MEDICAL STUDENTS IN SOHAG UNIVERSITY, A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Medical students are exposed to high academic stress and consume caffeinated beverages to enhance their performance. **Objectives:** The study aims to identify consumption patterns, awareness, and adverse effects of caffeine-containing beverages as energy drinks among medical students. **Methods:** A cross-sectional study included healthy 350 medical students with a mean age group of 20 ± 2 years using an interview questionnaire between October 2023 and January 2024. **Results:** The prevalence of caffeinated beverage consumption was high among participants (86.3%). The most consumed caffeinated beverage was tea 250 (82.7%), then coffee 238 (78.8%), then carbonated drinks 149 (49.3%), then energy drinks (ED) 111 (36.7%) with overlapping between them. The awareness section reflects the lack of knowledge and awareness among participants. The main reason for their consumption was alertness, which reflects the goal of consumption in the chosen population. There were 219 (72.5%) of consumers suffering from withdrawal manifestations. Headache, difficulty concentrating, and disturbed mood were the most common three withdrawal symptoms. There were 249 (82.5%) of consumers suffering from intoxication. The most common five symptoms were tachycardia 172 (56.9%), GIT disturbance 154 (50.9%), nervousness 152 (50.3%), restlessness 141 (46.6%), and insomnia 138 (45.6%), with overlapping between symptoms. **Conclusion:** The intake of caffeine-containing drinks among Sohag medical students was quite high and surpassed safe levels, necessitating programs to raise their awareness about the health consequences of excessive caffeine consumption.

Keywords: Caffeinated beverages, Intoxication, Medical students.

INTRODUCTION

One of the most widely utilized CNS stimulants in use nowadays is caffeine. Many people, particularly children and medical students, consume caffeine-containing beverages such as coffee, tea, soft drinks, and energy drinks to stay awake. Individuals consumed around 166 million 60-kilogram bags of coffee worldwide between 2020 and 2021. Thus, it's critical to comprehend the consumer drivers of beverages containing caffeine **(Samoggia and Rezzaghi, 2021 & Yi et al., 2022).** Caffeine is an alkaloid naturally produced in tea leaves, coffee seeds, cocoa fruit, kola tree fruit, and energy drink additives. Because of its physiological function, it has drawn more interest **(Enyart et al., 2020).** Caffeine directly inhibits the action of adenosine receptors and improves dopaminergic neurotransmission by reducing the modifying effects of adenosine on dopamine **(Ferré et al., 2018).**

It affects the release of neurotransmitters such as dopamine, noradrenaline, gamma-aminobutyric acid, acetylcholine, and serotonin, which enhances mood **(Zhang, 2001),** stimulates the organism, improves concentration, and eliminates physical fatigue **(Smith 2002).** Caffeine also inhibits phosphodiesterase (PDE) activity, an enzyme that is responsible for the degradation of cyclic adenosine monophosphate (cAMP) to the noncyclic form 5-AMP **(Fisone et al., 2004).** The inhibition of PDE increases the cAMP concentration in cells and elevates blood pressure **(Herman and Herman, 2013).** Energy drinks strong in caffeine, sugar, taurine, vitamins, and energizing chemicals are popular among medical students who want to improve their mental and physical performance **(Qasem et al., 2024).** Young adults and sportsmen are increasingly consuming energy drinks, prompting worries about potential health risks such as cardiovascular disease, nervous system

disorders, and addiction (**Costantino et al., 2023).**

Orally administered caffeine almost has complete absorption and typically reaches peak plasma concentrations in 30 to 60 minutes. In healthy humans, the half-life of caffeine is approximately 3-6 hours (**Wikoff et al., 2017).** The US Food and Drug Administration (US FDA) regularly monitors the caffeine concentration in beverages, allowing a maximum consumption of 200 mg per day without generating any issues for adults (**Sanchez, 2017).**

According to studies, Egypt consumes more caffeine-containing beverages than the recommended daily limit of 200 mg, with 61.4% of the population drinking at least one caffeinated beverage/day (**Tayel et al., 2018; El Nimr et al.2019).** High caffeine doses can be toxic, and users may become dependent, leading to recurrent health problems despite consuming low to moderate doses (**Amer et al., 2023).** Caffeine withdrawal is a condition characterized by symptoms such as headache, fatigue, mood swings, difficulty concentrating, and flu-like symptoms, which must appear within 24 hours of abrupt caffeine cessation and can't be better explained by another medical or mental disorder (**Sweeney and Griffiths, 2023).** The DSM-5 defines caffeine intoxication as recent caffeine consumption with at least five of twelve symptoms, including tachycardia, muscle twitching, diuresis, restlessness, nervousness, excitement, insomnia, and psychomotor agitation (**Hearn et al., 2020).** Caffeine intoxication symptoms should be clinically significant, producing distress or impairment in social, occupational, or other settings, and are usually dose-dependent (**Sweeney and Griffiths, 2023).**

THE AIM OF THE WORK

1. Determine the prevalence of caffeine usage among Sohag medical students.

2. Identify the consumption pattern of various caffeinated drinks.

3. Assess medical students' awareness of caffeinated beverages including energy drinks.

4. Determine the percentage of caffeine withdrawal and intoxication among caffeine users.

METHODOLOGY

After learning about the study's goal, each participant gave verbal agreement.

