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)

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Objective: To determine the association between caffeinated-beverage consumption, self-perceived academic load, and self-perceived stress levels in first and second year students at UPR-MSC.

Methods: A descriptive epidemiological study was performed using a self-administered anonymous questionnaire given to a representative stratified sample of 275 students. Questions included information regarding socio-demographic characteristics, academic load and stress indicators, and caffeinated-beverage consumption. Chi^2 was used to assess the associations between these variables.

Results: Most participants were women (68%), aged 21-30 years (88%), with low annual household incomes (43%). Most perceived their academic loads as being heavy (68%), and most perceived their academic stress levels as being moderate (37%). Academic load was significantly correlated with stress level (p<0.001). About 88% of the participants reported consuming caffeinated beverages; of those, 87% drank soft drinks, 83% drank coffee, 56% drank hot chocolate, 40% drank tea, and 29% drank energy drinks, all of which were—according to the participants (54%)—used mainly to stay awake. Soft drinks and coffee intake increased in periods of high stress, and many (49%) reported that these beverages were useful for coping with stress. Energy drinks, in particular, were consumed more often by men compared to women (p<0.05). None of these beverages were significantly associated with academic stress or load.

Conclusion: Consuming caffeinated beverages is a popular practice among participants in this sample, with soft drinks and coffee being the ones that are the most frequently consumed. No associations were found between the consumption of caffeinated beverages and academic stress or load. [*P R Health Sci J 2013;2: 95-100*]

Key words: College students, Academic load, Academic stress, Caffeinated beverages

College students are vulnerable to stress as a result of the daily academic challenges they face (1). Stress is a rising public health problem with important consequences in terms of the general well-being and health of the population (1,2). Stress is the result of an individual's perception of lacking the needed resources to cope effectively with a given situation (3). Academic stress, in particular, occurs when an individual is confronted with a stressful educational-environment situation that is perceived to be overwhelming and with which the individual cannot effectively cope (4,5).

Academic stressors include excessive homework and tasks, unclear assignments, weekly tests, lack of time management skills, uncomfortable classrooms, grades, sleeping difficulties and problems with teachers and/or classmates (6-7). Health professions students often experience high levels of stress as a result of information overload (5,8).

Students experience psychological or physical reactions to stressors when they perceive excessive stress (9). Some of the reactions associated with stress could be emotional (such as hostility, anxiety disorders, and depression), physical (such

as headaches, fatigue, sleep difficulties, and even high blood pressure and loss of appetite); behavioral (such as inability to concentrate, attention loss, lack of focus and use of illegal substances, among others); or related to social conflicts (10).

The strategies used to resolve stressful situations are referred to as coping mechanisms (11,12), and it involves changing the individual's appraisal of a situation or mentally reframing it to make it less stressful (10). Individual factors that influence how students cope with academic stressors include age, gender, ethnic, cultural, and socioeconomic characteristics. The academic stress associated with the need to perform well and obtain good grades may promote the use of stimulating beverages to maintain alertness and extend study time. The consumption of caffeinated beverages is one of the coping strategies used by college students in the management of stressful academic situations, as has been reported in several studies (3,9,13).

Caffeinated beverages include coffee, tea, hot chocolate, soft drinks, and energy drinks (14). The main active ingredient in caffeinated beverages is caffeine (15), one of the most widely consumed pharmacologically active substances in the world (14). About 87% of individuals in the United States (US) consume food and/or beverages containing caffeine, with a reported average caffeine consumption of 149.8 mg per day from all caffeine sources, which are primarily coffee (71%), soft drinks (16%), and tea (12%) (16). A recent study conducted at two different medical schools in Puerto Rico found that 56.2% of the sample members consumed caffeine, getting it mainly from coffee (17). There are other components present in some caffeinated beverages, including herbal extracts such as guarana, ginseng, and gingko biloba; B vitamins; amino acids such as taurine; amino acid derivatives such as carnitine; and sugar derivatives including glucuronolactone and ribose (18). The acute and long-term effects resulting from excessive and chronic consumption of these additives alone and/or in combination with caffeine are not known (15). However, excessive caffeine consumption can produce harmful health and nutritional consequences, such as promoting diuresis and natriuresis, a reduction in insulin sensitivity, an increase in blood pressure, chronic daily headaches, and even death (15,19). Caffeine also increases alertness, improves memory, and enhances mood and decreases stress symptoms, but only if it is consumed in moderation.

