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(RESEARCH ARTICLE)

Psychostimulants – a boon or bane during examinations

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Abstract

Psychostimulants or neuroenhancers have been used by students to increase their performance in pursuit for higher grades. Our study aimed to assess the effect of stimulants on test anxiety and psychological distress in medical students. The students were approached with self-administered questionnaire for Test Anxiety, Psychological Distress and use of stimulants during the period of examinations. The stimulants were categorized according to their average caffeine content into tea or qahwa, instant coffee and energy drinks with two other categories that is stimulant drugs use and no stimulant use. The respondents were female medical students from study year 1-5. About 84% students used stimulants, of which maximum were coffee users 64.6% followed by tea or qahwa 38.6%, energy drinks 13.86% and stimulant drugs 7.8%. The percentage of students taking stimulant drugs showed an increasing trend from year 1 (3.96%) to year 5 (11.27%) while those who did not use any type of stimulant decreased from year1 to year 5. The mean test anxiety and mean psychological distress was highest for energy drink users followed by stimulant drug users. Energy drink was positive correlated with test anxiety with statistical significance indicating the detrimental effect of high concentration of caffeine in it. Test anxiety and psychological distress was higher in students using stimulants compared those who did not. Stimulants though believed to enhance performance and alertness, may actually be disadvantageous when used in higher doses as it increases test anxiety and psychological distress which may decrease performance.

Keywords: Caffeine; Stimulants; Test anxiety; Medical students; Psychological distress

1. Introduction

Stimulants or psychostimulants have been known to enhance the mental and physical performance by stimulating the nervous system by their sympathomimetic activities. Wide ranges of stimulants ranging from beverages containing caffeine to drugs which stimulate brain function have been used. Stimulants have been used in demanding professions like military or in sports to increase alertness and energy levels and physical performance. With the advancement of education and increase in competitiveness and the drive to excel, stimulants are also being used by students to enhance their cognition, memory, alertness, increase reaction time and to stay awake. Stimulants like nonprescription stimulant drug use was found to be higher in college students than their peers of same age group that are not enrolled in college [1]. Physiological and mental arousal does lead to increased performance up to a limit along the Yerkes-Dodson law [2]. Stimulants like caffeine in lesser doses for short periods of time do help improve cognition, reaction time, endurance, memory and lower anxiety [3]. The increased use of these stimulants may cause hyper arousal which may produce downward slope of the curve which lead to increased stress, anxiety and manifest its detrimental effects on performance. Test anxiety and psychological distress have positive correlation and was increased in higher years of study [4] and can lead to depression and even suicidal tendencies. The use of stimulants was higher in the medical stream students than other groups. Our aim was to evaluate the use of cognitive stimulants caffeine containing

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beverages like tea, Qahwa (Arabic coffee), coffee, energy drinks and amphetamine or methylphenidate containing stimulant drugs by medical students, to check for any association with test anxiety and psychological distress and variation in choice of stimulant with progression through the first to fifth year of study.

1.1. Test anxiety

Test anxiety is state of increased anxiety during testing situations which might decrease performance and leads to poor outcome thereby lowering their grades [5, 6]. It includes; emotional symptoms cognitive symptoms and physical symptoms of sympathetic overdrive. Students who fail to cope with test anxiety end up in depression, burnout and even suicides. Poor preparation for the test or history of poor grades [7] are some of the causes of test anxiety and many students try to overcome this by taking stimulants to stay awake and alert so as to prepare well and its overuse can further elevate anxiety.

1.2. Psychological distress

Academic pressures, financial problems, less leisure time, apart from emotional problems in family and peer expectations produce psychological distress in students more so in medical students owing to vast curriculum and need to be diligent and conscientious. Anxiety depression and suicidal attacks are different forms of psychological distress disorders observed in students. Increased use of stimulants can aggravate these conditions, cause dependence and increased psychological distress [8, 5]. Stimulants decrease sleep and make students susceptible to psychological distress [9].