The proposed protocol for this study was reviewed by the Medical Research Ethics Committee (MREC) of the Faculty of Medicine at Sohag University and approved by the committee's standard operating procedure regulations under IB. The registration number is Soh-Med-23-10-08PD. A cross-sectional design included 350 students from Sohag University's Faculty of Medicine in grades one through five. The data was acquired using a predesigned structured questionnaire (**El-Nimr et al., 2019; Khan, 2019).**

The sample size was estimated using the Open Epi Info Website. A sample size of 350, medical students at Sohag University or more measurements/surveys is necessary to achieve a 95% confidence that the true value is within ±5% of the measured/surveyed value between October 2023 and January 2024. A multiple-staged stratified random sampling approach was used. First, an equal number of students from each grade level were selected (n = 70). Then, a random section was chosen. Finally, a systematic random sample was employed to select male and female students from each region. A predesigned, structured interview questionnaire was used to collect information from the students in six sections.

Section one covered sociodemographic information (age, address, gender, and academic grade).

Section two was about raising awareness and understanding about various types, ingredients, sources of information, the amount of caffeine in those beverages, the safe amount of caffeine per day, their thoughts on them, and the negative consequences. **Section three** asked about the consumption of those beverages, the pattern of caffeinated beverage use, motivational factors, frequency per day, and duration of consumption. **Section four** discussed the student's lifestyle (physical activity, mental activity, sedentary lifestyle), daily sleeping hours, drinking timing, relationship with food, and smoking. **Section Five** covered medical history, such as the presence of chronic disease and the regular use of drugs.

Section six examined withdrawal symptoms.

Students were asked about caffeine withdrawal symptoms (in the 24 hours following an abrupt cessation or reduction in consumption after prolonged daily use). Students were judged to be in caffeine withdrawal if they showed three or more of the

following symptoms within 24 hours of abruptly discontinuing or reducing consumption after extended daily use: headache, marked weariness or muscle pain/stiffness, drowsiness, depression or problems concentrating, irritability, nausea or vomiting **(Dews et al., 2002; Juliano and Griffiths 2004).**

Students were diagnosed with caffeine intoxication if they showed five or more of the following symptoms during or after recent caffeine administration. Restlessness, anxiety, insomnia, flushed cheeks, gastrointestinal disruption, diuresis, muscular twitching, meandering flow of thought and speech, tachycardia or cardiac arrhythmia, periods of weariness, and psychomotor agitation **(El-Nimr et al., 2019).**

RESULTS

A cross-sectional study was carried out at Sohag University's Faculty of Medicine to estimate the proportion, pattern, and effect of caffeinated beverage use among Sohag medical students to assess their awareness of caffeinated beverages, particularly energy drinks. 350 people participated in the study. The first group consisted of 302 cases (86.3%) who drank caffeinated beverages, including energy drinks. The second group contained 48 participants (13.7%) who had not confirmed that they consumed caffeinated beverages, as demonstrated in **Figure (1).** Before statistical analysis, the Kolmogorov-Smirnov test was used to ensure normality and variance homogeneity in the data.
Table (1) compares consumers with non-consumers based on different factors.

The socio-demographic data:

Regarding the age: Students in the study were between 18:22 years. There was a significant difference in the mean values comparing consumers (19 ± 1) with the non-consumers (21 ± 2) P<0.006.

In terms of sex, there were no statistically significant differences between consumers and non-consumers. Female consumers accounted for 48.3% (146), while males accounted for 51.7% (156).

There was a significant statistical decrease
6)

in the mean values of consumers (rural =131 (43.4%), urban=171 (56.6%)) compared with the mean values of non-consumers (rural=30 (62.5%), urban=18 (37.5%)) P=0.01.

As regards the academic grades there was a highly significant increase among consumers compared to non-consumers as the academic year progressed.

Consumers and non-consumers demonstrated significant differences in activity and lifestyle. Physical exercise was practiced by 106 (35.1%) consumers, but not by non-consumers (0%).

There 185 (61.3%) consumers were practicing mental activities while 48 (100%) non-consumers were practicing mental activities.

1) A sedentary lifestyle was reported by 11 (3.6%) of consumers and 0% of non-consumers.

2) Sleeping hours differed significantly between consumers and non-consumers. The normal sleeping hours range from 7 to 8 hours daily **(Chaput et al., 2020).**

3) There were 69 (22.8%) and 52 (17.2%) consumers sleeping within the usual range of 7 and 8 hours respectively, and 29 (56.2%) and 2 (4.2%) of non-consumers sleeping within the normal hours (7 and 8 hours respectively). Also, there were 137(45.4%), 22 (7.3%), and 22 (7.3%) consumers were sleeping within 6 hours/ day, less than 6 hours, and more than 8 hours respectively in comparison to 17 (35.2%), zero, and zero of non-consumers were sleeping within 6 hours/ day, less than 6 hours, and more than 8 hours respectively. This means that more non-consumers slept within the normal range of sleeping hours.

4) Regarding smoking there was a significant difference between consumers (29=9.6% smokers, 273= 90.4% non-smokers) and non-consumers (0% smokers, 48=100%).

5) As regards their opinion about caffeinated beverages 197 (56.3%) thought that those beverages were dangerous while 153 (43.7) thought that those beverages were useful with no significant statistical difference between both consumers and non-consumers.

