Caffeine Consumption and Academic Performance among Medical Students of Dow University of Health Science (DUHS), Karachi, Pakistan

Muhammad Sami Khan[1], Nighat Nisar[2], Syed Arsalan Ahmed Naqvi[3], Faryal Nawab[4]

Abstract

Objective: To determine the frequency of caffeine consumption and its effect on academic performance among medical students of DUHS, Karachi, Pakistan.

Methods: A cross-sectional study was conducted at Dow Medical College, DUHS. About 400 medical undergraduate students from first to final year MBBS were included through systematic sampling. Those students who were on leave on the day of interview and addicted to substance abuse other than caffeine and those who were on drug use rehabilitation were excluded from the study. The duration of study was from January 2016 to May 2016. The data was collected by self-administered structured questionnaire which included the information regarding socio-demographic characteristics, perceptions regarding caffeine consumption on academic performance. The data were entered and analysed by using SPSS version 16. Frequency and percentages were calculated and multivariate analysis was performed to determine the association of caffeine consumption and academic performance of medical students.

Results: The mean age of the medical students were 20.83 ± 1.57 years. About 58.5% were females, 46.3% of the students scored less than 3 Grade Point Average (GPA). Majority (94%) of the students consume caffeine in any form such as tea, coffee. About 68% students reported that caffeine use increases their academic performance. On multivariate analyses, caffeine consumption did not show any significant association with academic performance.

Conclusion: High proportions of medical students were found to be consuming caffeine due to the misconception that caffeine increases academic performance. This study found no significant association with academic performance and caffeine consumption.

Keywords: Social perception, universities, medical students, addictive behaviour, caffeine.

IRB: Approved by Institutional Review Board, Dow University of Health Sciences.

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Introduction

Caffeine is a central nervous system stimulant and belongs to the category of xanthine group[1]. A cup of coffee contains about 90% of caffeine and it needs 20 minutes to clear from the stomach after consumption. The effect starts from an hour and remains for 3-4 hours[2]. The peak plasma concentration is reached after 40 to 60 minutes[3]. The half-life of caffeine is about six hours in healthy adults[4]. The human history showed that it is a widely consumed drug worldwide. About 80% of the world's population consumes caffeine in one form or the other. The caffeine quantity reported was(± 137 mg/cup of caffeinated coffee and ± 2 mg/cup of decaffeinated coffee; the volume of one cup is approximately 240 ml), tea (± 47 mg/cup), caffeinated soft drinks (± 46 mg/340 ml can or bottle of cola beverage), energy drinks (up to 80 mg/can)[3,4], and

[1,3] Dow University of Health Sciences
[2,4] Department of Community Medicine,
Dow University of Health Sciences

Correspondence: Dr. Faryal Nawab
Department of Community Medicine
Dow University of Health Sciences
Email: dr.farnab@gmail.com
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caffeinated chocolates, non-beverage foodstuff, medications (± 7 mg/200 g). The scientific literature reported that it is hard to find complete non-users of caffeine[2,4,5]. The reason behind caffeine consumption reported was increased self-reported alertness, improved performance, vigilance in performing tasks, concentration, improved long-term memory and faster locomotors speed[6,7]. The habitual consumption of caffeine has not been reported to improve short-term memory, information processing, planning and attention[7]. The caffeinated beverages consumption among students and athletes has become very popular due to media promotion and social marketing of caffeinated drinks. A study conducted in the United States among college students reported that 51% reported at least one energy drink consumed in the preceding month. The reason reported was to reduce sleep 67%, to increase energy 65%, and to drink with alcohol while partying 54%[8]. A study conducted among medical students of Turkey showed 32.6% consumed energy drink at least once[9]. Another research from The Aga Khan University, Pakistan reported 52% of medical students consumed caffeine to cope up with academic and athletic stress and workloads[10]. Another survey conducted inthe United States examined the relationship between energy drinks consumption and academic performance by using self-reported cumulative Grade Point Average (GPA) to measure academic performance. Results from this survey showed that energy drink consumption and academic performance were negatively correlated[11].

Literature suggests that use of caffeinated beverages is quite common among medical undergraduates[12,13]. Several studies have been conducted internationally to examine the physical and social impact of energy drink consumption among undergraduate students[14,15].