2. Material and methods

A cross sectional study was done with exam going medical students ranging from year1 to year 5 of medical school of Makkah Saudi Arabia and their test anxiety and psychological distress was examined in view of the stimulants they are using. In our study we collected self-administered questionnaire for test anxiety the Westside test anxiety scale, for psychological distress Kessler's psychological distress scale K-10 along with information of use of stimulants during examination period.

2.1. Westside test anxiety scale

Includes 6 questions on self-assessment of anxiety and cognitive impairment [10]. The response is 5 point likert scale with a score of 1-5. A score of 1-3 is low to average to high normal test anxiety. Scores above 3 to 5 show abnormally high levels of test anxiety from moderately high to extremely high test anxiety which needs intervention.

2.2. Kessler's psychological distress scale K-10

Is a self-administered questionnaire on psychological distress with 10 questions enquiring about symptom of emotional status of anxiety and depression experienced in the last 4wks with score from 10-50. Scores of 10- 15 are taken as normal, 16-21 as mild psychological distress, 22-29 as moderate or high and 30-50 as severe or very high psychological distress[11,12].

2.3. Stimulants used

The information on use and choice of stimulants was taken. The stimulants were categorized as 0-nostimulant use,1-tea or qahwa (13-26 mg of caffeine), 2-coffee(40-60mg caffeine) and 3-energy drinks(80-160mg caffeine) and 4-stimulant drugs users to understand the prevalence of stimulants use and its relation with student's psychological distress and test anxiety.

2.3.1. Caffeine

Caffeine is the most widely used psychostimulant in the global population. It is present in our daily foods in the form of tea, coffee, soft drinks, energy drinks, chocolate, biscuits etc. Around 87% of children and adults in United States consume caffeine containing products [13]. Caffeine is a methylxanthine compound which produces alertness and arousal which may be attributed to increased cognition, decrease reaction time, produce wakefulness, increase endurance and decreasing the perception of pain and exertion [14]. Its mechanism of action involves blocking of A1 and A2 adenosine receptors which consequently increase levels of such hormones such as Adrenaline and Dopamine responsible for effects like increased heart rate and neural stimulation. Its other effects include inhibition of phosphodiesterase and hence increase cyclic AMP and intracellular calcium. It also increases Acetyl choline levels and antagonizes the effect of benzodiazepines [15]. But caffeine taken in larger doses can produce extreme adverse effects. Caffeine can worsen anxiety as reported and produce behavioral disorders which persists a for few days even after

stopping caffeine [16]. A dose 1g (15mg/kg) may cause nervousness, restlessness, agitation [17] etc. which may be called as symptoms of caffeinism, convulsions and 10-15g caffeine can be fatal. About 400mg of caffeine per day is found to be safe with still lesser values for children and pregnant women [18]. Regular use of caffeine produces tolerance to its effects and may require higher doses to exert its effect compelling the individuals to consume higher beverages with higher caffeine content. It also produces dependence and its withdrawal produces symptoms like headache tiredness etc. making it difficult to break the habit. Different beverages commonly taken by students and their caffeine content have been discussed below.

Tea

Tea is believed to promote health, act as an energizer and increase alertness and cognition. According to US department of Agriculture (USDA) food data the caffeine content is 26.2 in a cup of regular tea. The caffeine content is 20 mg in black tea, 12 mg in green tea and 9 mg in tea with milk per 100 gm of tea [19].

Qahwa or Arabic Coffee

Qahwa is the traditional drink of Arabian people containing ground coffee beans and saffron or cardamom. The caffeine content in Qahwa is 4.3mg/cup per of 25 mL (Naser, Sameh, Muzaffar, Omar & Ahmed, 2018). It is taken as 1 or 2 cups of 80 mL accounting 13-26 mg of caffeine. Since tea and qahwa have similar content of caffeine of 13-26 mg and were considered together in the study.

