



CAFFEINATED PRODUCTS CONSUMPTION AND THEIR HEALTH AND BEHAVIOR ALERTS AMONG MEDICAL STUDENTS AT BENGHAZI UNIVERSITY

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ABSTRACT

Introduction: Caffeine is the most widely consumed psychoactive substance in the world and not only found in coffee, but also present in some products includes tea, energy drinks, caffeine containing medicine and soft drink. The aim of conducting the research is to study most popular caffeinated product consumption and its health and behavior alerts among medical students.

Methods: A cross sectional study was conducted from beginning of January to the end of March 2020 on branches of medical faculties involved 545 students. Purposive sampling was used to enroll students for this study and they were asked to respond to the validated questionnaires. A questionnaire related to the caffeinated products consumption and related health problems. The analysis included frequency, percentages, mean, standard deviation, unpaired T-test and ANOVA.

Result and discussion : The data collected on 545 students found that medical student consumed caffeine in the form of chocolate 87%, coffee 86%, Tea 74.9% soft beverages 67.2% , and Arabic coffee 59.1% (P= 0.000). Most of the medical student have had some reasons for drinking caffeinated products and these reasons shown significant differences (P< 0.05) and these reasons include 76.5% increase during exam time, about 65% , to a raise level of attention and focus at the lecture and 62% for improve mood .However, students did not aware and expect the negative effect towards caffeine consumption. Based on gender, there was different on the amounts of daily caffeine intake by which male more than female (P< 0.05). Furthermore caffeinated products consumption significant associated with increased body weight (P< 0.05) There also found significant differences of caffeinated products intake among male and female (P< 0.05) by which male more frequent consume.

Conclusions: Drinking caffeine containing products by the students were variable from different sources. Although, students were shown consumed caffeine at modest levels. In spite , monitoring is necessary for the daily intake and there is need for educational programs about the health effects related to high consumption of caffeinated products.

KEYWORDS: malnutrition, caffeinated, BMI, Behaviors.

INTRODUCTION

Caffeine is the most widely consumed psychoactive substance in the world and not only found in coffee, but also present in some products includes tea, energy drinks, caffeine containing medicine and soft drink. (1). It has been shown that about 80% of the world's population consumes some form of caffeine daily (2).

The caffeine is 1, 3, 7-trimethylxanthine which is a natural alkaloid found in different products such as coffee, chocolate, tea, some soft drinks, and energy drinks (3, 4). Caffeine may activate central nervous system particularly dopaminergic reward system and thence lead to feeling of strength reinforcement (5). Caffeine is



described as Generally Recognized as Safe (GRAS) in which caffeine intake of 3 mg/kg body weight per day are safe for adults (6).

Caffeine consumption has many beneficial effect, and one of it to be an increase performance and remain active throughout exercise by delaying fatigue and exhaustion (7). Besides, caffeine have positive relationship with performance, verbal memory, visuospatial reasoning and reaction time tasks and the effects became stronger with increasing age (8). There also found that caffeine often used to increases alertness and improves performance on tasks that required prolong level of attention (8). The recent evidences reported that caffeine can effectively used to enhance lipolysis, fat oxidation and glycogen breakdown and potent supplement to increase metabolic rate and stimulate weight loss (9, 10).

Current growing evidence demonstrated that low dose of caffeine will improve hedonic tone and decrease anxiety while at high dose, it can cause tense arousal such as anxiety and nervousness (11, 12). Furthermore, abstinence towards caffeine consumption among those who consume regularly with face symptoms of caffeine withdrawal such as detrimental effects and some other severe effects, that including greater sleepiness, poorer performance on simple reaction time, lower mental alertness, choice reaction time and recognition memory tasks (13). There are alerting that excessive intake of caffeine increase the risks of dehydration, anxiety, headache and sleep disturbances (14).

College students consumed excessive and often times dangerous levels of caffeine (15). In the study of caffeine habits among medical students found that very high percentage of caffeine consumers are among medical students and the reason beyond their consumption was consume caffeine while studying for exam to overcome stress during exams period (15) while another study reported that social consumption up to (70%) and preference for the taste up to (72.4%) (16) and the majorities of students consumed caffeine in any form such as tea and coffee (17).

The study conducted in undergraduate students of various medical and dental colleges in India revealed that caffeine has been demonstrated for increment of sharpness as well as alertness level of the individual (18). It has been found that caffeine has alert depending on types of caffeinated products, age and gender which ranging from high motivation in female, younger age groups, and As for the type of caffeinated products taste appeared to be equally and highly important to be considered an important finding with regard to the popularity and maintenance of caffeine consumption (19, 20).