In general, medical students face extended study load and for this purpose they prefer caffeinated beverages so there was need to determine the use of caffeine containing products among medical students and the effect of caffeine on their academic performance as there was no recent data available from our setup. Caffeinated products consumption has become a public issue in the last decade due to extensive publicity and easy availability of these beverages especially in youth. This study was aimed to determine the association between all types of caffeine containing substances used and academic performance among medical students of a large public sector medical college of Pakistan.

Material and Methods

A cross-sectional study was conducted at Dow University of Health Sciences for the period of five months from January 2016 to May 2016. The sample size of 384 was calculated by WHO sample size calculator by using the proportion of 52%[10] caffeine consumption among medical students of private medical college with 95% confidence interval and 5% margin of error and it was rounded off to 400. About 80 MBBS students from first year to final year were enrolled in the study through systematic sampling. The study excluded students who were on leave; addicted to substance abuse other than caffeine and those who were on drug use rehabilitation. A structured questionnaire which was pretested through pilot study on 30 students in similar setting was self-administered to the students after taking the written consent. The ethical approval was obtained from Institutional Review Board of Dow University of Health Sciences. The variables included in questionnaire were age, gender, year of MBBS, caffeine use, perceptions regarding caffeine consumption, cost spent on caffeinated drinks and its association with academic performance. Academic performance was assessed through latest GPA of the study participants. GPA less than 3.0 was considered as below average academic performance and GPA more than 3.0 was labelled as above average academic performance. The data were entered and analysed by using SPSS version 16. Frequency and percentages were calculated and multivariate analysis was performed for determining the association of caffeine consumption and academic performance.

Results

The mean age of the sample was 20.83 ± 1.57 years. About 58.5% were females and 41.5% were males. About 46.3% of students scored less than 3 GPA and 53.8% scored more than 3 GPA. Majority (94%) of the students consumed caffeine in any form and only 6% of the students did not consume caffeine in any form. The cost spend on caffeine was 3 USD per day with mean cost 0.54 ± 0.37 USD (Table 1).

About 46.8% of students consumed caffeine in form of coffee, 67.5% tea, 59.5% soft drinks, 6% energy drinks and 53.8% in chocolate form (Table 2).

Regarding perception about caffeine consumption 71.5% reported that it increases overall academic performance and 22% reported that it

increases IQ. About half of the students reported that caffeine helps in overnight study, 71% reported that it increases self-confidence, 36.7% reported that it increases reading power, 45% reported it increases study hours, 70% reported it invigorate fatigue and 75% reported it improves group activity (Table 3).

Uni-variate analyses were conducted for caffeine consumption and academic performance (GPA). Female gender showed significant association with GPA more than 3.0 as compared to male (OR=1.59, 95% CI, 1.06-2.37). Caffeine consumption did not show any significant association with academic performance (GPA). (Table 4)

Table 1. Socio-demographic characteristics of the study participants n= 400

Characteristics	Frequency (N= 400)	Percentage (%)
Age in years		
<20 years	165	41.3
>20 years	235	58.8
Gender		
Male	166	41.5
Female	234	58.5
Academic Year		
1st Year	81	20.3
2nd year	80	20.0
3rd year	82	20.5
4th year	77	19.3
5th year	80	20.0
GPA		
<3.0	185	46.3
>3.0	215	53.8
Consume caffeine in any form		
Yes	376	94.0
No	24	6.0

Table 2. Frequency distribution of consumption of Caffeine containing items by the study participants

Caffeine containing items	Frequency (N=400)	Percentage
Consume coffee		
Yes	187	46.8
No	213	53.2
Consume tea		
Yes	270	67.5
No	130	32.8
Consume soft drink		
Yes	238	59.5
No	16	40.5
Consume energy drink		
Yes	24	6.0
No	376	94.0
Eat chocolate		
Yes	215	53.8
No	135	46.2

Table 3. Distribution of variables regarding perceptions of students about caffeine consumption

Variables	Frequency	Percentage
Caffeine consumption increases academic performance		
Yes	286	71.5
No	114	28.5
Caffeine consumption increases IQ		
Yes	88	22
No	312	78
Caffeine helps in overnight study		
Yes	187	46.7
No	213	53.3
Caffeine increases self-confidence		
Yes	286	71.5
No	114	28.5
Caffeine increases reading power		
Yes	147	36.7
No	253	63.3
Caffeine increases recalling power		
Yes	310	77.5
No	90	22.5
Caffeine increases study hours		
Yes	180	45
No	220	55
Caffeine invigorate fatigue		
Yes	279	70.0
No	121	30.0
Caffeine improves group work activity		
Yes	300	75.0
No	100	25.0

