ORIGINAL ARTICLE

CAFFEINE CONSUMPTION AND KNOWLEDGE AMONG FIRST YEAR MEDICAL STUDENTS IN A MALAYSIAN PRIVATE MEDICAL SCHOOL.

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Abstract

Introduction: This study aimed to determine the prevalence of caffeine consumption and to assess the students' knowledge on its benefits, side effects and withdrawal symptoms among first year medical students in a private medical school in Perak, Malaysia.

Methods: This cross-sectional study was conducted amongst 164 first year medical students in a private medical school through a self-administered pretested questionnaire. Using EpiInfo software version, minimum sample size calculated was 98 (90% confidence interval for hypothesised 33% frequency). Data collected were analysed using SPSS version 16.

Results: 103 out of 150 questionnaires were returned. Analysis showed 90% consumed caffeine, with coffee (58%) being the most commonly consumed caffeinated product; followed by hot chocolate / chocolate bars (49%), and caffeinated tea (44%). Students consumed multiple caffeine products for example coffee and chocolate bars. Staying awake (86%) was the most frequent reason given for its consumption. Other reasons included preference for the taste (86%) and health purposes (37%). Most of the students (43%) consumed less than 7 servings of caffeine in a week. The average scores for questions on the benefits, side-effects and withdrawal symptoms were all not more than 5 out of 10. More than 50% of the students had moderate knowledge in all 3 areas assessed. Less than 5% of the students had no knowledge in the 3 areas assessed.

Conclusion: The high percentage of caffeine consumption compared to the relatively low marks in the caffeine knowledge questionnaires indicated that most of the students were consuming caffeine without having adequate knowledge on its benefits, side effects and withdrawal symptoms.

Keywords: Caffeine, medical students

Introduction

Caffeine is a popular and widely consumed central nervous system stimulant. Global consumption of caffeine is estimated at 120,000 tonnes per year, equivalent to one serving of a caffeinated beverage daily per person. [1] Caffeine is found in coffee, tea, soft drinks and energy drinks (see Table 1). [2-6]

Caffeine is absorbed in the small intestine within 45 minutes of ingestion and is then disseminated throughout the body. [7] The peak serum concentration is reached within one to two hours. [8] In healthy adults, caffeine's half-life is approximately 3 to 7 hours. [9] Its half-life is decreased in heavy cigarette smokers by 30 to 50%, doubled by oral contraceptive pills usage, and increased in pregnancy. [10]

Caffeine is consumed for various reasons such as to increase in attention and concentration. Caffeine consumed in low doses increases alertness and decrease fatigue [11] and metabolic rate. [12]

Consumed in high doses (≥ 300mg = 2-3 cups of coffee) causes insomnia, reduction in control of fine motor movements (i.e. muscle twitching), and increases anxiety level. Chronic caffeine usage can lead to addiction and cause withdrawals. [13] Withdrawal symptoms include headache, irritability, inability to concentrate, drowsiness, insomnia, abdominal and joint pain, appearing within 12 to 24 hours after cessation of caffeine ingestion. The withdrawal symptoms peaks at approximately 48 hours, and usually last from 2 to 9 days. [14] Chronic caffeine usage causes an increase in blood pressure, which is associated with an increased risk in cerebrovascular accidents and myocardial infarction.

Excessive ingestion of caffeine of more than 1g over a limited time frame can cause tinnitus, severe agitation, visual light flashes, and cardiac arrhythmias. Ingestion of more than 10g may lead to death secondary to seizures and respiratory failure. [15]

Students, especially medical students, often need to study for extended periods of time during tests or examinations. Caffeine brings about both commendable benefits and undesirable side effects. Therefore, it is important to determine the extent of caffeine usage by medical students and their knowledge of its benefits, side effects and withdrawal symptoms.

The objectives are to study the caffeine usage (purpose, frequency, type of caffeinated products) and knowledge of its benefits, side effects and withdrawal symptoms among medical students in a Malaysian private medical school.