To our knowledge, a in spite of this there are not much studies related to consumption of caffeine products among medical students. With this in mind the research question in a way that interested to view the response from medical students which represents the students from different branches of medical faculties in Benghazi, Libya. Therefore, The aim of conducting the this research is to study the caffeinated products consumption among medical students and their health and behavior alerts.

MATERIAL AND METHODS

1. Study Design and Study Time

A cross sectional study was conducted from Beginning of January to the end of March 2020 on the students from medical faculties which have 5 branches include medicine, dental, Pharmacy, Public health and Medical Technology in Benghazi, Libya.

2. Sample size and Sampling Method

Purposive sampling was used as the sampling method while conducting the study, which is a non-probability sampling method. The inclusion criteria were the medical students who voluntarily agreed to participate in the study and the questionnaires must be completed to be considered valid for the research after they filled up the consent form. Meanwhile, for the exclusion criteria, included those who did not fill up the consent form, not available when the questionnaires were distributed, incomplete questionnaires and irrelevant responses. We distributed our questionnaires to medical students of (medicine, dental, pharmacy, public health and medical technology students. Total 545 students (181 male and 364 female) gave on hand the questionnaire and the response rate was 99%.

3. Data Collection

The pre-validated 20 items questionnaire parts was distributed to the students. The Questionnaire containing the following items, informed consent (awareness and knowledge of the participants 'right), demographic data and the information regarding coffee consumption among undergraduate medical, health and behavior effects of caffeinated products consumptions, and Boyd weight status (BMI). Total caffeine contents of the products were collected base on the information available on the products.



4. Data Processing and Data Analysis

Data was introduced to Social package for social sciences version 23 used to statistically analyses the data. For the quantitative data (Caffeine contents)the mean and standard deviation and range were calculated by using either T Test or Anova test, whereas for the qualitative data (gender, ages type of caffeinated products consumed), the frequency of those data were counted, the percentage were calculated and Chi-square test was used. The level of significant at 5% which is 0.05.

5. Ethical Consideration

Participants of our study were obtained by voluntary participation. Informed consents were distributed to participants and they were asked to sign the consent forms if they voluntarily participating in our study. Furthermore, confidentiality of all data obtained from the participants were maintained. Besides, the research was conducted ethically by obtaining approval from the Local Research Ethics Committee, medical Faculties of Benghazi University, Libya.

RESULTS

The data collected on 545 students from branching of medical faculties shown that 181 (33.2%) male and 364 (66.8%) female (Figure 1). The age of the students were ranging from 20-27 years old with mean \pm SD was 23.5 ± 5 years old. Approximately 50% of the students were aged between 23-25 years old followed by age groups between 20-22 years old (42%) (Figure 2).