Table (1): Comparison between consumers and non-consumers as regards Socio-demographic characters, smoking, activity, sleeping hours, and opinion toward caffeine beverages, n=350.

		Total N=350		Consumers N=302		Non–consumers N=48		P
		No.	%	No.	%	No.	%	
Age	Mean ± SD	20 ± 2		19 ± 1		21 ± 2		<0.006#
	Median (IQR)	21 (18:22)		18(18:19)		21 (20:22)		
Sex	Females	171	48.9%	146	48.3%	25	52.1%	*0.6
	Males	179	51.1%	156	51.7%	23	47.9%	
Address	rural	161	46.0%	131	43.4%	30	62.5%	*0.01
	urban	189	54.0%	171	56.6%	18	37.5%	
Grade	1st	70	20.0%	41	13.6%	29	60.4%	
	2nd	70	20.0%	52	17.2%	18	37.5%	
	3rd	70	20.0%	69	22.8%	1	2.1%	<0.001
	4th	70	20.0%	70	23.2%	0	0.0%	
	5th	70	20.0%	70	23.2%	0	0.0%	
Activity& lifestyle	Physical activity	106	30.3%	106	35.1%	0	0.0%	
	Mental activity	233	66.6%	185	61.3%	48	100.0%	<0.008
	Sedentary life	11	3.1%	11	3.6%	0	0.0%	
Sleeping hours	6 hours	154	44.0%	137	45.4%	17	35.4%	
	7hours	98	28.0%	69	22.8%	29	56.2%	
	8hourrs	54	15.4%	52	17.2%	2	4.2%	<0.001
	Less than 6	22	6.3%	22	7.3%	0	0.0%	
	More than 8	22	6.3%	22	7.3%	0	0.0%	
Smoking	No	321	91.7%	273	90.4%	48	100.0%	*0.02
	yes	29	8.3%	29	9.6%	0	0.0%	
Opinion	dangerous	197	56.3%	176	58.3%	21	43.8%	*0.06
	useful	153	43.7%	126	41.7%	27	56.3%	

P value was calculated by Pearson Chi-Square of *Fisher's Exact Test or # independent Sample T Test wherever suitable, highlighted values are significant.
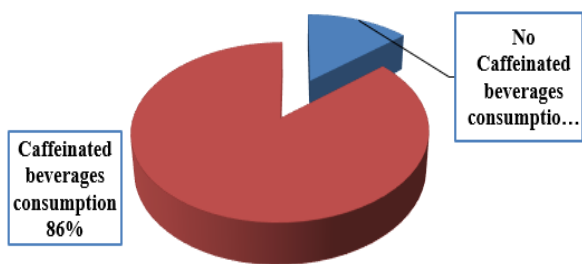
Figure (1): Prevalence of consumption of caffeinated beverages.

Table (2) illustrates the distribution of consumers according to their caffeine consumption pattern, frequency/duration, sleeping hours, relation to food/smoking, withdrawal symptoms, and intoxication.

The most consumed caffeine product was tea 250 (82.7%) coffee 238 (78.8%) then carbonated drinks 149 (49.3%) then energy drinks (ED) 111 (36.7%) with overlapping between them.

Most of the consumers have those beverages at night 106 (35.1%) than in the early morning 102 (33.8%) than in the afternoon 94 (31.1%).

One hundred forty- four 144 (47.7%) of the consumers had those beverages after food, and 124 (41.1%) had no relation with food at all. Only 34 (11.3%) had those beverages before food intake.

There were 276 (91.4%) of consumers who had no chronic disease while only 26 (8.6%) of consumers were suffering from chronic diseases.

There were 244 (80.8%) consumers who didn't take regular medications while there were 58 (19.2%) consumers who have been taking regular medications.

There were 219 (72.5%) of consumers suffering from withdrawal manifestations.

Figure (2) showed that the most common three manifestations were headache 223 (73.8%), difficulty in concentration 198 (65.5%), and disturbed mood 176 (58.2%). There were overlapping between symptoms.

There were 249 (82.5%) consumers suffering from intoxication and 53 (17.5%) consumers not suffering from intoxication. Figure (3) showed that the most common five symptoms were tachycardia 172 (56.9%), GIT disturbance 154 (50.9%), nervousness 152 (50.3%), restlessness 141 (46.6%), and insomnia 138 (45.6%) with overlapping between symptoms.

As regards the frequency of intake per day there were 187 (61.9%) consumers taking caffeinated beverages once or twice per day, while 78 (25.8%) consumers were taking caffeinated beverages more than twice per day, and 37 (12.3%) were irregular consumers.

There were 261 (86.4%) were consuming those beverages for more than one year, while only 41 (13.6%) were consuming caffeinated drinks for less than one year.

Table (3) showed that the main reason for consuming those beverages was alertness at (76.3%) percentage, then 10.6% for both their flavors and to increase sports performance, while only 2.6% for weight loss.

Table (2): Distribution of consumers according to their caffeine consumption pattern, frequency/duration, sleeping hours, relation to food/smoking, withdrawal symptoms, and intoxication, n=302.