Methods

This cross-sectional study was done among the 164 first year medical students in a private medical school in Perak, Malaysia as a student research project in 2015. Using the EpiInfo software version 7, the minimum sample size required for this survey with 90% confidence interval was 98 (hypothesised frequency 33%) or 103 (hypothesised frequency of 50%) To allow for loss to follow up the sample size was increased to 150.

Prior approval was obtained from the medical school's research committee. A self-administered questionnaire was designed and pretested on a few fourth year medical students. The variables included the purpose of use of caffeine, types of caffeinated products consumed, frequency of caffeine consumption and students' knowledge of effects of caffeine (benefits, side-effects and withdrawal symptoms of caffeine). Students' knowledge was assessed through 30 questions, 10 for each section: benefits, side-effects and withdrawal symptoms. Each correct answer was allotted one mark. The participants' scores in each section testing their knowledge were calculated and categorised as 0 = no knowledge; 1-3 = little knowledge; 4-6 = moderate knowledge; and 7-10 = good knowledge). Average scores obtained by the students were tabulated.

A table of caffeine dosages in different types of caffeinated products was provided in the questionnaire for reference, as the authors felt that

some students might not be aware of the presence of caffeinated products in products such as Pepsi, Coca cola and hot chocolate and it would assist the students to estimate the number of servings (1 serving of caffeine = 100mg), they consumed per week.

All first year medical students were included. A total of 150 questionnaires were distributed when these students gathered for a whole class lecture. A letter stating the objectives of study and seeking consent from students was attached to the questionnaire. Answering the questionnaire was voluntary and students were given the option to answer or not to answer the questionnaire. The returned questionnaires were compiled and data entered into a computerised data based and analysed using the Statistical Package for Social Sciences version 16 for Windows (SPSS Inc, Chicago, IL, USA).

Results

Of the 150 questionnaires distributed, 103 were completed and returned, giving a response rate of 69%. This exceeded the minimum sample size of 98 required. There were 28 male students (27%) and 75 female students (73%) Malay (76%), Indian (16%) and others (8%). The mean age of the respondents was 19 years. The gender and ethnic distribution corresponded to that of the medical students' population in this medical college.

90% of the students consumed caffeine. The types of caffeinated products consumed are shown in Table II. Majority of the students favoured coffee (58%) followed by hot chocolate/chocolate bars (49%) and caffeinated tea (44%). Reasons for consumption of caffeinated products are listed in Table III. The majority (86%) consumed caffeine to stay awake (in class and to study). Most of the students (43%) consumed less than 7 servings of caffeine in a week (1 serving = 100 mg caffeine), followed closely by students who consumed it sporadically (41%) while 16% consumed 7 or more servings in a week.

Three areas on knowledge of caffeine tested on students, included knowledge of side effects, withdrawal symptoms and benefits of caffeine consumption. Each area contained 10 questions with a total of 10 marks. The average scores of each were calculated. Students' average scores were 5 out of 10 in the knowledge of side effects of caffeine, 4.8 in knowledge of withdrawal symptoms of caffeine and 4.2 in knowledge of benefits of caffeine consumption. The average total score for all 3 areas was 14.1 out of 30.

A detailed analysis on how students scored in these 3 areas are summarised in Table IV.

Discussion

The results indicated that 90% of the students consumed caffeine. This was consistent with the belief that caffeine was one of the most universally consumed psychoactive substances.[15] A previous study by Valek et al. on high school students in Croatia yielded similar results, with only 10% of students denied ever having consumed caffeinated products. [16]

The majority of the students preferred coffee (58%) followed by hot chocolate/chocolate bars (49%) and caffeinated tea (44%). Instant coffee and canned coffee were easily available in Malaysia, the most popular being Nescafe. Other caffeinated products such as hot chocolate, chocolate bars and caffeinated tea were all easily available. It was apparent that chocolate-flavoured foodstuff and tea were well-liked among the students. Relatively few students consumed caffeinated soft drinks and energy drinks. Energy shots were the least popular caffeinated product consumed by students probably due to the limited availability of the products and being less well known.