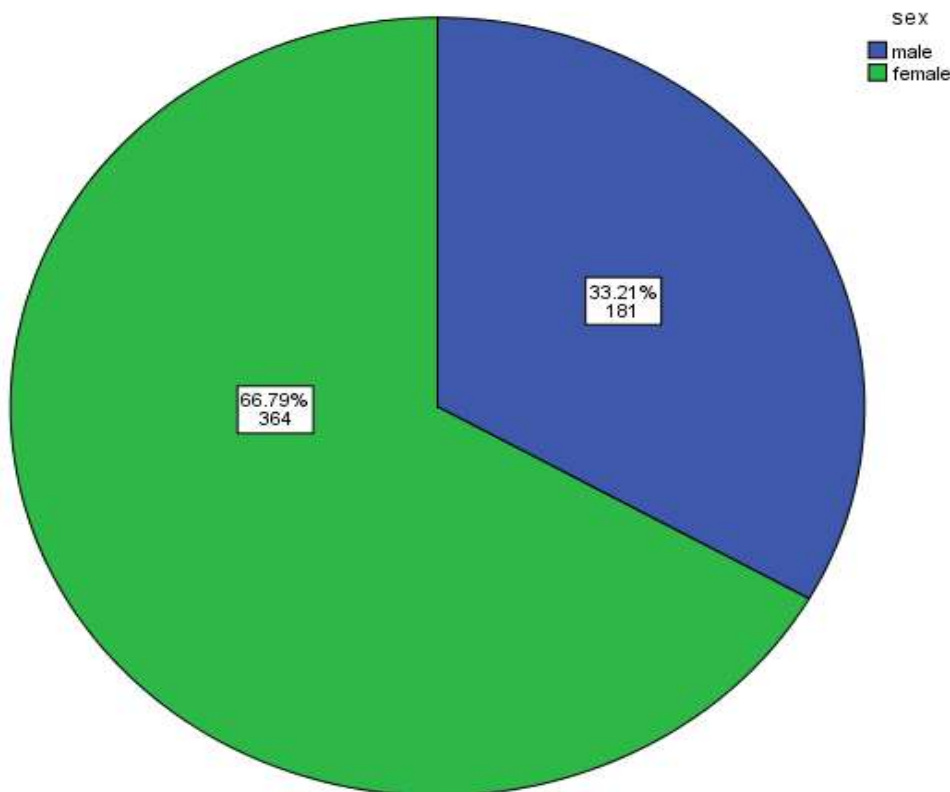


Figure 1: Gender distribution of the participants.

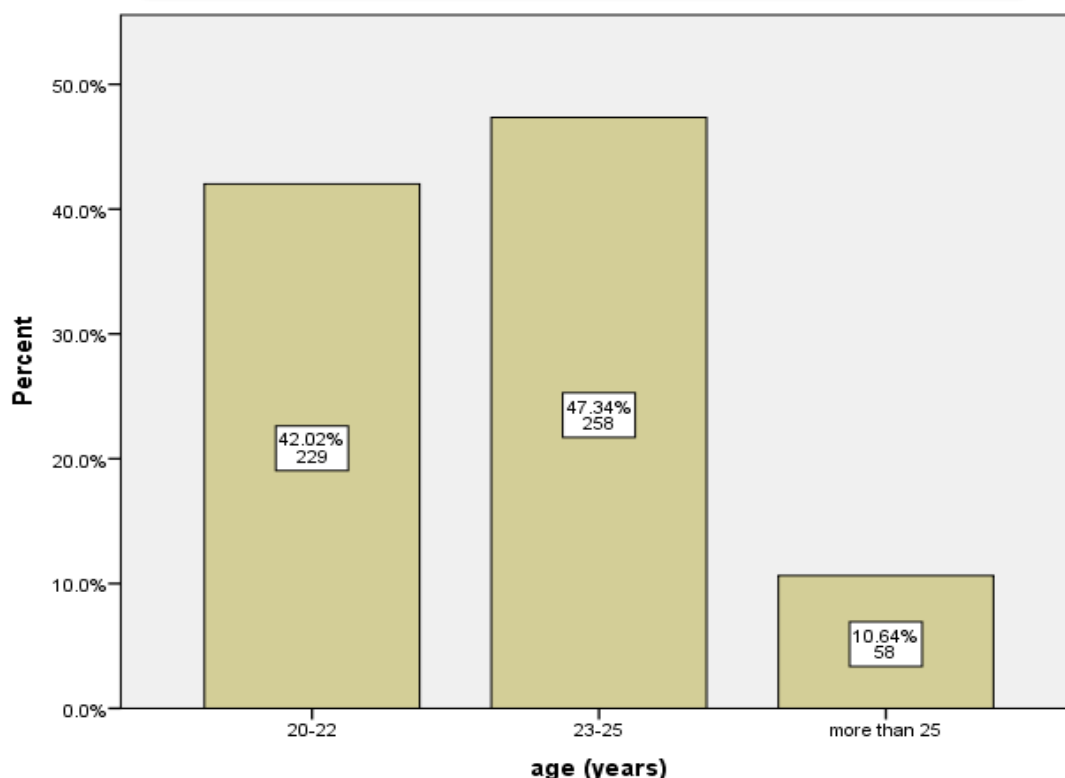


Figure 2: Age distribution of the participants.

In the next step, the data collected from branching of medical faculties were found that, more students participated in the studies were from medicine presented by about one third followed by 18.5%, 17.8% and 16.9% from public health and dentistry and medical technology respectively, while the Pharmacy being the lowest (11.6%). (Table 1).

Table 1: Number of students from Branching of medical faculties:

Branching of medical faculties	N	N %
Medicine	192	35.2%
Dentistry	97	17.8%
Pharmacy	63	11.6%
Public Health	101	18.5%
Medical Technology	92	16.9%
Total	545	100.0%

In the Table (2), the most popular caffeinated products consumed among students were found significantly high consumed include coffee, Tea, chocolate, soft beverages, and Arabic coffee (P= 0.000) while the remaining caffeinated products not shown any trends (P > 0.05). Further analysis of the popular caffeinated products consumed among branching of medical faculties shown same trends for coffee, Tea, chocolate, soft beverages, and Arabic coffee (P= 0.000) by which medicine students were highly consumed students. In regard Nescafe has been shown more consumed by pharmacy and public health faculty (data not shown because not significant).

