Journal of High Institute of Public Health 2019;49(3):154-161.

Original Article

Pattern of Caffeine Consumption among University Students

Nessrin A. El-Nimr [1 ¥], Sherine H. Bassiouny [2], Dalia I. Tayel [3]

[1] Department of Epidemiology, High Institute of Public Health, Alexandria University, Egypt
[2] El-Amreya Hospital, Ministry of Health and Population, Alexandria, Egypt
[3] Department of Nutrition, High Institute of Public Health, Alexandria University, Egypt

Abstract

Background: There has been a sharp increase in caffeine consumption among the Arab youth.
Objective(s): The aim of this study was to estimate the proportion of caffeine consumption among Alexandria University students, to assess their caffeine daily intake, to estimate the proportion of caffeine withdrawal and intoxication among caffeine consumers and to investigate the relationship between caffeine intake with body composition, blood pressure, and caffeine withdrawal and intoxication.
Methods: Using a cross-sectional design, 400 students from faculties of Alexandria University were included in the study. Data were collected using a predesigned structured interviewing questionnaire, anthropometric measurements and blood pressure measurement. The daily dietary intake of caffeine in mg /kg body weight/day was estimated for each subject and compared to the safe levels set by the EFSA.
Results: Almost all students consumed caffeinated drinks, with Cola drinks ranking 1st. About 12% had caffeine withdrawal, 0.5% suffered from caffeine intoxication and 65.3% exceeded the safe level set by the EFSA. The association between the level of caffeine consumption and the anthropometric measures was not significant, while the association between the level of caffeine consumption and blood pressure was significant.
Conclusion: The consumption of caffeine containing drinks among Alexandria University students was very high and exceeded the safe levels, which calls for campaigns to increase their awareness about the impact of high consumption of caffeine containing food and beverages on their health.

Keywords: Caffeine consumption; pattern; university students.

Available on line at:
jhiphalexu.journals.ekb.eg

Print ISSN: 2357-0601
Online ISSN: 2357-061X

¥*Correspondence*:
Email: n.elnimr@alexu.edu.eg

Suggested Citations: El-Nimr NA, Bassiouny SH, Tayel DI. Pattern of caffeine consumption among university students. JHIPH. 2019;49(3):154-161.

INTRODUCTION

Caffeine is the most commonly used mood-altering drug in the world.(1) Naturally, caffeine is present in a multitude of plant-based products including coffee, tea, cocoa, kola nuts, guarana and mate. In addition to drinks produced from these crops, foods such as coffee ice cream, coffee yogurt and dark chocolate also contain significant quantities. Caffeine is added to cola and non-cola soft drinks as well as to other popular food products including energy drinks.(2)

Caffeinated coffee and tea are the most consumed socially acceptable stimulants in the world. Approximately 90% of all adults in the world consume caffeine in their daily diet. In their natural forms, coffee and tea contain several chemical components that may confer both beneficial and adverse health effects, including caffeine and antioxidants.(3) Caffeine consumption has multiple systemic effects, involving the neuropsychiatric, cardiovascular, endocrine, and gastrointestinal systems. The impact on health may be modified by genetic factors, age, sex, medications, and other environmental exposures.(4) It induces positive effects in both cognitive and affective domains.(5) Many weight loss-promoted dietary supplements contain added caffeine.(6) Through increasing thermogenesis, fat oxidation, and fluid loss caffeine enhances weight loss and improves weight maintenance.(7)

Data from epidemiological studies have shown that caffeine has an adverse effect on sleep.(8) Other adverse effects related to caffeine include feelings of nervousness, jitteriness, and shakiness,(9) headache(10) and elevated systolic blood pressure independent of age.(11)

High caffeine intake can lead to dependence in a manner similar to other psychoactive substances.(12) Scientific evidence support the existence of a caffeine withdrawal syndrome. A comprehensive review of caffeine withdrawal validated ten symptom categories.[13] Caffeine intoxication was identified as early as 1914.[14] Caffeinism is defined by Josephson and Stine (1976) as ―a syndrome resulting from the excessive ingestion of caffeine and characterized primarily by cardiovascular and central nervous system manifestations.[15]

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]