Caffeine consumption was often associated with increased mental alertness, attention and concentration. [17] It also had the desired effect of putting off and avoiding sleep, and enhanced performance during periods of sleep deprivation, [18] which was very common among medical students due to the demanding nature of the course. This was consistent with the results showing the majority of the students (86%)

consumed caffeine to stay awake in class or to study during the night. Health purposes was the third most common reason chosen by students (37%), generally attributed to caffeinated tea, which was the third most common type of caffeinated products consumed (44%). Tea had long been associated with various health benefits. In a study conducted in Zhejiang Province, China, it was found that people who consumed black tea had a lowered risk of stroke. [19] It has also been proven in a previous study that long-term black tea consumption lowered serum concentration of LDL cholesterol. [20] On the other hand, it was suggested that green tea did lessen body weight, but not to a clinically relevant level. [21]

For healthy adults (more than 18 years of age), 300- 400mg of caffeine could be consumed in a day without any major side effects. [22] This was approximately equivalent to 4 cups of coffee, 5 cans of Red Bull or 11 bottles of Coke. 1000mg or more of caffeine intake daily is considered excessive. [23] 43% of the students consumed less than 7 servings of caffeine in a week, which was equivalent to less than 700mg of caffeine. It was well within the safe limits of caffeine consumption. Only 16% of students consumed more than 700mg of caffeine weekly.

The average total score on caffeine knowledge was 14.1 out of 30. From the results obtained on the individual questions, it showed that substantial number of students (>50%) had moderate knowledge on all 3 areas of caffeine. In addition, the students were most aware of the side effects of caffeine (30% with good knowledge), followed by 29% on withdrawal symptoms and the least on the benefits (20%). These findings could be attributed to the fact that a large number of students chose 'substitute for sleep' as one of the benefits of caffeine. It was a misconception that was proven inaccurate in a study. During periods of sleep deprivation, performance and mood deteriorated, with caffeine having no net therapeutic effect. [24]

The high percentage of caffeine consumption compared to the relatively low marks in the caffeine knowledge questionnaires indicated that most of the students were consuming caffeine without having adequate knowledge on its benefits, side effects and withdrawal symptoms. This should be brought to attention, especially when health is found to be affected. By creating awareness of the possible impacts of caffeine consumption, medical students may be encouraged to adopt healthier lifestyles.

The limitations of this study included a study group which were young adults from the same medical college. These results may not be generalized to other student populations.

Also each student took different types of coffee, tea and other caffeinated products and in varying amounts. Hence, it was impossible to calculate the exact quantity of caffeine consumed. Lastly, the questionnaire could only cover the most common benefits, side-effects and withdrawal symptoms of caffeine but not all the effects of caffeine.

Conclusion

The high percentage of caffeine consumption and relatively low marks in the caffeine knowledge questionnaires indicated that most of the medical students were consuming caffeine without having adequate knowledge on its benefits, side effects and withdrawal symptoms. This issue should be made aware to medical students to encourage the understanding of this extensively consumed substance.

Acknowledgment

The authors would like to thank the students who participated in the study, the Faculty of Medicine, Universiti Kuala Lumpur Royal College of Medicine Perak, for approving the study and for publication.