Table 4. Characteristics of socio-demographics, caffeine containing substances consumption and Grade Pont Average (GPA)

Characteristics	GPA<3	GPA>3	Odds Ratio	p-value
Gender				
Male	88	78	1.593	
Female	97	137	Ref	0.023
Age in years				
<20	77	88	1.029	
>20	106	129	Ref	0.889
Consume caffeine containing items				
Yes	171	205	0.596	
No	14	10	Ref	0.225
Consume Coffee				
Yes	77	110	0.681	
No	108	105	Ref	0.057
Consume tea				
Yes	118	152	0.730	
No	67	63	Re	f0.141
Consume energy drink				
Yes	12	12	1.173	
No	173	203	Ref	0.704
Consume soft drink				
Yes	104	134	0.776	
No	81	81	Ref	0.215
Eat chocolate				
Yes	106	109	1.305	
No	79	106	Ref	0.187

Discussion

Caffeine is the most widely used drug all over the world. In this study majority of the medical students reported use of caffeine in different forms, coffee, tea, energy drinks and chocolate. Caffeine consumption was found popular among students. This study demonstrates that majority of the participating students self-perceive that caffeinated beverages improve the academic performance. However, no association was found between caffeine consumption and academic performance.

The most popular caffeinated beverage among students was tea followed by soft drinks and coffee respectively. Similar results have been reported by the study of Iran in which tea was the most popular beverage among high school students[16]. However, studies from Saudi Arabia and South Africa reported coffee and soft drinks were commonly consumed beverages among medical students[17,18]. This can be attributed to the fact that due to easy availability and inexpensiveness of tea, it is widely consumed in Indo-Pak.

It is a common perception that caffeinated drinks, for example coffee, tea, soft drinks, energy drinks, and chocolate, are being considered to enhance information processing speed, attention, and reaction time in humans[19]. In our study majority of students perceived that caffeine consumption increases academic performance, increases IQ, helps in overnight study, increases self-confidence, increases reading power, increases recalling power, increases study hours and provide energy and improves group activity. More than half of the students reported that caffeine improves academic performance, build confidence, promote group activity, energize them and relieve fatigue. Research studies from other parts of the world reported similar findings. A survey conducted in America showed that almost all students participated in the survey was consuming caffeine in one or other forms. The same survey reported that caffeine is the most popular substance in the campus with an average of 1106.23-1698.02 mg per week, increasing with year in school[20]. However, in contrast our findings, a study from Serbia revealed that the common reasons for caffeine intake among adolescents were leisure, peer influence and habit[21]. In contrast to general perceptions scientific evidence from different research studies showed no such relationship. A study conducted in Turkey on medical students showed similar results that students reported caffeine consumption improves cognitive performance[9]. A systematic review from University of California conducted on relationship between tea, coffee, caffeine consumption and cognitive decline. This review did not prove any significant association of reducing cognitive decline among tea and coffee consumer; hence research studies did not prove protective effect of coffee consumption and reduction in cognitive decline[22].

A study conducted on first year and second year students of University Puerto Rico Medical Sciences Campus showed that more than two third of students consumed caffeinated beverages and reported that it helps them awake during exam, decreases stress and work load but none of the factor was found significantly associated with academic stress or load on statistical analysis[23]. The findings of this study were consistent with the findings of our study. Our study did not report significant association of caffeine consumption with increased academic performance. Majority of students perceived that it decreases workload and stress and increases academic performance but in reality, it has not been proven by research and studies recommended that students should remain careful while consuming caffeinated beverages due to the harmful effects of caffeine. This false perception was promoted by media and social marketing of caffeinated drinks companies which attract youngsters.

In our study only 6% of students reported energy drinks consumption, which is a good sign and if medical students are aware of the side effects of energy drinks, they can counsel young and adolescent individuals in general population about the harmful effects of energy drinks. In contrast to our findings several other studies reported high consumption of energy drinks in medical school due to

the perception that it improves mental alertness because of caffeine content in energy drinks[24-26]. A qualitative study conducted in India on student's preparation in examination showed that addiction level during exam increases among students and consumption of tea, coffee, tobacco and smoking increased especially among those who studied late night[27]. The reason could be peer pressure, media and social marketing of energy drinks. This stimulated the young generation to get involved in caffeinated energy drinks.