Caffeine intake varies across different types of beverages and in different population groups.[16] The American National Coffee Association (NCA) reported that in 2007, 37% of 18-24 year olds drank coffee, an increase from 26% in 2005. Young people often consume coffee drinks in large amounts.[18] Caffeine consumption by adolescents and young adults has increased dramatically over the last decade through both increased coffee consumption and so-called "energy drinks", which may contain other constituents that impact health.[19] In the USA, it was reported that 56% of young adults aging 18 to 34 drank soda daily and 44% of them drank coffee every day.[20] A study held in 2013 showed that 85% of the U.S. population consumed at least one caffeinated beverage per day. More than 78% consumed above the recommended 200 mg of caffeine per day.[21]

There has been a sharp increase in soft drink consumption among the Arab youth. Many of these soft drinks contain caffeine.[22] There is lack of data regarding the possible physical consequences of caffeinated beverages and a clearer understanding is needed about the reasons why young people use energy drinks and the contexts in which they are used.[23]

The aim of the study was to estimate the proportion of caffeine consumption among Alexandria University students, to assess their caffeine daily intake in relation to the safety level suggested by the European Food Safety Authority (EFSA), to detect the proportion of caffeine withdrawal and intoxication among caffeine consumers and to investigate the relationship between caffeine intake with body composition, blood pressure, and withdrawal and intoxication symptoms.

METHODS

The study was conducted in four faculties of Alexandria University from September 2016 till the end of February 2017, after obtaining the official approval of Alexandria University administration. A cross-sectional design was used. The sample size was calculated using Epi Info version 7. Based on the assumption that the prevalence of caffeine consumption among students is 50% and confidence limit of 5%, the minimum required sample size at 95% confidence level was calculated to be 384 students which was rounded to be 400. Students reporting having mental and anxiety disorders or chronic diseases were excluded from the study. A multistage stratified random sampling technique was used. First, four faculties (two practical and two theoretical) were selected at random from a list containing all faculties of Alexandria University. From each faculty, 100 students from both sexes (50 males and 50 females) were selected, then an equal number of students were selected from each grade in each selected faculty. From each grade one section was selected randomly. Finally, from each section male and female students were selected using a systematic random sampling technique.

A predesigned structured interviewing questionnaire was used to collect the students' personal data (age, sex and academic grade), medical history (presence of any chronic disease and regular use of medications) and lifestyle including practicing physical activity and daily sleep duration in hours. In addition, students were asked about manifestations of caffeine withdrawal (in the 24 hours following the abrupt cessation or reduction of consumption after prolonged daily use) and intoxication (during or after recent consumption of caffeine).

Food frequency list [24] was used to estimate the frequency of consumption per week of different beverages that contain caffeine as carbonated beverages (Coca Cola and Pepsi), energy drinks (red bull and power horse), different coffee brands and instant coffees, and black and green tea. Information based on the United States Department of Agriculture (USDA) National Nutrient Database (NDB) for Standard Reference for laboratory assessment of caffeine in foods was used as reference values to estimate the mean daily intake of caffeine.[25]

The mean daily caffeine consumption from each item of the consumed beverage/food containing caffeine was calculated in the edible state in gram per day for each study participant. The mean content of caffeine in each food/beverage item in the edible state was estimated in mg/g. These two values were multiplied by each other for each item to get the mean daily intake of caffeine from each item in mg/day. The daily dietary intake of caffeine was divided by the body weight for each participant to get his/her intake in mg /kg body weight/day. This value was then compared to the safe levels set by the EFSA. Caffeine consumption has been classified according to total caffeine intake per day as follows: a. safe level when it is less than or equal to 200 mg/day; b. unsafe level more than 200mg/day.[17]

Students were considered to have caffeine withdrawal if they suffered from developing three or more of the following symptoms in 24 hours following the abrupt cessation or reduction of consumption after prolonged daily use: headache, marked fatigue or drowsiness, depressed mood or irritability, difficulty concentrating, and nausea, vomiting, or muscle pain/stiffness.[13, 26] Students were considered to have caffeine intoxication if they suffered from developing 5 or more of the following symptoms during or after recent consumption of caffeine (typically a high dose or excess of 250 mg): restlessness, nervousness, excitement, insomnia, flushed face, diuresis, gastrointestinal disturbance, muscle twitching, rambling flow of thought and speech, tachycardia or cardiac arrhythmia, periods of inexhaustibility and psychomotor agitation.[27]