Table 1. Caffeine Content in Selected Food and Drugs [6-10]

Caffeine Content in Selected Food and Drugs			
Product	**Serving size**	**Caffeine per serving (mg)**	**Caffeine (mg/L)**
Hershey's Milk Chocolate	1 bar (43 g)	10	—
Coffee, decaffeinated	207 ml	5–15	24–72
Coffee, espresso	44–60 ml	100	1,691–2,254
Tea – black, green, and other types	177 ml	22–74	124–416
Coca-Cola Classic	355 ml	34	96
Mountain Dew	355 ml	54	154
Pepsi Max	355 ml	69	194
Red Bull	250 ml	80	320

Table 2. Types of caffeinated products consumed by the students (multiple responses allowed in question)

Types of caffeinated products consumed	**Number (Percentage) of students (N=103)**
Coffee	60 (58%)
Caffeinated tea (iced or hot, i.e. green tea, black tea)	45 (44%)
Caffeinated soft drinks (i.e. Pepsi, Coke, vitamin enhanced water)	25 (24%)
Energy drinks (i.e. Red Bull, Monster) & Energy shots (i.e. Red Bull Shot)	23 (22%)
Others (i.e. hot chocolate, chocolate bar)	51 (49%)

Table 3. Reasons for consumption of caffeine (multiple responses allowed in question)

Reasons for consumption of caffeine	**Number (percentage) of students (N=103)**
To stay awake (i.e. in class, to study during the night)	89 (86%)
To release stress	23 (22%)
Like the taste	43 (42%)
Routine (i.e. breakfast)	11 (11%)
Health purposes (i.e. detoxification, weight loss)	38 (37%)

Table 4. Students' knowledge on side effects, withdrawal symptoms and benefits of caffeine.

Level of students' knowledge (based on marks obtained)	**Number (Percentage) of students with knowledge on: (N=103)**		
	Side Effects of Caffeine	**Withdrawal symptoms of Caffeine**	**Benefits of Caffeine**
No knowledge (0)	2 (2%)	5 (5%)	3 (3%)
Little knowledge (1-3)	17 (16%)	13 (12%)	24 (23%)
Moderate knowledge (4-6)	53 (52%)	55 (54%)	55 (54%)
Good knowledge (7-10)	31(30%)	30 (29%)	21 (20%)

References

1. Geoffrey Burchfield (1997). Meredith Hopes, ed. "What's your poison: caffeine". Australian Broadcasting Corporation. http://trove.nla.gov.au/work/6311564?q&sort=holdings+desc&_=1421760953010&versionId=45625306
2. "Caffeine Content of Food and Drugs". Nutrition Action Health Newsletter. Center for Science in the Public Interest. 1996. Archived from the original on December 2012. Retrieved December 2014. http://www.cspinet.org/reports/caffeine.pdf
3. "Caffeine Content of Beverages, Foods, & Medications". The Vaults of Erowid. 7 July 2006. https://www.erowid.org/chemicals/caffeine/caffeine_info1.shtml
4. "Caffeine Content of Drinks". Caffeine Informer. http://www.caffeineinformer.com/the-caffeine-database
5. Chin JM, Merves ML, Goldberger BA, Sampson-Cone A, Cone EJ (October 2008). "Caffeine content of brewed teas". J Anal Toxicol 32 (8): 702–4. PMID 19007524. http://www.ncbi.nlm.nih.gov/pubmed/19007524