Coffee

About half of world's population use coffee. A cup of instant coffee like Nescafe coffee contains about 40-43 mg of caffeine [20] and 60 mg in Espresso coffee.

Energy drinks

The energy drinks mainly contain high concentration of caffeine – a high psychostimulant and glucose – energy substrate. Caffeine content in commonly used energy drink brands in Saudi Arabia are Code Red, Bison, Red Bull, Holsten, and Power Horse [21] is 80 mg per 8 fl Oz to 160mg in 16 fl Oz serving. Can but it can be high as 242 mg as in brands like 5-hour energy extra strength as given by U.S. Drug and Food Administration [19]. Energy drinks produce increased endurance to aerobic exercise, increased time to exhaustion, faster reaction time with no change in perceived exertion [22]. Other substrates and cognitive enhancers such as taurine, inositol, glucorunolactone, t-theanine, ginseng , methylxanthines, vitamin B, guarana, yerba mate, acai, maltodextrin, carnitine, creatine, glucuronolactone, and ginkgo biloba etc· [23, 24] can be found in energy drinks. A longitudinal study observed energy drink users are more likely to shift to stimulant drugs, cocaine and alcohol use [25]. 27 -55 % of students consume energy drinks with higher prevalence in males than females [26].

2.3.2. Stimulant drugs

Stimulant drugs prescribed for Attention deficit hyperactivity disorders (ADHD) are being misused by students to increase alertness and cognition, arousal and to stay awake. The stimulant drugs like amphetamine and methylphenidate Hcl are available as non-prescription drugs in some countries and readily available illegally in black-market in others. Methylphenidate and Amphetamine increase the levels of dopamine and Norepinephrine by lowering its uptake. The most common brands used are Ritalin, Adderall, Concerta etc. The prevalence of stimulant use is higher in medical students in United States of about 11-15% [27, 28]. In Saudi Arabia the prevalence has been said to be about 5% [29] lesser than of Australian students of 6.5% prevalence [30]. Increased doses of stimulant drugs can cause anxiety, depression, paranoia, headaches and panic attacks [31].

2.4. Ethics

Ethical approval was taken from the Biomedical Ethics Committee of Umm Al-Qura University (approval no.147).

2.5. Consent

Informed and signed consent was taken. Participant's anonymity was maintained.

2.6. Study design

Students of medicine of Umm Al Qura University were approached during the week of their final exams. The respondents were 404 females of age 18-25 years except one student of 26 years and another of 27 years studying in 1st to 5th year of medical school. The first page of the questionnaire included description of the study and its purpose

with their signed consent. The students who refused were not forced for the participation. Students having taking drugs on prescription for psychological disorder were excluded from study.

2.7. Statistics

The questionnaires were analyzed using Statistics Package for Social Sciences 20 (SPSS 20) descriptive statistics of frequencies, percentages, means with standard error, logistic regression and multinomial regression for odds ratio and 95% confidence interval and Pearson's correlations.

3. Results

Our study population consisted of female medical students of ages 18-25 years from study years 1st to fifth year of medical school. The number of students who responded was 404. The prevalence of use of stimulants in female medical students of study population was found to be 84.16%. 15.59% respondents said they did not use any stimulants. The descriptive statistics of the number of students taking different stimulants are given in Table.1

Table 1 Number of students using different stimulants and their percentages according to the year of study

Year of Study	Frequency N	No stimulant use N(%)	Tea or Qahwa N(%)	Coffee N(%)	Energy Drinks N(%)	Stimulant Drugs N(%)
1st year	101	22(21.78%)	31(30.69%)	57(56.43%)	12(11.89%)	4(3.96%)
2nd year	77	12(15.58%)	28(36.36%)	46(59.74%)	14(18.19%)	6(7.79%)
3rd year	81	11(13.58%)	40(49.38%)	50(61.73%)	11(13.58%)	7(8.64%)
4th year	74	6(8.11%)	29(39.19%)	62(83.79%)	10(13.51%)	4(5.4%)
5th year	71	12(16.91%)	28(39.44%)	46(64.79%)	9(12.68%)	8(11.27%)
Total	404	63(15.59%)	156(38.61%)	26(64.61%)	56(13.86%)	29(7.18%)