Body weight was measured in kg using beam balance scale according to Gibson procedure[28] by bioelectric impedance technique which was calibrated and checked daily against a known weight prior to use, with minimum clothing, without shoes. Readings were taken to the nearest 0.5 kg. Height was measured using wooden height measuring board to the nearest 0.1 cm.[28] Body mass index (BMI) was calculated according to the following equation: weight in kg/height in meter^2 (kg/m^2). Students' BMI was categorized based on the World Health Organization (WHO) BMI classification.[29] Body fat percentage, body water percentage and body muscle percentage were measured using bioelectric impedance analysis Beurer scale type BG 64.[30] Waist and hip circumferences were measured according to the standard procedures of the WHO to the nearest 0.5 cm with a measuring tape. All the measurements were taken twice. However if the measurements differed by more than 1.0 cm, a third measurement was taken. The measurements recorded for each participant were the mean values of the two closest measurements.[31] Waist/ hip ratio (WHR) was obtained from dividing the waist circumference by the hip circumference. The WHO classification of waist circumference and waist–hip ratio was used.[32]

Blood pressure was measured using a mercury sphygmomanometer with a suitable cuff size. After 5 minutes rest, the right arm blood pressure of a seated participant was assessed twice, 5 minutes apart, and the average was reported as the final blood pressure measurement. Students were classified according to the criteria of the American Society of Hypertension and the International Society of Hypertension as: hypotensive (≤100/60mmHg), normotensive (100-120/60-80 mmHg), prehypertensive (120-139/80-89 mmHg) and hypertensive (≥140/90 mmHg).[33] All measurements were carried out in the clinic present in each faculty.

Statistical analysis

Data were revised, coded and fed to the computer and analyzed using IBM SPSS software package version 20.0. Qualitative data were described using number and percent. Quantitative data were described using the mean and the standard deviation. Significance of the obtained results was judged at the 5 % level. Chi-square test was used for categorical variables to compare between different groups. Whenever chi-square test was invalid (more than 20% of the cells have expected count less than 5), Fisher's exact test was used for 2x2 tables.. Student t-test was used for normally distributed quantitative variables, to compare between the two means.

Ethical considerations

Verbal consent was obtained from each participant after informing them about the aim of the study. Ethical approval was taken from the Ethics Committee of the High Institute of Public Health, Alexandria University. Confidentiality of the participants was maintained and anonymity as well.

RESULTS

The mean age of students was 19.71 ± 2.19 years, with nearly equal proportions of males and females (49.5% and 50.5%, respectively). The sample was distributed almost equally between first (25%), second (24.6%), third (25.2%) and fourth (25.2%) academic years. More than half (56%) of students reported practicing physical activity, with a statistically significant difference between males and females (73.2% of males *versus* 39.1% of females practiced physical activity, χ^2=47.252, *p*< 0.001). Football was the most commonly practiced activity (40.2%), followed by walking (24.1%). About 34% of students reported performing physical activity twice weekly, with a mean duration of 68.79 ± 33.80 minutes each time. The mean sleeping time was 7.78 ± 1.66 hours/day.

The mean BMI of the students was 24.06 ± 4.06 kg/m^2, with no significant difference between both sexes (24.08 ± 4.11 among males, 24.05 ± 4.02 among females, student *t*-test= 0.079, *p*= 0.937). About two thirds (60.2%) of students had normal weight, followed by overweight (27.5%), then obese (8%). Only 4.3% were underweight. The difference between both sexes was not statistically significant. The mean waist circumference of students was 81.14 ± 10.85 cm, with a statistically significant difference between both sexes (85.11 ± 10.19 cm among males and 77.25 ± 10.05 cm among females, students *t*-test = 7.767, *p*< 0.001). The mean hip circumference was 96.27 ± 13.20 cm (97.03 ± 11.97 cm among males and 95.53 ± 14.29 cm among females), with no significant difference between both sexes. Nearly two-thirds (63.5%) of the students had normal waist hip ratio (58.6% were males and 68.3% were females) with a statistically significant difference between males and females (χ^2= 4.085, *p*= 0.043). About half of students (51.4%) were normotensive followed by pre-hypertensive students (37.8%), then hypertensive students (8.3%), and hypotensive students (2.5%) with a statistically significant difference between both sexes (χ^2= 20.08, *p*< 0.001).