**Table 2: The most popular caffeinated products consumed by the students**

Types of caffeinated products consumed		N	N %	P values
coffee	yes	469	86.1%	0.000
	no	76	13.9%	
	Total	545	100.0%	
tea	yes	408	74.9%	0.000
	no	137	25.1%	
	Total	545	100.0%	
chocolate	yes	474	87.0%	0.000
	no	71	13.0%	
	Total	545	100.0%	
soft beverage	yes	366	67.2%	0.000
	no	179	32.8%	
	Total	545	100.0%	
energy beverage	yes	86	15.8%	0.000
	no	459	84.2%	
	Total	545	100.0%	
Arabic coffee	yes	322	59.1%	0.000
	no	223	40.9%	
	Total	545	100.0%	
Nescafe	yes	260	47.7%	0.43
	no	285	52.3%	
	Total	545	100.0%	
cappuccino	yes	103	18.9%	0.000
	no	442	81.1%	
	Total	545	100.0%	
macchiato	yes	73	13.4%	0.000
	no	472	86.6%	
	Total	545	100.0%	
espresso	yes	31	5.7%	0.000
	no	514	94.3%	
	Total	545	100.0%	

Chi-square test was performed and considered significant at $\alpha < 0.05$

The types of medication containing caffeine were also investigated among students (Table 3). By about 43% of the students were used panadol and being least was migraines drugs (6.4%).

Table 3: Types of medication containing caffeine:

Type of medicine contain caffeine	N	N %
panadol extra	232	42.6%
migraine medications	35	6.4%
not consume	278	51.0%
Total	545	100.0%

Furthermore, to understanding the reasons why students do preferred drink caffeinated products, a numbers of questions were prepared and predesigned and those questions were shown in Table (4). The significant answers reported by students beyond drink caffeinated products found that increased caffeinated products during examination, improved moods, increase levels of attention ($P=0.000$).

**Table 4: Reasons for caffeinated products consumptions**

Parameters		N	N %	P values
caffeine consumption increase during exam time?	Yes	417	76.5%	0.000
	no	128	23.5%	
	Total	545	100.0%	
improve mood	yes	339	62.2%	0.000
	no	206	37.8%	
	Total	545	100.0%	
raise level of attention and focus at the lecture?	Yes	355	65.1%	0.000
	no	190	34.9%	
	Total	545	100.0%	
to stay awake	yes	284	52.1%	0.324
	no	261	47.9%	
	Total	545	100.0%	
usually of social habits	yes	149	27.3%	
	no	396	72.7%	
	Total	545	100.0%	
adjusting the level of blood pressure and glucose	yes	41	7.5%	
	no	504	92.5%	
	Total	545	100.0%	

Chi-square test was performed and considered significant at $\alpha < 0.05$

The students respond to next questions related side effect of excessive caffeinated products consumed were shown in the Table (5), for the knowledge questions presented in table (5) students they likely have poor awareness and knowledge of high intake of caffeinated products by which lack of knowledge among students ranging from 55% for stomachaches to 85.7% for nausea.

Table 5: Awareness of the students for the side effect of excessive caffeinated products consumption:

Parameters		N	N %	P values
Difficulty falling sleep	yes	212	38.9%	0.9
	no	333	61.1%	
	Total	545	100.0%	
stomach problem	yes	246	45.1%	0.8
	no	299	54.9%	
	Total	545	100.0%	
nausea	yes	78	14.3%	0.1
	no	467	85.7%	
	Total	545	100.0%	
increase diuresis	yes	115	21.1%	0.5
	no	430	78.9%	
	Total	545	100.0%	
increase heartbeat	yes	156	28.6%	0.7
	no	389	71.4%	
	Total	545	100.0%	

Chi-square test was performed and considered significant at $\alpha < 0.05$

In the table (6), Body weight status of the students have also evaluated by body mass index. Furthermore, normal body mass index was predominate among the students (66.1%) followed by 21.8% and 7.2% for overweight and underweight respectively.

**Table 6: Body mass index categories**

		N	N %
BMI	underweight	39	7.2%
	Normal	360	66.1%
	overweight	119	21.8%
	obese	27	5.0%
	Total	545	100.0%

The total caffeine intake was presented in table (7) in which mean \pm SD of mg caffeine consumption was 232.3 \pm 112 mg/day.