Students who are not using stimulants decreased from 21.78% in first year to 16.91% in fifth year with the least in fourth year of 8.11%. Multinomial regression analysis with not using any stimulant as dependent variable and study year as the covariable showed OR=.860 CI .710, 1.042 with reference category –use stimulants, but this was statistically insignificant. 7.18% of students reported use stimulant drugs. The use of stimulant drugs in first year of study was 3.96% students and increased 11.27% in the final and fifth year. Multinomial regression analysis showed Odds Ratio OR=1.210 and confidence interval CI .928,1.578 with reference category-does not use stimulant drugs.This was not statistically significant. The maximum number of students that is 64.61% used Coffee as a stimulant followed by tea and qahwa, energy drinks and stimulant drugs. The variations of percentages of different stimulants used with the progression of years of study are depicted in the Fig-1 shown.

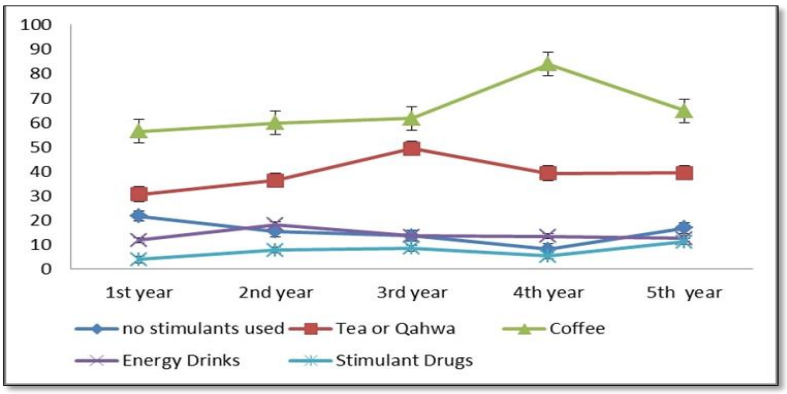

Figure 1 Stimulant use along the study years (in terms of percentages and standard error bars)

The test anxiety as well as psychological distress scores was higher in students who were taking stimulants but did not show any statistically significant correlation. Test anxiety was lesser in students who did not use any stimulant and was highest in energy drink users followed by stimulant drug users. The variation of mean test anxiety and mean psychological distress is depicted in the line Fig-2 and Fig-3 respectively.

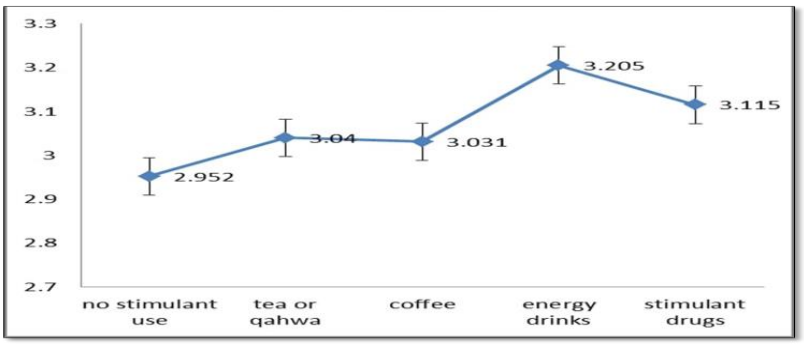

Figure 2 Mean test anxiety for different stimulants.