Although numerous studies have evaluated the impact of stress in college students, and a recent study in Puerto Rico evaluated the use of caffeinated beverages by medical students, little is known regarding the association between caffeinated-beverages consumption (as a stress coping strategy), academic load, and stress in college students in Puerto Rico. In addition, there is concern about the high levels of stress in health professions students. Therefore, the aim of this study was to determine the association between caffeinated-beverage consumption, self-perceived academic load, and self-perceived stress levels among first and second year students at UPR-MSC.

Methods

Study Design and Sample

This descriptive epidemiological study examined a representative stratified sample of 275 college students who completed their first or second year at UPR-MSC in the period spanning from August 2010 to May 2011. The distribution was as follows: 34.2% from Medicine, 28.7% from Public Health, 16.7% from Health Professions, 12.0% from Nursing, 5.5% from Dental Medicine and 2.9% from Pharmacy. Students in their third or fourth year, those in special enrollment programs or enrolled in joint programs, and those who were pregnant were excluded from participating in the study. The Institutional Review Board for Research with Human Subjects of UPR-MSC approved the study protocol in August 2011.

Data Collection

Subjects were recruited through email, flyers posted in strategic locations around the campus, and direct contact. Students were informed of the study protocol, and those willing to participate anonymously completed a self-administered questionnaire.

Questionnaire

An expert-validated questionnaire was developed for this study. The expert group was composed of professionals with background in nutrition, biochemistry, and psychology, who assessed and approved the questions used. Participants completed the questionnaire on August 2011 but were instructed to answer retrospectively, based on their experiences during the academic period covering from January to May 2011. This questionnaire consisted of several sections, and took approximately 30 minutes to complete. The sections were:

I) Demographic data, which section included age (years), gender (men or women), and annual household income (low [$0 – $24,999], moderate [$25,000 – $74,999], or high [$75,000 – >$100,000]).

II) Academic load perception, which section included a question used to identify the student's perception regarding his or her academic load. The available responses to choose from included: low, moderate, and heavy.

III) Academic stress perception, which section included a previously validated stress questionnaire adapted from the Systemic Cognitive Model of Academic Stress (20). This questionnaire was tested using Cronbach's Alpha (0.895), which itself provided a measure of the degree to which situations in the student's academic life were appraised as stressful, and which can, in addition, be used as an outcome measure of experienced levels of

academic stress. Students reported how frequently they experienced certain physiological, psychological, and behavioral responses to stress. Each response was scored using the Lickert scale (with a score from 1 to 5), and the maximum possible score attainable when combining the scores from each response was 50. Academic stress level was classified as low (<25 points), moderate (25-35 points), or high (>35 points).

IV) Caffeinated beverages, which section was used to determine how prevalent caffeinated-beverage consumption is among college students and which type of beverage was the most common in this population. The questionnaire included a frequency pattern table preceded by the following question: "In the academic period covering from January to May 2011, how many times did you consume a caffeinated-beverage of any type?". Respondents were asked to report (for the 5 most common caffeinated beverages on the market, which included coffee, tea, hot chocolate, soft drinks, and energy drinks) the portions and frequency of their consumption. Caffeinated-beverage consumption was estimated (in ounces per day) by multiplying the portion (ounces) by the frequency (as indicated for each type of beverage). Additionally, other questions explored reasons for consuming caffeinated beverages as well as their effectiveness as a coping strategy.

A copy of the questionnaire is available from the senior author upon request.

Statistical Analysis

We used mean, standard deviation and range to describe the socio-demographic profile, perception of academic load, perception of stress, and consumption of caffeinated beverages, while percentage and frequency distribution were used for categorical variables. Caffeinated-beverage consumption was analyzed in tertiles for highly consumed beverages, such as soft drinks and coffee; a dichotomous category (used or not used) was used for the beverages less frequently consumed, such as tea, hot chocolate, and energy drinks. Chi^2 (Fisher's exact test and Pearson's chi-squared test) was used to establish the association between self-perceived academic load and stress and caffeinated-beverage consumption. All analyses were performed with the Statistical Package for the Social Sciences (SPSS), version 17.0. Significance was set at $p<0.05$.