Table 7: Mean caffeinated products consumed:

Total caffeine consumed	Mean \pm SD
Branching of medical faculties (mg/day)	232.33 \pm 112

The mean caffeine intake was not found significant consumed among medicine students ($P=0.447$) compared to other branching of medical faculties. The mean caffeine consumptions was as high as in medicine, pharmacy, public health, dentistry and medical technology.

Table 8: Total caffeine intake and medical faculties branching:

	faculties					P values
	medicine	dentistry	pharmacy	public health	medical technology	
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	
Total .caffeine (mg/day)	250.57 \pm 135	225.77 \pm 116	244.48 \pm 124	229.84 \pm 114	195.61 \pm 107	0.447

In compared to the normal body weight, obese students were significantly consumed more caffeine ($P= 0.033$), while those underweight or overweight did not shown any trends (Table 9). Although, further investigated the consumption of caffeine among male and female shown in table (10) by which male significantly ($P= 0.001$) consumed caffeine than female (Table 10).

Table 9: BMI and Total daily caffeine consumption:

	BMI				P values
	underweight	Normal	overweight	obese	
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	
Total. Caffeine (mg/day)	213.46 \pm 113	218.90 \pm 121	233.91 \pm 129	286.78 \pm 136	0.033

Student T test was performed by which at $\alpha < 0.05$ considered significant.

Table 10: caffeine consumption among male and female:

	sex		P values
	male	female	
	Mean \pm SD	Mean \pm SD	
Total. caffeine	271.08 \pm 135	213.33 \pm 113	0.001

Student T test was performed by which at $\alpha < 0.05$ considered significant.

**Table 11: Relationship between caffeine consumption and reasons for caffeine products intake**

		Total. caffeine	
		Mean± SD	P values
1-caffeine consumption increase during exam time?	Yes	243.75± 101	0.001
	no	191.93±80	
2-improve mood	yes	251.73±70	0.005
	no	198.29±101	
3-raise level of attention and focus at the lecture?	Yes	246.53±60	0.02
	no	205.02±61	
4-stay awake	yes	254.72±78	0.03
	no	207.22±45	

T test has been performed between yes and no in each group and considered significant at $\alpha < 0.05$.

DISCUSSION

The natural of the faculties of medicines were more female than male. The data collected on 545 students from branching of medical faculties shown that 181 (33.2%) male and 364 (66.8%) female. In which two fold more female than male The age of the students were ranging from 20-27 years old with mean \pm SD was 23.5 \pm 5 years old. Approximately 50% of the students were aged between 23-25 years old followed by age groups between 20-22 years old (42%). The similar result for female and age predominant were also confirmed in numbers of studies conducts in Malaysia (21), UAE (22) and Pakistan (23).

In regarding branching of medical faculties in Benghazi, Libya, which is consist of 5 faculties include medicine, dental, pharmacy, public health and medical technology. In the present work one third of the students were from medicine followed by 18.5%, 17.8% and 16.9% from public health and dentistry and medical technology respectively, while the Pharmacy being the lowest (11.6%). In fact our study considered first studies compile a numbers of branching of medical faculties. It could be why faculty of medicine presented the highest participants this is due to high number of students accepted at entry of university. According to data registry of the student from Benghazi university the total number of students at the faculty of medicine approximately 4000 students, while the other faculties, dental 700 students, pharmacy 900 students, public health 1400 students and medical technology 500 students and this could explained the variation in the participants.

The consumption of caffeinated products among students were reported significantly as following chocolate 87%, coffee 86%, Tea 74.9% soft beverages 67.2% , and Arabic coffee 59.1% ($P = 0.000$). Furthermore, these trends were also same among branching of medical faculties. For these popular products were found differently by the works done by Rajeswaran and et al (21), Bhojaraja and et al (22), El-Nimr, and et al (24), and Norton et al (25) and by which they concluded coffee or tea more frequent consumptions than other products. More than 50% of the students did not consumed medication containing caffeine, and this result inconsistent with other works (26, 27).