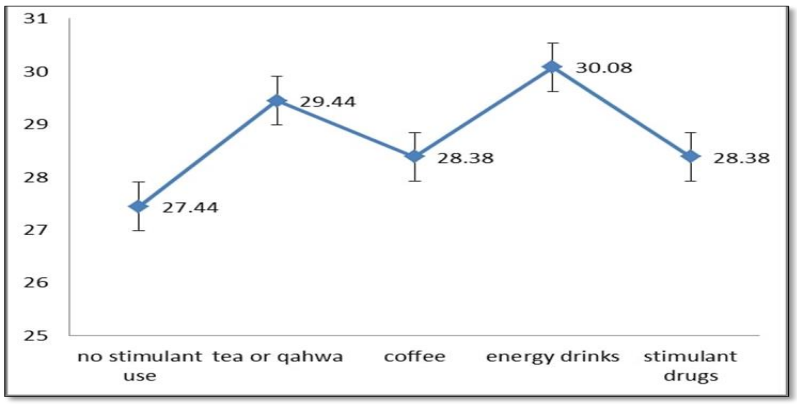

Figure 3 Mean psychological distress for different stimulants

The frequencies and percentages of respondents with high test anxiety and high psychological distress needing intervention are given in Table. 2

Table 2 Frequencies and percentages of students with low test anxiety, high test anxiety, low psychological distress and high psychological distress.

Stimulant Used N	**No. of respondents with Low Test Anxiety N(%)**	**No. of respondents with High Test Anxiety N(%)**	**No. of respondents with low psychological distress N(%)**	**No. of respondents with High Psychological Distress N(%)**
No Stimulant Used 63	28(44.44%)	35(55.55%)	15(23.8%)	48(76.2%)
Tea or Qahwa 156	69(44.23%)	87(55.76%)	21(13.5%)	135(86.5%)
Coffee 261	120(45.98%)	141(54.02%)	42(16.1%)	219(83.9%)
Energy Drinks 56	20(35.71%)	36(64.28%)	6(10.7%)	50(89.3%)
Stimulant Drugs 29	16(55.17%)	13(44.82%)	3(10.3%)	26(89.7%)

Binary logistic regression was done for high test anxiety and for high psychological distress with different stimulants and its odds ratio OR and confidence interval 95% are shown with their P values in the Tables-3 and 4 respectively.

Table 3 Odds ratio of high test anxiety with stimulant used

Variable-Stimulants used	Response category	OR(CI 95%)	P value
No stimulant used	Yes No	1.158(.675,1.988) reference	.594
Tea or Qahwa	Yes No	1.241(.830,1.855) reference	.293
Coffee	Yes No	1.192(.792,1.792) reference	.400
Energy Drinks	Yes No	1.759(.979,3.159) reference	.059
Stimulant Drugs	Yes No	.719(336,1.536) reference	.394

Table 4 Odds ratio of high psychological distress with stimulant used

Variable-Stimulant used	Response category	OR (CI 95%)	P value
No stimulant used	Yes No	1.590(.834,3.036) reference	.160
Tea or Qahwa	Yes No	1.623(.932,2.827) Reference	.087
Coffee	Yes No	1.326(.785,2.241) reference	.291
Energy Drinks	Yes No	1.914(787,4.655) Reference	.152
Stimulant Drugs	Yes No	1.920(.565,6.526) reference	.296

Pearson's correlation was done for anxiety and psychological distress with stimulant variables. Energy drinks were positively correlated with test anxiety with statistical significance P=0.027 ($p<0.05$). Energy drinks and psychological distress were also positively correlated but not statistically significant. All other stimulants checked separately showed positive correlation with test anxiety and psychological distress but not statistically significant. The use of stimulants taken together was positively correlated (but statistically not significant) with test anxiety (Pearson correlation .095 P value .056) and psychological distress (Pearson correlation .054 and P value .282). Variable of no stimulant used was negatively correlated with both high test anxiety and high psychological distress but not statistically significant. Test anxiety and psychological distress are positively correlated with statistical significance.