Results

Table 1 shows the socio-demographic characteristics of the sample. A representative sample of 275 students completed the questionnaire. Most of the participants were women (67.6%), ranged in age from 21 to 30 years (88.0%), and lived in homes with low annual household incomes (42.7%).

Table 1. Socio-demographic characteristics of the sample (n = 275)

Variables	Categories	(%)
Gender	Men	32.4
	Women	67.6
Age	21 to 30 years	88.0
	31 to 53 years	12.0
Household Income	Low	42.7
	Moderate	36.8
	High	20.5

Academic load was perceived as low by 2.8% of the sample, as moderate by 28.8%, and as heavy by 68.4%. Academic stress was perceived as low by 31.6% of the sample, moderate by 36.7%, and high by 31.6%. There was a significant association between academic load and academic stress levels (r = 0.25; p<0.001).

Figure 1 shows the distribution of caffeinated-beverage consumption. In general, 88.3% of the sample reported consuming caffeinated beverages; of these, 87.0% consumed soft drinks, 83.0% consumed coffee, 56.0% consumed hot chocolate, 40.0% consumed tea, and 29.0% consumed energy drinks. The overall estimated consumption of caffeinated beverages by socio-demographic characteristic is shown in Table 2. There was a significant association between gender and caffeinated-beverage consumption, in that a greater proportion of men than women consumed energy drinks (38.8%; p<0.001).
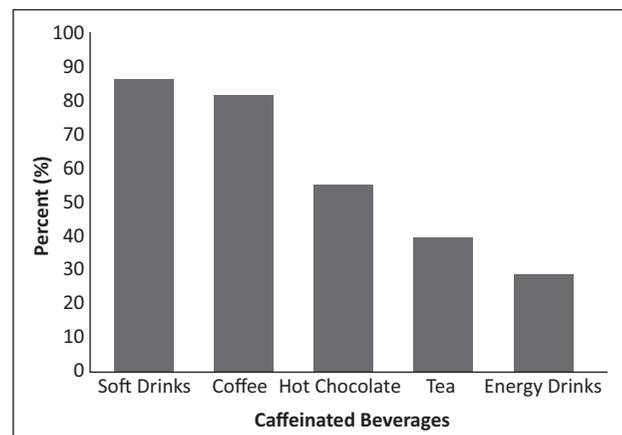
Figure 1. Distribution of caffeinated-beverage consumption in the sample (n = 272)

Table 3 shows the association between caffeinated-beverage consumption and self-perceived academic load and stress levels in the sample. There was no significant association between these variables and soft drink, coffee, hot chocolate, or energy-drink consumption (p>0.05).

Figure 2 shows the changes in the different types of caffeinated-beverage consumption in periods of high stress. Most students reported a considerable increase in their consumption of soft drinks (65.4%) and coffee (55.0%) in moments of high stress