		Count	%
Mostly consumed caffeine products	*Tea*	250	82.7%
	Coffee	238	78.8%
	Energy drinks	111	36.7%
	Carbonated drinks	149	49.3%
Timing	*Afternoon*	94	31.1%
	Morning	102	33.8%
	Night	106	35.1%
Relation with food	*After*	144	47.7%
	Before	34	11.3%
	No relation	124	41.1%
Smoking	*No*	273	90.4%
	Yes	29	9.6%
The presence of chronic disease	*No*	276	91.4%
	Yes	26	8.6%
Use of regular medications	*No*	244	80.8%
	Yes	58	19.2%
withdrawal symptoms	*No*	83	27.5%
	Yes	219	72.5%
intoxication	*No*	53	17.5%
	Yes	249	82.5%
Frequency of intake/day	*Irregular*	37	12.3%
	1-2 times /day	187	61.9%
	more than 2	78	25.8%
Duration of consumption	*Less than one year*	41	13.6%
	More than one year	261	86.4%

Table (3): motivational reason for the consumption of caffeinated beverages, n= 350.

	Count	%
Alertness	267	76.3%
Flavor	37	10.6%
Sport	37	10.6%
Weight loss	9	2.6%
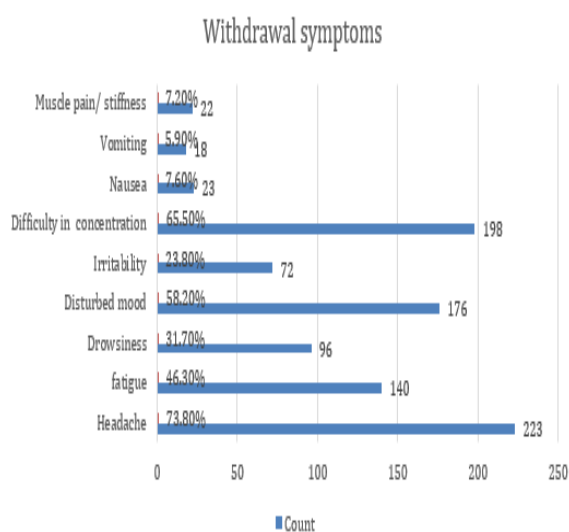
Figure (2): Manifestations of caffeine withdrawal within 24 hours following abrupt cessation or reduction of consumption after prolonged use. Three or more considered withdrawal.
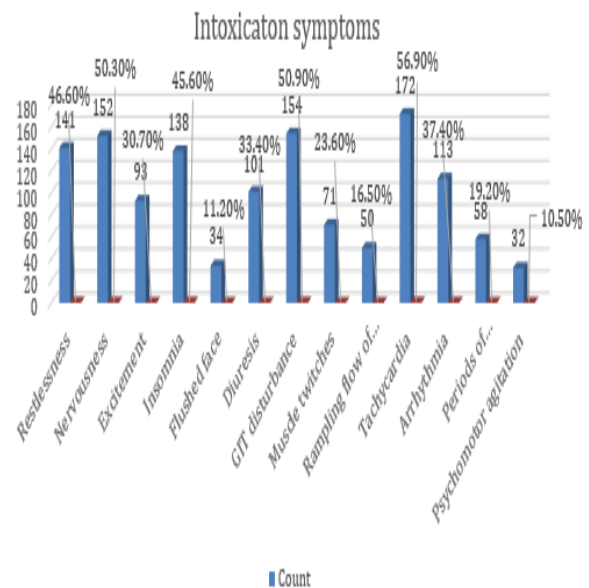
Figure (3): Manifestations of caffeine intoxication. Five or more are considered intoxication.

Table (4) illustrates the awareness of caffeinated beverages among consumers and non-consumers.

Consumers and non-consumers had a similar understanding of caffeinated beverages (p-value = 0.2).

Also, there was no statistically significant difference between consumers and non-consumers in terms of their source of information (p value=0.1), with family members and media coming in front with 100% for both, followed by colleges with 73.7% overlapping among sources.

There was a high statistical increase in the non-consumers (87.5%) as compared to the consumers (67.5%) as regards the knowledge about the ingredients of those beverages (p-value =0.004).

There was no statistically significant difference in caffeine content in such beverages or the safe quantity of caffeine consumed per day between consumers and non-consumers (p values=0.3 and 0.2, respectively).

As regards knowledge about the adverse effects of those beverages there was a highly statistically significant increase in non-consumers (95.8%) as compared to the consumers (59.9%) (p value= 0.001).

**Table (5)** shows the relationship between intoxication and other consumers' variables.

There was no statistically significant difference in terms of daily intake frequency (p

= 0.5), duration of consumption (p = 0.8), relation to a specific time (p = 0.2), relation to food (p = 0.8), smoking (p = 0.6), or presence of chronic disease (p = 0.2).

Table (4): Awareness about caffeinated beverages among consumers and non-consumers, n=350.