Table 1 shows that among consumers, Cola drinks ranked first (48.9%), followed by coffee (47.1%) and red tea (45.8%), while 5.6% consumed energy drinks. Half of the females consumed cola drinks, while more than half of the males consumed red tea. More males consumed coffee (54.4%) than females (40.1%). A statistically significant difference could be noticed between students' sex and all types of caffeinated drinks consumed except for Cola drinks. The commonest frequency of drinking was twice a day (38.2%) with no significant difference between males and females. The majority of the sample (85.3%) has been drinking caffeine containing drinks for more than a year, with no significant difference between males and females. Figure 1 illustrates that almost all students (n= 395, 98.8%) consumed caffeinated drinks. All females consumed caffeinated drinks (n= 202) compared to 97.5% of males (n=193). This difference was statistically significant (FET=5.166, p= 0.029). Half of the students (49.9%; 55.4% among females and 44% among males) reported suffering from symptoms after abrupt cessation or reduction of use of caffeine containing drinks, with significant difference between males and females (χ^2=5.134, p= 0.023). The most commonly reported symptom was headache (64.5%), followed by being sleepy (40.1%), having a depressed mood (34.5%), fatigue and difficultly to concentrate (28.4% each). Nearly 20% reported that they always experienced these symptoms, while 69% reported that they sometimes showed these symptoms with no significant difference between males and females. On the other hand, 56.5% of students (50.3% among males and 62.4% among females) reported experiencing symptoms during or after recent consumption of caffeine, with a statistically significant difference between both sexes (χ^2=5.89, p= 0.015). The most commonly presented symptom was insomnia (34.5%), followed by nervousness (22.4%), frequent urination (21.1%), excitement and restlessness (19.7% and 18.8%, respectively).

Table 1: Distribution of Alexandria University students consuming caffeine containing drinks according to their caffeine consumption pattern and their sex (Alexandria, 2017)

Caffeine consumption pattern	Sex		Total	χ^2 (p value)
	Males (n=193)	Females (n=202)	(n=395)	
	n (%)	n (%)	n (%)	
Type [a]				
Cola drinks	92 (47.7)	101 (50.0)	193 (48.9)	0.21 (0.64)
Coffee	105 (54.4)	81 (40.1)	186 (47.1)	8.11 (0.004*)
Red tea	101 (52.3)	80 (39.6)	181 (45.8)	6.44 (0.011*)
Chocolate	35 (18.1)	71 (35.1)	106 (26.8)	14.55 (<0.001*)
Green Tea	24 (12.4)	45 (22.3)	69 (17.5)	6.63 (0.01*)
Energy drinks	17 (8.8)	8 (4.0)	22 (5.6)	3.91 (0.047*)
Frequency per day				
Once	58 (30.1)	68 (33.7)	126 (31.9)	5.39 (0.37)
Twice	74 (38.3)	77 (38.1)	151 (38.2)	
Three times	28 (14.5)	23 (11.4)	51 (12.9)	
Four times	16 (8.3)	24 (11.9)	40 (10.1)	
Five times and more	17 (8.8)	10 (4.9)	27 (6.8)	
Duration of consumption				
Less than 1 year	23 (11.9)	35 (17.3)	58 (14.7)	2.306 (0.13)
More than 1 year	170 (88.1)	167 (82.7)	337 (85.3)	

* Significant (p< 0.05)

[a] responses are not mutually exclusive

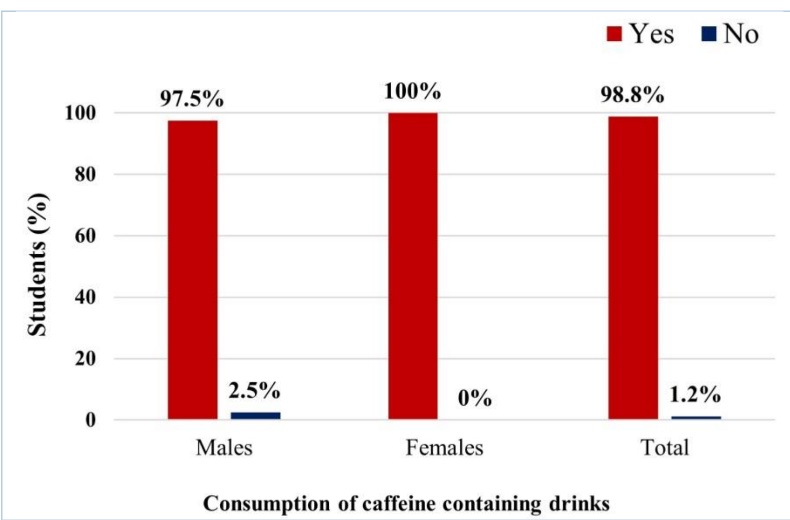

Figure 1: Distribution of Alexandria University students according to their sex and consumption of caffeine containing drinks (Alexandria, 2017)