Table 2. Caffeinated-beverage consumption by socio-demographic characteristic (n = 272)†
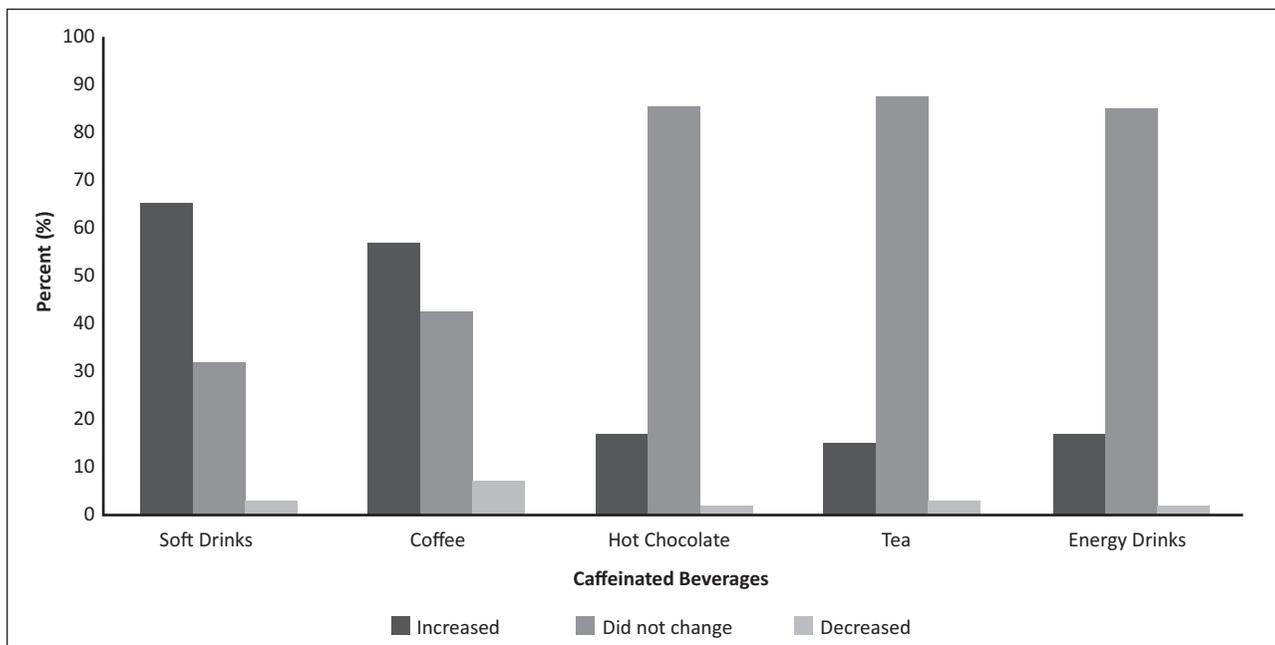
Variables	Caffeinated beverages (%)											
	Coffee			Tea		Hot chocolate		Soft drinks			Energy drinks	
	<0.34	0.34-7.99	≥8.00	Not used	Used	Not used	Used	<0.96	0.96-9.42	≥9.43	Not used	Used
Age												
21-30 y	34.2	26.2	39.7	65.0	35.0	51.1	48.9	28.8	37.9	33.3	73.8	26.3*
31-53 y	25.0	15.6	59.4	64.3	35.7	37.5	62.5	41.9	32.3	25.8	90.6	9.4
Gender												
Men	29.2	28.1	42.7	60.7	39.3	64.0	36.0	25.3	38.6	36.1	64.4	35.6*
Women	35.0	23.3	41.7	66.1	33.9	42.2	57.8	32.9	36.5	30.5	81.1	18.9
Annual Household Income												
Low	31.9	26.5	41.6	57.4	42.6	43.5	56.5	36.0	39.6	24.3	75.7	24.3
Moderate	39.0	25.0	36.0	73.0	27.0	49.0	51.0	26.7	38.9	34.4	76.0	24.0
High	25.0	21.4	53.6	62.5	37.5	62.5	37.5	24.5	28.6	46.9	75.0	25.0

*Statistical significance were found using Chi² at p<0.05; †3 participants did not complete this section of the questionnaire and so were not included in the analysis.

Table 3. Association between caffeinated-beverage consumption, self-perceived academic load and self-perceived stress (n = 272)†

Variables	Caffeinated beverages											
	Coffee			Tea		Hot chocolate		Soft drinks			Energy drinks	
	<0.34	0.34-7.99	≥8.00	Not used	Used	Not used	Used	<0.96	0.96-9.42	≥9.43	Not used	Used
Academic load (%)												
Light/Moderate	34.8	28.4	32.1	31	34	27.3	36.8	34.2	34.4	27.5	33.0	29.2
Heavy	65.2	71.6	67.9	69	66	72.7	63.2	65.8	65.6	72.5	67.0	70.8
Academic stress (%)												
Low	18.0	4.5	14.2	12.6	14.4	12.0	14.0	10.5	16.1	14.8	14.1	10.6
Moderate	58.4	61.2	62.8	58.3	64.9	61.7	61.0	65.8	58.1	59.3	58.3	66.7
Heavy	23.6	34.3	23.0	29.1	20.6	26.3	25.0	23.7	25.8	25.9	27.7	22.7

*No significant associations were found using Chi² at p<0.05; †3 participants did not complete this section of the questionnaire and so were not included in the analysis.

Figure 2. Student perceptions regarding changes in his/her consumption of caffeinated beverages in moments of high stress (n = 272)

while the consumption rates of the other beverages mainly remained unchanged.

A large minority of the students (49.0%) reported that the consumption of caffeinated beverages was useful for coping with stress, and most of them (42.6%) admitted that they would probably re-use caffeinated beverages as a stress coping strategy in the future (data not shown in tables). The main reasons for consuming these beverages were that they (the drinks) made it possible to stay awake for long periods of time (54.0%), "other reasons" (unspecified) (19.0%), that the consumption of such beverages formed part of their routine (18.0%), that they (the drinks) made it possible to improve their concentration (12.0%), and that they (the drinks) acted as meal substitutes (8.0%).