Knowledge about		Total		Consumers N=302		Non–consumers N=48		P
		No.	%	No.	%	No.	%	
Caffeinated beverage	No	17	4.9%	13	4.3%	4	8.3%	*0.2
	Yes	333	95.1%	289	95.7%	44	91.7%	
How do you know?	Family	350	100.0%	302	100.0%	48	100.0%	
	Colleges	258	73.7%	218	72.2%	40	83.3%	0.1
	Media	350	100.0%	302	100.0%	48	100.0%	
Ingredients	No	246	70.3%	204	67.5%	42	87.5%	*0.004
	yes	104	29.7%	98	32.5%	6	12.5%	
amount of caffeine	No	262	74.9%	223	73.8%	39	81.3%	0.3
	YES	88	25.1%	79	26.2%	9	18.8%	
safe amount of caffeine	No	221	63.1%	187	61.9%	34	70.8%	*0.2
	YES	129	36.9%	115	38.1%	14	29.2%	
Adverse effects	No	123	35.1%	121	40.1%	2	4.2%	*<0.001
	YES	227	64.9%	181	59.9%	46	95.8%	

P value was calculated by Pearson Chi-Square of *Fisher's Exact Test wherever suitable, highlighted values are significant.
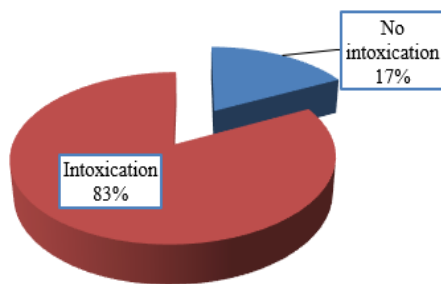
Figure (4): percentage of intoxication among consumers.

There was a very statistically significant difference between inebriated and non-intoxicated customers in terms of withdrawal symptoms (p = 0.006). In addition, there was a statistically significant difference between intoxicated and non-intoxicated customers who used regular drugs (p = 0.02).

Table (5): The relationship between intoxication and other variables among consumers, n=302.

		N=53		N=249		
		No.	%	No.	%	
Frequency of intake/day	Irregular	9	17.0%	28	11.2%	0.5
	1-2 times /day	31	58.5%	156	62.7%	
	more than 2	13	24.5%	65	26.1%	
Duration of consumption	Less than one year	6	11.3%	35	14.1%	*0.8
	morethan1year	47	88.7%	214	85.9%	
withdrawal symptoms	No	53	100%	30	12.0%	*<0.006
	Yes	0	0.0%	219	88.0%	
Certain time	Afternoon	14	26.4%	80	32.1%	0.2
	Morning	15	28.3%	87	34.9%	
	Night	24	45.3%	82	32.9%	
Relation with food	After	26	49.1%	118	47.4%	0.8
	Before	5	9.4%	29	11.6%	
	No relation	22	41.5%	102	41.0%	
Smoking	No	47	88.7%	226	90.8%	0.6
	Yes	6	11.3%	23	9.2%	
Presence of chronic disease	No	51	96.2%	225	90.4%	0.2
	Yes	2	3.8%	24	9.6%	
Use of regular medications	No	49	92.5%	195	78.3%	*0.02
	Yes	4	7.5%	54	21.7%	

P value was calculated by Pearson Chi-Square or * Fisher's Exact Test wherever suitable.

DISCUSSION

Caffeine is the most popular mood-altering chemical in the world **(El-Nimr et al., 2019)**.

This study concentrated on only caffeinated drinks. The study quantifies caffeinated beverage use among Sohag University medical undergraduates using data from a convenience sample of 350 student surveys, with a 95% confidence level, the real value is within ±5% of the measured/surveyed value across all five academic grades (70 students each). It is based on a rigorous study that looked at the volunteers' intake of a variety of caffeinated products, as well as their sociodemographic and lifestyle characteristics. More than 86% of students reported consuming caffeine, with the majority drinking tea, coffee, carbonated beverages, and energy drinks.

Sociodemographic data:

Among all caffeinated beverages consumers, about 48% were females and about 51% were males. This is consistent with another study on Omani University Students by **Khan,2019** The study discovered a considerable increase in caffeinated beverage consumption among male and female university students (95% and 97%, respectively)

Caffeinated beverage consumption was higher in urban students than in rural (54%, and 46% respectively). Also, consumption increases gradually with progression in academic grades (13.6% in the first grade up to 23.2 % in the fifth

grade), and age.

Lifestyle and sleeping hours:

The study showed more consumption of caffeinated beverages for mental activity among medical students (66.6%) than for physical activity (30.3%) while only 3.1% had a sedentary lifestyle among consumers. This points to the importance and dependence of those beverages in medical students' life activities. Moreover, there was a high statistical difference between consumers and non-consumers as regards their lifestyle (p value=0.008). This goes in harmony with a study by **(El-Nimr et al., 2019).**

This study reported a high statistically significant decrease in sleeping hours between consumers compared to non-consumers (p-value= <0.001).

This result goes in harmony with a study by **Nasir et al., 2018** showed that insomnia was the most frequent symptom among participants, accounting for approximately 33.6%.

According to **Khan's 2019 report,** about 46% reported insomnia, which was considered the most common problem among consumers.

In a study by **Attila and Çakir 2011,** 45.1% had normal sleep patterns, with an average of 7.23 +/- 1.31 hours per day, which conflicted with the current study.

A prior study was done at Hacettepe University (Ankara, Turkey) with 439 medical, sports, and arts students. Only fourth-year students were targeted.

This may be due to the difference between the two studied populations and the study was only performed on fourth-grade students while the present study was conducted on all medical students' grades.

Smoking rates differed significantly between consumers (9.6% smokers) and non-consumers (0% smokers).