The major reasons for consuming of caffeinated products were varied and shown significant differences ($p < 0.05$), where more than tow third gave the reason that 76.5% caffeine consumption increase during exam time, about 65% to a raise level of attention and focus at the lecture and 62% for improve mood. In compared to other studies (25,26) in which the reason beyond consumption of caffeinated products were due to, feel awake (79%); enjoy the taste (68%); the social aspects of consumption (39%); improve concentration (31%); increase physical energy (27%); improve mood (18%); and alleviate stress (9%). However, some studies have listed such different reason (53%), to get refreshed (51%), taste and flavour (49%) (27,28, 29). Furthermore, the student did not aware of the symptoms of excessive caffeinated product intake ($p > 0.05$) such as difficult falling sleep, stomachache, nausea increased diuresis and hear rates. The similar finding were also obtained by Rajeswaran and et al (21). On the other hands Bhojaraja and et al (22) and in his works reported that about 56% were of an opinion that they do experience different symptoms if they don't consume their daily caffeine intake (22).

The anthropometric measurements by BMI of the students shown that (66.1%) were have normal body weight status and this result was inconsistent with (30, 31).

In the current research there was found the mean caffeine consumptions was 232.3 mg/day. Caffeine is one of many constituents in foods that can exert physiological effects. Scientific and historical evidence shows that among the healthy adult population, moderate caffeine consumption (e.g., (400 mg/day) is not associated with adverse health effects (32). Improvements in mental alertness, concentration, fatigue, and athletic performance are well documented benefits. Modest intake of caffeine that is 200 – 300mg per day are beneficial to health (6). A safe level of daily caffeine intake is regarded as one not exceeding 400 mg per day (6). Excessive daily intake above 400 mg may however cause agitation, sleep disturbances, anxiety, irritability,



nervousness (3). A regular, long term and excessive intake may lead to an addiction and adverse health consequences. Caffeine, like sugar, may activate the dopaminergic reward system and thence lead to addiction. The adverse health effects of caffeine are even more apparent in sensitive populations, namely children and adolescents.

In 1978, the Food and Drug Administration (FDA) classified caffeine as a Multiple Purpose Generally Recognized as Safe Food Substance, with tolerance at 0.02% (200 part per million [ppm]), stating that moderate caffeine intake produces no increased risk to health.(16) In 2015, the European Food Safety Authority (EFSA) suggested that consuming caffeine up to 200 mg (about 3 mg/kg body weight) from all sources do not raise safety concerns for the general adult population (17).

The mean caffeine consumptions was as high as in medicine, pharmacy, public health, dentistry and medical technology students. However these finding was not statistically significant ($P=0.447$). The association between caffeine intake and body weight revealed that increase caffeine intakes have significant relationship with increased body weight ($P<0.05$) and this result was controversial with number of studies (27-29) by which increase caffeine intake led to decreased or maintaining body weight. On the other hands some researcher shown that increased caffeine consumptions result in an increased body weight (32). Furthermore, male shown significant increase consumption of caffeine than female (271 vs 213 mg/dy) ($P=0.001$) and this were also established in number of studies (33, 34). There was strong relationship between caffeine consumption ($p<0.05$) and reasons beyond its consumption such as increased caffeinated products during examination, improved moods, increase levels of attention.

Overall, drinking caffeine containing products by the students are variable from different sources, so monitoring is necessary for the daily intake and there is need for educational programs about the health effects related to high consumption of caffeine. Its highly recommended that caffeine intake should be regularly monitoring among the students in order to avoid caffeine toxicity.

CONCLUSION

The present study revealed that female gender and age groups between 23-25 were more predominant in the study. More than one third of the student from faculty of medicine. Consumption of caffeinated products among students were reported significantly as following chocolate 87%, coffee 86%, Tea 74.9% soft beverages 67.2% , and Arabic coffee 59.1%. Although, there were significant reasons reported by students for caffeinated products consumptions in which more than tow third gave the reason that caffeine consumption increase during exam time, about 65% to a raise level of attention and focus at the lecture and 62% for improve mood. There were no significant differences and awareness in data for symptoms of excessive caffeinated products consumptions among the students. More than 66% of the students have normal body weight. The result of the present works were also shown mean caffeine consumption was 232.3 mg/day which is considered safe. There also shown mean caffeine consumptions was as high as in medicine, pharmacy, public health, dentistry and medical technology students. Increase caffeine intakes have significant relationship with increased body weight and male shown significant increase consumption of caffeine than female (271 vs 213 mg/dy). The current work proved that strong relationship between caffeine consumption and reasons beyond its consumption such as increased caffeinated products during examination, improved moods, increase levels of attention.

Taken together this result suggested that Drinking caffeine containing products by the students are variable from different sources, so monitoring is necessary for the daily intake and there is need for educational programs about the health effects related to high consumption of caffeine.

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