Table 2 shows that 12.2% of students consuming caffeine containing drinks had caffeine withdrawal after abrupt cessation or reduction of use (had ≥3 symptoms), with a higher percent of females compared to males (17.3% and 6.7%, respectively). This difference was statistically significant (χ^2= 10.37, p= 0.001). Only 0.5% of students consuming caffeine containing drinks had caffeine intoxication (had ≥5 symptoms). All of these students were males, and the difference was not statistically significant (FET= 2.1, *p*= 0.15).

Table 2: Proportion of caffeine withdrawal and intoxication among Alexandria University students according to their sex (Alexandria, 2017)

Caffeine withdrawal and intoxication	Sex		Total (n=395)	Test of significance (*p* value)
	Males (n=193)	Females (n=202)		
	No. (%)	No. (%)	No. (%)	
Withdrawal				
Yes (≥3 symptoms)	13 (6.7)	35 (17.3)	48 (12.2)	χ^2 =10.37
No (<3 symptoms)	180 (93.3)	167 (82.7)	347 (87.8)	(0.001*)
Intoxication				
Yes (≥5 symptoms)	2 (1.1)	0 (0.0)	2 (0.5)	FET=201 (0.15)
No (<5 symptoms)	191 (98.9)	202 (100.0)	393 (99.5)	

* Significant (p<0.05); FET, Fisher's exact test

Table 3 illustrates that the students' caffeine consumption ranged from 1.96 to 2435.18 mg/day and the mean consumption was 405.47 ± 396.43 mg/day. About 69% consumed more than 200 mg of caffeine per day, with no significant difference between males and females, while 65.3% exceeded the safe level set by the EFSA of 3 mg/kg/day (unsafe level), with no significant difference between males and females. The students' mean caffeine consumption was 6.21 ± 6.63 mg/kg/day and ranged from 0.03 mg/kg/day to 49.8 mg/kg/day.

Table 3: Distribution of Alexandria University students consuming caffeine containing drinks according to their sex and caffeine daily intake in relation to the safety level set by EFSA (Alexandria, 2017)

Safety level	Sex		Total (n=395)	Test of significance (*p* value)
	Males (n=193)	Females (n=202)		
	n (%)	n (%)	n (%)	
Total caffeine intake (mg/day)				
≤200 mg/day (safe level)	53 (27.5)	68 (33.7)	121 (30.6)	χ^2=1.787
>200 mg/day (unsafe level)	140 (72.5)	134 (66.3)	274 (69.4)	(0.181)
Range	1.96 – 1992.38	1.96 – 2435.18	1.96 – 2435.18	
Mean ± SD (median)	441.38 ±400.04 (316.13)	371.17 ± 390.87 (288.82)	405.47± 396.43 (306.49)	*t*= 1.764 (0.078)
Caffeine intake/kg body weight (mg/kg/day)				
≤3 mg/kg/day (safe level)	59 (30.6)	78 (38.6)	137 (34.7)	χ^2=2.819
>3 mg/kg/day (unsafe level)	134 (69.4)	124 (61.4)	258 (65.3)	(0.093)
Range	0.03 – 30.65	0.03 – 49.80	0.03 – 49.80	
Mean ± SD (median)	6.29 ± 6.14 (4.67)	6.13 ±7.09 (4.44)	6.21 ± 6.63 (4.65)	*t*=0.247 (0.805)

χ^2, p; χ^2 and *p* values for Chi square test
t, *p*: *t* and *p* values for Student t-test
SD, standard deviation