In line with this study, another study conducted in Saudi Arabia discovered a slightly greater incidence of caffeine usage among smokers or ex-smokers, as well as persons married to healthcare providers (94.9%). This could be because national anti-smoking clinics are available throughout South Africa, treating tobacco users per worldwide standards. Similar studies found no evidence for the causal effects of smoking on caffeine consumption, or vice versa, among Dutch and British individuals **(Amer et al., 2023).**

In this study regarding Sohag medical students' opinions about caffeinated beverages 197 (56.3%) thought that those beverages were dangerous however 153 (43.7%) thought that those beverages were useful with no statistically significant difference between both consumers and non-consumers (P- value= 0.06). This reflects the low awareness about the side effects of caffeinated beverages among both consumers and non-consumers that had reported their usefulness 153 (43.7%). This may be due to the need for them as central nervous system activators for studying and enhancing sports performance. About 63% believed caffeine was hazardous to health, 26% said it disrupted coordination, 77% believed caffeine improved performance, and (29%) claimed caffeine helped them lose weight **(Nasir et al., 2018).**

The pattern of caffeinated beverage consumption:

The present study found that the most consumed caffeinated beverage was tea 250 (82.7%) then coffee 238 (78.8%) then carbonated drinks 149 (49.3%) then energy drinks (ED) 111 (36.7%) with overlapping between them.

Another study conducted at Omani University by **Khan,2019** in three different colleges, including, the College of Applied and Health Sciences, the College of Business Administration, and the College of Engineering, found that tea (77%) was followed by coffee (42%) and related beverages such as Nescafe (41%), cappuccino (28%), espresso (6%), with overlapping between consumers, soda (6.5%), and caffeinated soft drinks (30%).

Another poll among Alexandria University students indicated that the most consumed beverages were colas, followed by coffee and red tea **(El-Nimr et al., 2019).**

This may be explained by the difference in nature between the two populations in lower and upper Egypt, also this study included only medical students. The Texas Christian University poll indicated that coffee use was the highest, followed by soda, tea, and lastly energy drinks **(Somogyi, 2010).** The Caffeine Intake by the Americans between 2003-2008, revealed that Cola drinks were preferred, followed by tea and coffee **(Traylor et al., 2012).** This could be explained by the age disparity between the two groups, as postgraduates were included in the Texas study, Also the fact that college students in the USA are typically older than those in the same year of study in Egypt.

Most of the consumers have those beverages at night 106 (35.1%), in the early morning 102 (33.8%), and in the afternoon 94

(31.1%) the proportions were close, but more were consuming beverages at night this may be due to the main purpose for those beverages as medical students use them decrease sleeping hours.

Shanshal et al., 2023 that nighttime drinking was quite widespread in this study, which is far higher than the 0% nighttime consumers in a Saudi study (**Alabbad et al., 2019).** It also questioned non-medical students. The higher intake at night could be attributed to late-night gatherings with friends in cafés, as well as our participants' low level of understanding.

A prior study conducted on freshmen attending Marshall University aged 18 to 20 years indicated that approximately 61% took caffeine to get up in the morning (**McIlvain et al., 2011).**

There were 144 (47.7%) of the consumers had those beverages after food, 124 (41.1%) had no relation with food at all were only 34 (11.3%) had those beverages before food intake.

A study by **Attila and Çakir, 2011** illustrated that about 90% of consumers drink with meals, about 7% don't drink with meals, and 3% aren't related to meals. This difference between the two studies may be related to the difference between the two cultures and the variance between the studied populations.

Approximately 276 (91.4%) of consumers had no chronic disease while only 26 (8.6%) suffered from chronic diseases.

In contrast, this prior study of Medical Interns and Students from Three faculties in Jeddah, Saudi Arabia about energy drink usage indicated that nearly 37% of consumers had health problems, whereas 27% had no health concerns (**Ibrahim et al., 2014).**

Mahoney et al., 2019 conducted a study at five different American universities that reported lower health drank considerably more caffeine from all sources, particularly sodas, than those reporting better health status. There were 244 (80.8%) consumers who did not use regular drugs, compared to 58 (19.2%) who did.

A study **by Hammond et al., 2018** on a sample of children aged 12 years and young adults aged 18-24 years recruited from a consumer panel found that energy drinks consumers were consuming other caffeinated products 10.6%, who were drinking alcohol 22.5%, who were taking recreational drugs were 8.3%, who were taking medications were 6.4%, while coffee consumers were consuming other caffeinated products 6.0%, who were drinking alcohol 3.2%, and who were taking recreational drugs.

This difference in co-ingestions between the present study (Egypt) and the previous one (Canada) is because of the difference between communities.

Caffeine withdrawal symptoms appear within 24 hours of sudden discontinuation or reduction of consumption after long-term use. Three or more people pondered withdrawal (**El-Nimr et al., 2019).**

There were 219 (72.5%) of consumers suffering from withdrawal manifestations. Headache, difficulty concentrating, and disturbed mood were the most common three withdrawal symptoms (223 (74%), 198 (65.5%), 176 (58%) respectively). Other symptoms were fatigue, drowsiness, irritability, nausea, muscle pain, and vomiting.

A prior study by **McIlvain et al.,2011**discovered that the most prevalent withdrawal symptoms were weariness (20%), headache (36%), and cravings (25%). This study was conducted on 300 freshmen at Marshall University. The ethnic origin was largely Caucasian, with 270 (90%) of participants being Caucasian, hence there were some parallels in the results.