6. Richardson, Bruce (2009). "Too Easy to be True. De-bunking the At-Home Decaffeination Myth". Elmwood Inn. http://elmwoodinn.com/about/caffeine.html
7. Liguori A, Hughes JR, Grass JA (1997). "Absorption and subjective effects of caffeine from coffee, cola and capsules". Pharmacol. Biochem. Behav. 58 (3): 721–6. PMID 9329065. http://www.ncbi.nlm.nih.gov/pubmed/9329065
8. "Koffazon". Swedish Drug Catalog. 10 February 2010. http://www.catalog.md/drugs/koffazon.html
9. "Caffeine". DrugBank. University of Alberta. 16 September 2013. http://www.drugbank.ca/drugs/DB00201
10. Fredholm BB, Bättig K, Holmén J, Nehlig A, Zvartau EE (1999). "Actions of caffeine in the brain with special reference to factors that contribute to its widespread use". Pharmacol. Rev. 51 (1): 83–133. PMID 10049999. http://www.ncbi.nlm.nih.gov/pubmed/10049999
11. Smith, A (2002). "Effects of caffeine on human behavior". Food and Chemical Toxicology 40 (9): 1243–55. PMID 12204388. http://www.umfcv.ro/files/e/f/Effects%20of%20caffeine%20on%20human%20behavior.pdf
12. Acheson, KJ, Zahorska-Markiewicz, B, Pittet, P, Anantharaman, K, Jéquier, E (1980). "Caffeine and coffee: Their influence on metabolic rate and substrate utilization in normal weight and obese individuals". The American Journal of Clinical Nutrition 33 (5): 989–97. PMID 7369170. http://www.researchgate.net/publication/15830271_Caffeine_and_coffee_their_influence_on_metabolic_rate_and_substrate_utilization_in_normal_weight_and_obese_individuals
13. Juliano, LM, Griffiths, RR (2004). "A critical review of caffeine withdrawal: Empirical validation of symptoms and signs, incidence, severity, and associated features". Psychopharmacology 176 (1): 1–29. PMID 15448977. http://www.ncbi.nlm.nih.gov/pubmed/15448977
14. First Aid for the Psychiatry Clerkship. Third Editon 2011. Latha Ganti Stead, Matthew S. Kaufman, Jason Yanofski. McGraw Hill Medical. ISBN 978-007-132438-0
15. James JE. Critical review of dietary caffeine and blood pressure: a relationship that should be taken more seriously. Psychosom Med 2004;66:63–71. http://www.ncbi.nlm.nih.gov/pubmed/14747639

16. Valek M, Laslavia B, Laslavia Z. Daily caffeine intake among Osijek high school students: questionnaire study. Croatia Medical Journal 2004;45:72–5. http://www.ncbi.nlm.nih.gov/pubmed/14968457?dopt=Abstract
17. Bolton S (1981). "Caffeine: Psychological Effects, Use and Abuse". Orthomolecular Psychiatry 10 (3): 202–211. http://orthomolecular.org/library/jom/1981/pdf/1981-v10n03-p202.pdf
18. Snel J, Lorist MM (2011). "Effects of caffeine on sleep and cognition". Prog. Brain Res. Progress in Brain Research 190: 105–17. ISBN 978-0-444-53817-8. PMID 21531247 http://www.ncbi.nlm.nih.gov/pubmed/21531247
19. Shen L, Song LG, Ma H, Jin CN, Wang JA, Xiang MX (August 2012). "Tea consumption and risk of stroke: a dose-response meta-analysis of prospective studies". J Zhejiang Univ Sci B (Review) 13 (8): 652–62. PMC 3411099. PMID 22843186. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3411099/
20. Hartley L, Flowers N, Holmes J, Clarke A, Stranges S, Hooper L, Rees K (June 2013). "Green and black tea for the primary prevention of cardiovascular disease". Cochrane Database Syst Rev (Systematic Review and Meta-Analysis) 6: CD009934.PMID 23780706. http://www.ncbi.nlm.nih.gov/pubmed/23780706
21. Johnson R, Bryant S, Huntley AL (December 2012). "Green tea and green tea catechin extracts: an overview of the clinical evidence". Maturitas (Review) 73 (4): 280–7. PMID 22986087. http://www.ncbi.nlm.nih.gov/pubmed/22986087
22. “Caffeine: How much is too much?” Mayo Clinic. 14 April 2014. http://www.mayoclinic.org/healthy-living/nutrition-and-healthy-eating/in-depth/caffeine/art-20045678?pg=1
23. “Caffeine in the diet”. Medline Plus. 30 April 2014. http://www.nlm.nih.gov/medlineplus/ency/article/002445.htm
24. Shepard JD, Al'Absi M, Whitsett TL, Additive pressor effects of caffeine and stress in male medical students at risk for hypertension. Am J Hypertens 2000; 13: 475–81. http://www.ncbi.nlm.nih.gov/pubmed/10826397?dopt=Abstract