Table 4 shows that the mean sleeping hours per day was slightly higher among the unsafe consumers. A weak, positive and statistically significant correlation was found between sleeping hours per day and the level of caffeine consumption (r= 0.105, *p*= 0.037). Reporting practicing physical activity was higher among unsafe level consumers compared to safe level consumers (58.4% and 50.4%, respectively), with a statistically insignificant difference. Higher percentage of obesity could be noticed among unsafe level consumers (9.5%) compared to safe level consumers (5%), while the percentage of normal weight students was higher among safe level consumers (62%) compared to unsafe level consumers (59.5%). This difference was not statistically significant. The correlation between BMI and total caffeine daily intake was negative, weak and not significant (r= -0.037, *p*= 0.460). The percentage of students with abdominal obesity was higher (10.2%) among unsafe level consumers compared to safe level consumers (8.3%), with a statistically insignificant difference. The correlation between waist circumference and total daily caffeine intake was positive, weak and not significant (r= 0.027, *p*= 0.597). Unexpectedly, the percentage of students with risk for cardiovascular diseases was higher (38%) among safe level consumers compared to unsafe level consumers (35.4%). The difference was not significant. The correlation between waist hip ratio and total daily caffeine intake was negative, weak and not significant (r= -0.029, *p*= 0.566). The table also shows that the percentage of hypertensive and pre-hypertensive students was higher among unsafe consumers (9.9% and 41.6%, respectively) compared to safe consumers (3.3% and 30.6%, respectively). This difference was statistically significant. The correlation was positive, weak and not significant. The proportion of caffeine withdrawal was higher among unsafe consumers compared to safe consumers (16.1% and 3.3%, respectively). This difference was statistically significant (χ^2= 12.79, *p*= 0.00). Students with caffeine withdrawal were 5.6 times more likely to be unsafe consumers compared to students without caffeine withdrawal (cOR= 5.6, 95% CI= 1.96 - 15.95). The association between the safe level and unsafe level consumers regarding the presence of caffeine intoxication was not statistically significant. Students with caffeine intoxication had an almost equal probability to be safe consumers compared to students without caffeine intoxication.

Table 4: Distribution of Alexandria University students consuming caffeine containing drinks according to their sleeping hours/day, physical activity, anthropometric measures, blood pressure, caffeine withdrawal and intoxication and their total daily caffeine intake (Alexandria, 2017)

Parameter	**Total caffeine intake (mg/day)** ≤200mg/day (n = 121)	>200mg/day (n = 274)	**Test of significance (*p* value)**
	No. (%)	**No. (%)**	
Sleeping hours per day			
Range	4-12	4-15	
Mean ± SD (median)	7.69±1.48 (8)	7.83±1.74 (8)	*t*=0.758 (0.449)
r(*p*)	0.105 (0.037*)		
Physical activity			
Yes	61 (50.4)	160 (58.4)	χ^2=2.169 (0.154)
No	60 (49.6)	114 (41.6)	
BMI (kg/m²)			
Underweight (< 18.5kg/m²)	4 (3.2)	13 (4.7)	χ^2=2.987 (0.394)
Normal weight (18.5-24.9 kg/m²)	75 (62.0)	163 (59.5)	
Overweight (25-29.9 kg/m²)	36 (29.8)	72 (26.3)	
Obese (≥30 kg/m²)	6 (5.0)	26 (9.5)	
r(*p*)	-0.037 (0.460)		
Waist circumference			
Normal	111 (91.7)	246 (89.8)	χ^2=0.369 (0.544)
Abdominal obesity	10 (8.3)	28 (10.2)	
r(*p*)	0.027 (0.597)		
Waist hip ratio			
Normal	75 (62.0)	177 (64.6)	χ^2=0.249 (0.618)
Risk for cardiovascular disease	46 (38.0)	97 (35.4)	
r(*p*)	-0.029 (0.566)		
Blood pressure			
Hypotensive	4 (3.3)	6 (2.1)	χ^2=12.093 (0.007*)
Normotensive	76 (62.8)	127 (46.4)	
Pre-hypertensive	37 (30.6)	114 (41.6)	
Hypertension	4 (3.3)	27 (9.9)	
r(*p*)	0.017 (0.731)		
Caffeine withdrawal			
Yes (≥3 symptoms)	4 (3.3)	44 (16.1)	χ^2=12.79 (0.00*)
No (<3 symptoms)	117 (96.7)	230 (83.9)	
cOR (95% CI)	5.6* (1.96-15.95)		
Caffeine Intoxication			
Yes (≥5 symptoms)	2 (1.7)	0 (0.0)	FET=4.55 (0.93)
No (<5 symptoms)	119 (98.3)	202 (100.0)	
cOR (95% CI)	1.02 (0.99-1.04)		

*Significant (p<0.05)
χ^2 and *p*, χ^2 and p values for Chi square test; r, Pearson coefficient; cOR, crude odds ratio; CI, confidence interval; FET, Fisher's exact test; *t*, *p*: *t* and *p* values for Student *t*-test