Also, an Egyptian study by **El-Nimr et al., 2019** in four different colleges of Alexandria University between 2016 and 2017 found a contrast in results with the present study as there were 48 (12.2%) tested more than three withdrawal symptoms and considered suffering from withdrawal syndrome while there were 347 (87.8%) case that suffered from less than three withdrawal symptoms.

This may be due to the difference in the tested population and culture as the present study was done on medical students at Sohag University. While the other was done among different faculties in Alexandria. Also, the study was conducted 8 years ago.

There were 249 (82.5%) of consumers suffering from intoxication. The most common five symptoms were tachycardia 172 (56.9%), GIT disturbance 154 (50.9%), nervousness 152 (50.3%), restlessness 141 (46.6%), and insomnia 138 (45.6%) with overlapping between symptoms.

There were no statistically significant differences as regards frequency of intake/day (p value= 0.5), duration of consumption (p-value =

0.8), relation to a certain time (p value=0.2), relation with food (p value= 0.8), smoking (p value= 0.6), and presence of chronic disease (p-value = 0.2). About 63% who took one to two times per day suffered from intoxication this may be due to the chronicity of intake as about 86% of intoxicated students were consuming caffeinated beverages for more than one year of consumption (chronic toxicity).

While there was a very statistically significant difference between inebriated and non-intoxicated customers in terms of withdrawal symptoms (88%; p = 0.006).

In addition, there was a statistically significant difference between intoxicated and non-intoxicated customers who used regular drugs (p = 0.02).

According to **El-Nimr et al.'s 2019** study, just 0.5% of students who drank caffeine-containing beverages experienced caffeine intoxication. The difference was not statistically significant (p= 0.15), which contradicted the current study for the same reasons as previously stated in withdrawal symptoms.

Khan,2019 found that the most common three symptoms were insomnia, headache, increased urination, heart palpitation, and gastrointestinal problems, with differences between males and females. The contrast between the current and prior studies could be attributed to the differences between the two analyzed populations.

Ibrahim, 2014 previous study on energy drink consumption at three medical faculties found side effects such as palpitation (30%), insomnia (30%), frequent micturition (19%), headache (16%), and jolt and crash episodes (5%). The current study differs from the previous one in that it included several caffeinated beverages, whereas the previous one only included energy drinks.

Shanshal et al., 2023 conducted a recent study among non-medical college students at the University of Mosul. They discovered that 31% of energy drink users experienced sleeplessness (94%), palpitations (90%), uneasiness (71%), exhaustion (65%), and worry (64%).

According to **Hammond et al. (2018)**, The negative effects of caffeinated and energy drinks on youth and young adults in Canada are as follows: approximately 42% of respondents have ever encountered at least one bad event from energy drinks, whereas approximately 31% have experienced at least one adverse incident from coffee. The proportion of participants who

reported having an adverse event was much greater with energy drinks than with coffee.

More over half of respondents who claimed ever using energy drinks had at least one negative experience, compared to 36% who reported never drinking coffee. The majority of respondents who reported an adverse event from energy drinks had consumed fewer than the recommended maximum of one or two drinks (depending on the container size): 51% reported one drink and 23% reported two drinks. Similarly, the majority of individuals who reported an adverse reaction to coffee had consumed one (43%) or two (24%) beverages.

motivational reason for the consumption of caffeinated:

There are motivational factors that encourage young adults to increasing intake of energy drinks **(Poulos and Pasch., 2015).** Regardless of gender, one of the most important motivators for drinking high-energy drinks is the desire for an energy boost. More use of energy drinks for causes such as insufficient sleep is reported among American students **(Malinauskas.,2007).** Students in the UAE described typical reasons for consumption as taste, obtaining energy when weary, and during the study **(Robby and Sanad., 2017)**. Saudi female students consumed more energy drinks during exams than males consumed more energy drinks for causes such as athletic performance and improved driving **(Alsunni and Badar., 2011).** Another survey found that the most common reasons students take energy drinks are to remain alert, improve their energy, and participate in great tasks. Furthermore, loss of weight was an additional cause of energy drink intake **(Reid et al., 2015).** Other reasons for high-energy drink intake among university students were to stay late for study purposes, to feel alert, to taste, and flavor, for an energy boost, and to relieve stress **(Bhojaraja et al., 2016).**

In the present study, the main reason for consuming those beverages was alertness (76.3%), then 10.6% for both their flavors and to increase sports performance, while only 2.6% for weight loss. This may be due to the main purpose of medical students increasing their mental activity for studying (61.3%).

Shanshal et al., 2023 discovered that 125 students drink energy drinks for no apparent reason, 108 for studying, 76 for keeping awake, and 62 for athletic performance.

Khan,2019 The most prevalent reasons for

female energy drink consumption were to boost energy (68%), study (61%) during exams (49%), time of day (59%), avoid sleep (58%), and flavor preference (36%). The bulk of female motivational reasons are linked to their study rules. This was the same perspective as the current study.

Awareness about caffeinated beverages between the two groups:

To assess the awareness of the participating students we asked if they knew that there is a caffeine contained drinks. About 95% of medical students said yes with no major statistical difference between consumers and non-consumers (p-value = 0.2).

One hundred percent (100%) said that their knowledge was attributed to their family and media. Also, about 74% knew from their colleagues with no statistically significant difference between consumers and non-consumers (p value=0.1).