Conclusion

This study concluded that high proportions of medical students were found consuming caffeine due to the misconception that caffeine increases academic performance. This study found no significant association with academic performance and caffeine consumption.

The present study had few limitations. Firstly, it was a cross-sectional study so temporal association and dose-response relationship could not be assessed. Secondly, the information regarding caffeine consumption and academic performance was obtained through self-reported questionnaire which could have led to recall bias. However, the major strength of this study was pre-tested questionnaire along with representative sample.

It is recommended that medical students should adopt healthy life style and use caffeine in moderation. The false perception that caffeine improves academic performance should be corrected by frequent health awareness sessions and seminars. The college canteen authority must provide healthy caffeine free beverages so students would have healthy choices. Recommendations should be made to the student health and counseling service on campus to implement measures, such as displaying posters in strategic locations or distribution of information leaflets, in an attempt to change the perception of students regarding caffeine consumption.

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Conflict of Interest

Authors have no conflict of interests and no grant/funding from any organisation for this study.

References

1. Ritter JM, Lewis LD, Mant TGK. A Textbook of Clinical Pharmacology; Chapter 7. 4th ed. London: Arnold; 1999. pp. 108-118.
2. Winston AP, Hardwick E, Jaberi N. Neuropsychiatric effects of caffeine [Online]. Advances in PsychiatricTreatment2005;11:432-9. Available from: http://apt.rcpsych.org/content/11/6/432. Accessed on July 20, 2017.
3. James JE. Critical review of dietary caffeine and blood pressure: a relationship that should be taken more seriously. Psychosom Med 2004;66:63-71.
4. James JE, Rogers PJ. Effects of caffeine on performance and mood: withdrawal reversal is the most plausible explanation. Psychopharmacology 2005;182:1-8. [DOI: 10.1007/s00213-005-0084-6].
5. Lopez-Garcia E, van Dam RM, Rajpathak S, Willett WC, Manson JE, Hu FB. Changes in caffeine intake and long-term weight change in men and women. Am J Clin Nutr 2006;83:674-80.
6. Christopher G, Sutherland D, Smith A. Effects of caffeine in non-withdrawn volunteers. Hum Psycho pharmacol 2005;20:47-53. [DOI: 10.1002/hup.658]
7. Hameleers PA, Van Boxtel MP, Hogervorst E, Riedel WJ, Houx PJ, Buntinx F, et al. Habitual caffeine consumption and its relation tomemory, attention, planning capacity and psychomotor performance across multiple age groups. Hum Psycho pharmacol 2000;15:573-81. [DOI: 10.1002/hup.218].
8. Malinauskas BM, Aeby VG, Overton RF, Carpenter-Aeby T, Barber-Heidal K. A survey of energy drink consumption patterns among college students. Nutr J 2007;6:35. [DOI: 10.1186/1475-2891-6-35].
9. Hidiroglu S, Tanriover O, Unaldi S, Sulun S, Karavus M. A survey of energy-drink consumption among medical students. J Pak Med Assoc 2013;63:842-5.
10. Usman A, Bhombal TS, Jawaid A, Zaki S. Energy drinks consumption practices among medical students of a private sector university of Karachi, Pakistan. J Pak Med Assoc 2015;65:105-7.

11. Pettit ML, DeBarr KA. Perceived stress, energy drink consumption, and academic performance among college students. J Am Coll Health 2011;59:335-41. [DOI: 10.1080/07448481.2010.510163].

12. O'Brien MC, McCoy TP, Rhodes SD, Wagoner A, Wolfson M. Caffeinated cocktails: energy drink consumption, high-risk drinking, and alcohol-related consequences among college students. Acad Emerg Med 2008;15:453-60. [DOI: 10.1111/j.1553-2712.2008.00085.x].

13. Mino Y, Yasuda N, Fujimura T, Ohara H. Caffeine consumption and anxiety and depressive symptomatology among medical students [Online]. Arukoru Kenkyuto YakabutsuIson Japanese Journal of Alcohol Studies & Drug Dependence 1990;25:486-96. Available from: http://europepmc.org/abstract/med/2085289. Accessed on August 15, 2017.