Discussion

College students are constantly influenced by multiple stressors arising both from different aspects of their lives and from society (21). Academic stress—life itself—often generates difficulties, having an impact on the quality of life of many, even most, college students. The results of the present study were able to determine that the majority of the participating students self-perceive their academic loads and stress levels as being, respectively, heavy and moderate. In addition, this study shows that the consumption of caffeinated beverages is a popular practice among this group of students. However, no association was found between caffeinated-beverage consumption and academic stress or load.

The most popular caffeinated beverages among students were soft drinks and coffee, and their consumption increased in periods of high stress. Similar results were found in a study conducted at two medical schools in Puerto Rico, in which study, investigators found a high consumption of caffeine-containing products among students, in particular, coffee (56.2%) and energy drinks (27.0%) (17). That study also found that students used these beverages to stay awake (56.1%), which agrees with one of the main reasons detailed in the present report.

Energy-drink consumption was significantly associated with gender, in that men reported a higher consumption of energy drinks than women did. Similarly, a study performed with 136 US undergraduates pursuing health-related degrees also found men reporting higher consumption of energy drinks than women (22). Furthermore, a study in 496 US college students (19) and another study conducted with a stratified random sample of 4,271 college students from 10 universities in North Carolina both found that the majority of energy drink consumers were men (18).

The use of energy drinks is also popular among college students at many universities. The previously mentioned survey conducted in 496 US college students found that 51.0% of the participants reported consuming 1 or more energy drinks in an average month for the current (at the time of the study) semester (19). The study conducted with college students from North Carolina found that 24% of the participants reported having consumed 1 or more energy drinks in the past 30 days (18). Furthermore, in the previously mentioned study (that which assessed energy-drink consumption in 136 college students), investigators found a positive correlation between participants' perceived stress and energy-drink consumption (22); however, we were not able to detect this association in the present analysis. To our knowledge, there are no other published studies investigating this relationship.

A possible explanation for the consumption of caffeinated beverages by college students, particularly those from health-related sciences schools, is that they are subject to constant and increasing academic loads, and, consequently, to academic stress (12), and they take advantage of the effects of stimulating beverages to improve academic performance (17). Smith and colleagues found that, compared to placebos, caffeinated beverages had energizing effects on 18- to 55-year-old participants (23). Caffeine is the primary constituent responsible for these energizing effects. Although there is no human requirement for caffeine, even low doses of caffeine (12.5 to 100 mg) can improve cognitive performance and mood. However, chronic high caffeine ingestion is associated with central nervous system, cardiovascular, gastrointestinal, and renal dysfunction, as such ingestion promotes diuresis and natriuresis, reduces insulin sensitivity, increases blood pressure, leads to chronic daily headaches, and can even lead to death (15).

The present study had several limitations. The information on the questionnaire was self-reported by students, and the questions included were retrospective, which could have led to recall-bias. This study was not able to evaluate changes in the consumption of caffeinated beverages over time. We measured only the broad categories of these beverages, such as coffee, tea, hot chocolate, soft drinks, and energy drinks, and did not measure sub-categories, such as calming or relaxing teas, and non-caffeinated soft drinks. Also, we did not measure other stressors, such as medical conditions. On the other hand, the present study had several strengths, such as including a representative sample of students from the UPR-MSC campus and using a previously validated questionnaire for estimating academic stress.

In conclusion, the prevalence of caffeinated-beverage consumption was high in this sample (which is consistent with previous reports), with soft drinks and coffee being the most frequently consumed of the beverages in question. Soft drink and coffee consumption, particularly, increased in high stress periods, and were used mainly to stay awake. Energy-drink consumption was significantly higher in men, but no significant associations were found between caffeinated-beverage consumption and academic stress or load in this sample.

Importantly, the results of the present study describe the pattern of caffeinated-beverage consumption among students on this campus. The abuse of caffeinated beverages, particularly energy drinks, has been linked to many health consequences.