4. Discussion

Our study aimed to analyze the use of stimulants in medical students and its effect on psychological distress and test anxiety. Test anxiety and psychological distress made it difficult for students to perform well even after studying hard and putting lot of effort. **It is a major disadvantage to students**. The use of stimulants in female medical students was found to be of about 84%. the 83.91% students in our study used caffeine in one or other form for alertness while Mahoney et al reported 93% users for caffeine [32]. 7.18% used stimulant drugs of which 27 students used stimulant

medications along with caffeine and two admitted to using only stimulant medications. Caffeine is consumed in the form of tea, qahwa (Arabic coffee), Coffee (mostly Nescafe) or Energy drinks. As the Caffeine content of tea and qahwa (Arabic Coffee) is less and almost equivalent, they have been considered together. Maximum number of students that is of about 64% consumes Coffee to remain alert for academic purpose similar. 38.6% use tea or qahwa and 13.86% use energy drinks higher than study with Australian university students reported highest number students using coffee 41.4% and energy drinks 23.6% [30]. The use of stimulants was positively correlated with test anxiety and psychological distress making students more vulnerable stress during examinations and may affect their performance. The mean test anxiety was higher for students who used stimulants compared to those who do not use any stimulant. Both test anxiety and psychological distress were negatively correlated with no stimulant use sparing them from adverse effects. The percentage of students having high test anxiety or psychological distress was the least for students who did not use any stimulant compared to those who used some kind of stimulant and showed the least Odds Ratio compared to other variables. Caffeine in lesser doses can decrease stress and anxiety. Mean psychological distress was lesser than users of tea or qahwa and mean test anxiety was also not much increased with that of tea and qahwa users. It may be because of the protective effect of caffeine [33]. The caffeine content in average coffee such as Nescafe is about 40mg. Mean Test anxiety for users of energy drinks was highest and was positive correlated with statistical significance of $P=0.027(<0.05)$ which can be because of their high concentration of caffeine that is average of 80-160mg per can of drink. Increased caffeine intake produce behavior similar to anxiety disorders with increased hypothalamic activity which persists for long time even after stopping caffeine as proven in studies on rats [16]. Around 64.28% of students who take energy drinks showed high test anxiety levels. Energy drink users showed the highest mean test anxiety and psychological distress and should be avoided be exam going students. Other stimulants were also positively correlated with test anxiety. The Mean psychological distress was also highest in energy drink users when compared to others with 89.3% of them showing high psychological distress needing intervention. The Odds Ratio of high psychological distress was highest with Stimulant Drug use when compared to other variable though it was lesser for test anxiety but not statistically significant. Test anxiety did show increasing trend with increasing caffeine content from tea to coffee to energy drinks but statistically significant correlation was not found. In our study the prevalence of stimulant drug use in female medical students was 7.26%. higher then reported by Alrakaf et al., 2020 of 5.8%[29] and 4.4% Australian medical students[30] in male and female study population but lesser than French female medical students of 11.1% [35]11.3% Italian medical students [35] and 15% in American medical students of 15% [36] The use of stimulant drugs was higher in medical students and more so in higher years of study and lower in first year similar to studies by Alrakaf et al and Emanuel et al [28,29].

5. Conclusion

Our study has shown that students using stimulants either caffeine containing products or using stimulant drugs show increased test anxiety and psychological distress. High test anxiety and high psychological distress was associated with consumption of products having more caffeine content such as energy drinks with significant positive correlation with test anxiety. This study helps us to understand the detrimental effect of psychostimulants on stress associated with exams and steps must be taken to educate the student population on the disadvantages and adverse effects of stimulants which might end in becoming a bane rather than a boon on performance outcome.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare there is no conflict of interest and no financial aid was taken for this research.

Statement of ethical approval

The research work studies the effect of psychostimulants taken by female medical students (human subjects) of year 1 to year 5 during examinations. Ethical approval was taken from the Biomedical Ethics Committee of Umm Al-Qura University (approval no.147).