There was (87.5%) of the non-consumers who didn't know about the ingredients of those beverages and (67.5%) of the consumers didn't know about the ingredients also, with a highly statistically significant difference between them (p-value =0.004). Regarding the knowledge about the amount of caffeine contained in those beverages about 74% of the consumers said they didn't know and 81% of the non-consumers said that they didn't know with no significant difference between them (p value=0.3). Regarding the safe amount of caffeine consumed per day, there was no statistically significant difference between the consumers (62% didn't know) and the non-consumers (71% didn't know) (p-value= 0.2).

As regards knowledge about the adverse effects of those beverages there was a highly statistically significant increase in non-consumers (95.8% knew the adverse effects) as compared to the consumers (59.9% knew the adverse effects) (p value= 0.001) which is good as this illustrates that if knowledge about adverse effects increase this will decrease the wrong usage of those beverages.

This shows a lack of information and awareness among the participants. This could be due to the marketing strategies utilized by selling companies to persuade their target customers with a message of favorable benefits for their health and social image **(Stead et al., 2011).**

In addition to similar findings, a study from Jeddah discovered that more than half of the students (males and females) were ignorant of

caffeine as an energy drink ingredient **(Alrasheedi, A., 2017).**

In contrast, the previous study by **Khan,2019** demonstrated that increasing awareness of energy drinks among students resulted in higher usage, although the majority of energy drink customers (75%) were ignorant of any extra ingredients. The majority of energy drink consumers (85%) are unaware of the amount of caffeine in their beverages. In addition, 46% of participants were ignorant of how much energy drink they were consuming.

According to findings from the United States, despite their negative sentiments toward caffeine, adolescents continued to consume energy drinks **(Ward, 2009).**

Musaiger and Zagzoog 2014, Musaiger and Zagzoog (2014) found that 49% of adolescents were unaware that energy drinks included caffeine. In the UAE, 95% of university students knew nothing about the high caffeine content of energy beverages. **(Jacob et al., 2013).**

CONCLUSION AND RECOMMENDATION(S)

Sohag medical students consumed caffeinated beverages in large quantities. Tea was the most commonly consumed caffeinated beverage, followed by coffee, carbonated beverages, and energy drinks. The awareness component demonstrates the participants' lack of knowledge and awareness. The primary reason for their consumption was awareness, which mirrors the objective of consumption in the target audience. There was a large percentage of customers experiencing withdrawal and intoxication symptoms. 219 (72.5%) of consumers experience withdrawal symptoms. This study illustrates people's lack of information and awareness regarding the dangers of certain beverages. As a result, this study advises enacting tight laws to prevent motivated advertising. As a result, it is critical to raise awareness among young people about the risks of these beverages.

STATEMENTS AND DECLARATIONS

corresponding author upon reasonable request.

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نمط الاستهلاك والوعي و الآثار السلبية للمشروبات التي تحتوي على الكافيين لدى طلاب كلية الطب بجامعة سوهاج ـ دراسة مقطعية.

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الخلفية: يتعرض طلاب الطب لضغوط أكاديمية ويستهلكون المشروبات التي تحتوي على الكافيين لتحسين أدائهم.الأهداف: تهدف الدراسة إلى التعرف على أنماط الاستهلاك والوعي والآثار الضارة للمشروبات التي تحتوي على الكافيين كمشروبات طاقة بين طلاب الطب.

الطرق: دراسة مقطعية تتضمن 350 طالب طب بمتوسط عمر(20+2 سنة) يتمتعون بصحة جيدة باستخدام استبيان المقابلة بين أكتوبر 2023 ويناير 2024. النتائج: كان معدل انتشار استهلاك المشروبات التي تحتوي على الكافيين مرتفعا بين المشاركين بنسبة 86.3%. وكانت المشروبات التي تحتوي على الكافيين الأكثر استهلاكا هي الشاي 250 (82.7%) ثم القهوة 238 (78.8%) ثم المشروبات الغازية 149 (49.3%) ثم مشروبات الطاقة 111 (ED) (36.7%) مع وجود تداخل بينهما. ويعكس قسم التوعية نقص المعرفة والوعي لدى المشاركين. كان السبب الرئيسي لاستهلاكها هو اليقظة التي تعكس هدف الاستهلاك لدى السكان المختارين. كان هناك 219 (72.5٪) من المستهلكين الذين يعانون من مظاهر الانسحاب. كان الصداع وصعوبة التركيز والمزاج المضطرب هي الأعراض الثلاثة الأكثر شيوعًا للانسحاب. كان هناك 249 (82.5٪) من المستهلكين يعانون من التسمم. وكانت الأعراض الخمسة الأكثر شيوعًا هي عدم انتظام دقات القلب 172 (56.9٪)، واضطراب الجهاز الهضمي 154 (50.9٪)، والعصبية 152 (50.3٪)، وعدم الارتياح 141(46.6٪)، والأرق 138 (45.6٪) مع تداخل بين الأعراض.

الاستنتاج: كان تناول المشروبات التي تحتوي على الكافيين بين طلاب الطب في سوهاج مرتفعًا جدًا وتجاوز المستويات الآمنة، مما يستلزم برامج لزيادة وعيهم حول العواقب الصحية للإفراط في تناول الكافيين