DISCUSSION

Caffeine is the most widely consumed psychoactive substance worldwide.[16] Coffee, tea, and some soft drinks are popular nutritional sources of caffeine. Depending on the serving size, the sort of item and the preparation technique, the quantity of caffeine in food products differs.[34] Due to its potential adverse health impacts, caffeine intake in college-age students is receiving more attention.[35] The current study showed that almost all

Alexandria University students consumed caffeine containing drinks, with females being higher consumers than males. Similar findings were reported in a study held in Texas Christian University in 2012.(36) The present findings showed that the most commonly consumed beverages were Cola drinks, followed by coffee, and red tea. The “Caffeine Intake by the U.S. Population” report prepared for FDA which presented an in-depth analysis of the US population’s consumption of caffeine between 2003-2008 disclosed the preference of young people for Cola drinks, followed by tea and coffee.(37) The Texas Christian University study, however, revealed that the frequency of coffee consumption per day was the highest followed by soda, tea and ultimately energy drinks.(36) This could be explained by the age difference between the two samples, as postgraduates were included in the Texas study and the fact that college students in the USA are generally older than those in the same year of study in Egypt.

The daily level of consumed caffeine in the current results was more than the safe level set by the FDA (4.65 versus 3 mg/kg/day). This finding is comparable with several studies in the USA.(18, 34, 38, 39) Approximately 50% of the students in the present research reported experiencing symptoms after abrupt cessation or reduction of their caffeine use. Other studies have revealed comparable results.(36, 39) Daily drinking of caffeine over a lengthy period of time strengthens reliance on caffeine and prevents withdrawal, which explains why most caffeine consumers in the present study had no caffeine withdrawal. In relation to the level of consumption, students with caffeine withdrawal were more likely to be unsafe consumers compared to students without caffeine withdrawal, because the more caffeine is consumed, the more dependent consumers are, the more symptoms they experience when abstaining from it.

Unexpectedly caffeine intoxication was encountered more among safe level consumers, while there was no intoxication at all among the unsafe level consumers, which could be explained by their tolerance to the substance.(39)

Among users who exceeded the safe level (unsafe level consumers), 59.5% were of normal weight, 26.3% were overweight, 9.5% were obese and 4.7 % were underweight. Whereas among safe level consumers 62% were of normal weight, 29.8% were overweight, 5% were obese and 3.3% were underweight. There was no association between the BMI and the quantity of caffeinated drinks consumed, which was consistent with other research.(40, 41) In a research conducted in Japan in 2003, the BMI was not influenced by the quantity of coffee or green tea consumed .(40) In 2011, a research released by the European Journal of Applied Physiology revealed that consumption of 6 mg / kg (double the safe amount) of caffeine did not affect body weight loss.(41)

The present findings showed a statistically significant association between blood pressure and the level of caffeine consumption. Epidemiological trials researching the association between caffeine and blood pressure in non-hypertensive participants resulted in conflicting outcomes. A meta-analysis published in 2011 recorded an inverse "J-shaped" curve with increased risk of blood pressure with up to 3 cups of coffee per day compared to less than 1 cup, and then decreased with higher intakes.(42) In 2012, another meta-analysis reported no association between coffee consumption and blood pressure or risk of high blood pressure.(43) Reviewed randomized controlled trials that investigated the impacts on blood pressure of single doses of caffeine or caffeinated coffee among normotensive and hypertensive participants reported that a single dose of caffeine (200–250 mg, equivalent to two to three cups of coffee) in normotensive participants was discovered to raise systolic blood pressure by 3–14 mmHg and diastolic blood pressure by 4–13 mmHg.(17) These analyses highlight the major studies-wide variability as well as the ambiguous definition of coffee consumption and adherence to the assigned quantity.

CONCLUSION AND RECOMMENDATIONS

The consumption of caffeine containing drinks among Alexandria University students, both males and females, was very high and exceeded the safe levels, with carbonated beverages being the most commonly consumed ones. Caffeine withdrawal was sometimes experienced by students, while caffeine intoxication was very rare. The association between the caffeine intake and the anthropometric measures was not significant, while the association between the level of caffeine consumption and blood pressure was significant.

Nutrition educational programs are recommended to increase awareness of Alexandria University students about the impact of high consumption of caffeine containing food and beverages on their health, in order to avoid adverse physiological symptoms.. Further follow up researches are needed to emphasize more strongly on proven side effects of long term caffeine usage.

Conflict of Interest: None to declare.

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