Statement of informed consent

Informed and signed consent was taken. Participant's anonymity was maintained.

References

[1] Ford J, Pomykacz C. Non-Medical Use of Prescription Stimulants: A Comparison of College Students and their Same-Age Peers Who Do Not Attend College. Journal Of Psychoactive Drugs. 2016; 48(4): 253-260.

[2] Yerkes RM, Dodson JD. The relation of strength of stimulus to rapidity of habit-formation". Journal of Comparative Neurology and Psychology. 1908; 18(5): 459–482.

[3] Sweeney P, Levack R, Watters J, Xu Z, Yang Y. Caffeine increases food intake while reducing anxiety-related behaviors. Appetite. 2016; 101: 171-177.

[4] Aziz N, Serafi A. Increasing levels of test anxiety and psychological distress with advancing years of medical education. British Journal of Medical And Health Research. 2017; 4(3): 40-52.

[5] Balogun A, Balogun S, Onyencho C. Test Anxiety and Academic Performance among Undergraduates: The Moderating Role of Achievement Motivation. The Spanish Journal Of Psychology. 2017; 20.

[6] Dr S, Jha S, Punia A, Babita B. The Relationship between Test Anxiety and Academic Performance among Undergraduate Medical Students: A Cross-sectional Study. SSRN Electronic Journal. 2019.

[7] Tsegay L, Shumet S, Damene W, Gebreegziabhier G, Ayano G. Prevalence and determinants of test anxiety among medical students in Addis Ababa Ethiopia. BMC Medical Education. 2019; 19(1).

[8] Ogeil RP, Phillips JG. Commonly used stimulants: Sleep problems, dependence and psychological distress. Drug and Alcohol Dependence. 2015; 153: 145–151.

[9] Zunhammer M, Eichhammer P, Busch V. Sleep Quality during Exam Stress: The Role of Alcohol, Caffeine and Nicotine. PLoS ONE. 2014; 9(10): e109490.

[10] Driscoll R. Westside Test Anxiety Scale Validation. 2007; 1-6.

[11] Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry. 2003; 60(2): 184-9.

[12] Brooks RT, Beard J, Steel Z. Factor structure and interpretation of the K10. Psychological Assessment. 2006; 18(1): 62–70.

[13] Frary C, Johnson R, Wang M. Food sources and intakes of caffeine in the diets of persons in the United States. Journal of The American Dietetic Association. 2005; 105(1): 110-113.

[14] Nehlig A, Daval J, Debry G. Caffeine and the central nervous system: mechanisms of action, biochemical, metabolic and psychostimulant effects. Brain Research Reviews.1992; 17(2): 139-170.

[15] Cooper M. Caffeine consumption among adults on benzodiazepine therapy: united states 1988-1994. Psychological Reports. 2004; 95(5): 183.

[16] O'Neill C, Newsom R, Stafford J, Scott T, Archuleta S, Levis, S. et al. Adolescent caffeine consumption increases adulthood anxiety-related behavior and modifies neuroendocrine signaling. Psychoneuroendocrinology. 2016; 67: 40-50.

[17] Gilman AG, editor, Rall TW, editor, Nies AS, editor, Taylor P, editor. (eds). In: Goodman and Gilman's The Pharmacological Bases of Therapeutics in Two Volumes. New York: McGraw-Hill. 1990; 625.

[18] Nawrot P, Jordan S, Eastwood J, Rotstein J, Hugenholtz A, Feeley M. Effects of caffeine on human health. Food Additives and Contaminants. 2003; 20(1): 1-30.

[19] Agriculture Research Service [Internet]. U.S. department of agriculture. 2020 [cited 20 August 2020].

[20] Naser L, Sameh A, Muzaffar I, Omar A, Ahmed M. Comparative evaluation of caffeine content in Arabian coffee with other caffeine beverages. African Journal Of Pharmacy And Pharmacology. 2018; 12(2): 19-26.