14. Velazquez CE, Poulos NS, Latimer LA, Pasch KE. Associations between energy drink consumption and alcohol use behaviors among college students. Drug Alcohol Depend 2012;123:167-72. [DOI: 10.1016/j.drugalcdep.2011.11.006].

15. Azagba S, Langille D, Asbridge M. An emerging adolescent health risk: caffeinated energy drink consumption patterns among high school students. Prev Med 2014;62:54-9. [DOI: 10.1016/j.ypmed.2014.01.019].

16. Khademalhossini Z, Ahmadi J, Khademalhosseini Z. Prevalence of Tea, Coffee and Nescafe Consumption among High School Students and its Relationship with Depression and Anxiety [Online]. Sociology and Criminology-Open Access 2015:3:1-6. Available from: https://www.omicsonline.org/open-access/prevalence-of-tea-coffee-and-nescafe-consumption-among-high-schoolstudents. Accessed on July 20, 2017.

17. Al-turki Y, Alenazy B, Algadheeb A, Alanazi M, Almarzouqi A, Alanazi A, et al. Caffeine Habits among Medical Students in King Saud University [Online]. IJSR 2016;5:754-64. Available from: https://www.ijsr.net/archive/v5i2/NOV161264.pdf. Accessed on July 20, 2017.

18. Lee KH, Human GP, Fourie JJ, Louw WA, Larson CO, Joubert G. Medical students' use of caffeine for 'academic purposes' and their knowledge of its benefits, side-effects and withdrawal symptoms [Online]. South African Family Practice 2009;51:322-7. Available from: https://safpj.co.za/index.php/safpj/article/download/1262/1583. Accessed on July 20, 2017.

19. Santos C, Lunet N, Azevedo A, de Mendonca A, Ritchie K, Barros H. Caffeine intake is associated with a lower risk of cognitive decline: a cohort study from Portugal. J Alzheimers Dis 2010;20 Suppl1:S175-85. [DOI: 10.3233/JAD-2010-091303].

20. Norton TR, Lazev AB, Sullivan MJ. The "buzz" on caffeine: Patterns of caffeine use in a convenience sample of college students [Online]. Journal of Caffeine Research 2011;1:35. Available from: http://online.liebertpub.com/doi/abs/10.1089/jcr.2010.0003. Accessed on July 20, 2017.

21. Milovanovic DD, Jakovljevic M, Scekic M, Djordjevic N. Caffeine consumption patterns and determinants among adolescents in Serbia. Int J Adolesc Med Health 2016. [DOI: 10.1515/ijamh-2016-0076].

22. Arab L, Khan F, Lam H. Epidemiologic Evidence of a Relationship between Tea, Coffee, or Caffeine Consumption and Cognitive Decline. Adv Nutr 2013;4:115-122. [DOI: 10.3945/an.112.002717].

23. Ríos LJ, Betancourt J, Pagán I, Fabián C, Cruz YS, González MA, et al. Caffeinated-beverage Consumption and its Association with Socio-demographic Characteristics and Self-perceived Academic Stress in First and Second Year Students at the University of Puerto Rico Medical Sciences Campus (UPR-MSC). P R Health Sci J 2013;2:95-100.

24. Attila S, Çakir B. Energy-drink consumption in college students and associated factors. Nutrition 2011;27:316-22. [DOI: 10.1016/j.nut.2010.02.008].

25. Scholey AB, Kennedy DO. Cognitive and physiological effects of an "energy drink": an evaluation of the whole drink and of glucose, caffeine and herbal flavouring fractions. Psychopharmacology (Berl) 2004;176:320-30. [DOI: 10.1007/s00213-004-1935-2].

26. Seidl R, Peyrl A, Nicham R, Hauser E. A taurine and caffeine containing drink stimulates cognitive performance and well being. Amino Acids 2000;19:635-42.

27. Datta SS, Boratne AV, Patil R. How medical undergraduates prepare for university examination: Lesson from teaching medical institution in South India [Online]. Indian Journal of Community Health 2012;24:352-5. Available from: https://doaj.org/article/941abc6e406f4068aa50044aee41f536. Accessed on July 20, 2017