[21] Rahamathulla M. Prevalence, side effects and awareness about energy drinks among the female university students in Saudi Arabia. Pakistan Journal Of Medical Sciences. 2017; 33(2).

[22] Alford C, Cox H, Wescott R. The effects of Red Bull Energy Drink on human performance and mood. Amino Acids. 2001; 21(2): 139-150.

[23] Childs E. Influence of energy drink ingredients on mood and cognitive performance. Nutrition Reviews. 2014; 72: 48-59.

[24] Alsunni A. Energy Drink Consumption: Beneficial and Adverse Health Effects. International Journal Of Health Sciences. 2015; 9(4): 459-465.

[25] Arria A, Caldeira K, Kasperski S, O'Grady K, Vincent K, Griffiths R, Wish E. Increased Alcohol Consumption, Nonmedical Prescription Drug Use, and Illicit Drug Use Are Associated With Energy Drink Consumption Among College Students. Journal of Addiction Medicine. 2010; 4(2): 74-80.

[26] Khamis Ragab Ibrahim N, Iftikhar R, Murad M, Fida H, Abalkhaeil B, Al Ahmadi J. Energy Drinks Consumption amongst Medical Students and Interns from Three Colleges in Jeddah, Saudi Arabia. Journal Of Food And Nutrition Research. 2014; 2(4): 174-179.

[27] Wasserman J, Fitzgerald J, Sunny M, Cole M, Suminski R, Dougherty J. Nonmedical Use of Stimulants Among Medical Students. The Journal of The American Osteopathic Association. 2014; 114(8): 643-653.

[28] Emanuel R, Frellsen S, Kashima K, Sanguino S, Sierles F, Lazarus C. Cognitive Enhancement Drug Use Among Future Physicians: Findings from a Multi-Institutional Census of Medical Students. Journal Of General Internal Medicine. 2013; 28(8): 1028-1034.

[29] Alrakaf F, Binyousef F, Altammami A, Alharbi A, Shadid A, Alrahili N. Illicit Stimulant Use among Medical Students in Riyadh, Saudi Arabia. Cureus. 2020.

[30] Lucke J, Jensen C, Dunn M, Chan G, Forlini C, Kaye S, et al. Non-medical prescription stimulant use to improve academic performance among Australian university students: prevalence and correlates of use. BMC Public Health. 2018; 18(1).

[31] Williamson S. Adverse effects of stimulant drugs in a community sample of drug users. Drug and Alcohol Dependence. 1997; 44(2-3): 87-94.

[32] Mahoney C, Giles G, Marriott B, Judelson D, Glickman E, Geiselman P, Lieberman H. Intake of caffeine from all sources and reasons for use by college students. Clinical Nutrition. 2019; 38(2): 668-675.

[33] Kasimay Cakir O, Ellek N, Salehin N, Hamamcı R, Keleş H, Kayalı D. et al. Protective effect of low dose caffeine on psychological stress and cognitive function. Physiology & Behavior. 2017; 168: 1-10.

[34] Fond G, Gavaret M, Llorca P, Boyer L, Micoulaud-Franchi J, Domenech P. (Mis) use of prescribed stimulants in the medical student community: Motives and behaviors. A population-based cross-sectional study. European Neuropsychopharmacology. 2016; 26: S348-S349.

[35] Majori S, Gazzani D, Pilati S, Paiano J, Sannino A, Ferrari S, Checchin E. Brain doping: stimulants use and misuse among a sample of Italian college students. Journal of preventive medicine and hygiene. 2017; 58(2): E130–E140.

[36] Webb JR, Valasek MA, North CS. Prevalence of stimulant use in a sample of US medical students. Annals of clinical psychiatry: official journal of the American Academy of Clinical Psychiatrists. 2013; 25(1): 27–32.