For that reason, health-related professionals need to be aware of the consequences of energy-drink consumption and be prepared to provide appropriate community education. Our results also emphasize the need for further studies, particularly longitudinal studies. Future research should identify whether college students recognize the amounts of caffeine that are present in the wide variety of caffeinated beverages that they are consuming, the amounts of caffeine that they are consuming in various situations, and the physical side effects associated with caffeine consumption. Also, the findings of this study indicate a need for stress management programs at UPR-MSC, such as stress and effective coping strategies workshops. A focus on students' needs and problems can help prevent the harmful effects that stress has on health and academic performance.

Resumen

Objetivo: Determinar la asociación entre el consumo de bebidas cafeinadas, nivel de carga académica y estrés académico auto-percibidos de los universitarios de primer y segundo año de UPR-RCM. Metodología: Se realizó un estudio epidemiológico descriptivo utilizando un cuestionario anónimo auto-administrado en una muestra representativa de 275 sujetos que incluyó preguntas sociodemográficas, indicadores de carga y estrés académicos, y consumo de bebidas cafeinadas. Se utilizó Ji2 para determinar la asociación entre variables. Resultados: La mayoría de los participantes eran mujeres (68%), de 21-30 años (88%) y con ingreso familiar anual bajo (43%). El 68% de la muestra percibió su carga académica como fuerte y 37% percibió su estrés académico como moderado. Se observó una asociación significativa entre carga académica y nivel de estrés académico (p<0.001). El 88% de los participantes consumió bebidas cafeinadas; de estos, 87% bebió refrescos, 83% bebió café, 56% bebió chocolate caliente, 40% bebió té y 29% bebió bebidas energizantes. De los que consumieron bebidas cafeinadas, 54% reportó usarlas para mantenerse despiertos y el 49% indicó que fue una estrategia efectiva. El consumo de refrescos y café aumentó en periodos de mayor estrés académico. Las bebidas energizantes, particularmente, fueron utilizadas mayormente en hombres (p<0.05). Ninguna de estas bebidas se asoció significativamente con el estrés o carga académica. Conclusión: El consumo de bebidas cafeinadas es una práctica popular en esta muestra, principalmente el refresco y el café. No se encontraron asociaciones entre el consumo de bebidas cafeinadas y estrés o carga académica.

Acknowledgments

References

1. Bjorksten O, Sutherland S, Miller C, Stewart T. Identification of medical student problems and comparisons with those of other students. J Med Educ 1983;58:759-767.
2. Misra R, McKean M. College students' academic stress and its relation to their anxiety, time management, and leisure satisfaction. Am J Health Stud 2000;16:41-52.
3. Lazarus RS. Coping theory and research: Past, present, and future. Psychosom Med 1993;55:234-247.
4. Agolla JE, Ongori H. An assessment of academic stress among undergraduate students: The case of University of Botswana. Educ Res Rev 2009;4:63-70.
5. Firth-Cozens J, Morrison L. What stresses health professionals? A coding system for their answers. Brit J Clin Psychol 1986;25:309-310.
6. Kohn J, Frazer G. An academic stress scale: Identification and rated importance of academic stressors. Psychol Rep 1986;59:415-426.
7. Ross S, Niebling B, Heckert T. Sources of stress among college students. Coll Stud J 1999; 33:312-317.
8. Bushby P. Tackling the knowledge explosion without overloading the student. Aust Vet J 1994;71:372-374.
9. Thoits PA. Stress, coping, and social support processes: Where are we? What next? J Health Soc Behav 1995;Spec No:53-79.
10. Williams SM, Arnold PK, Mills JN. Coping with stress: A survey of Murdoch University veterinary students. J Vet Med Educ 2005;32:201-212.
11. Zohar D. When things go wrong: The effect of daily work hassles on effort, exertion and negative mood. J Occup Organ Psychol 1999;72:265-283.
12. Diaz Y. Estrés académico y afrontamiento en estudiantes de Medicina. Rev Hum Med 2010;10:1-10.
13. Lazarus RS, Folkman S. Stress, Appraisal, and Coping. New York, NY: Springer Publishing Company; 1984
14. Acheson KJ, Gremaud G, Meirim I, Montigon F, Krebs Y, Fay LB, et al. Metabolic effects of caffeine in humans: Lipid oxidation or futile cycling? Am J Clin Nutr 2004;79:40-46.
15. Reissig CJ, Strain EC, Griffiths RR. Caffeinated energy drinks--A growing problem. Drug Alcohol Depend 2009;99:1-10.
16. Food and Drug Administration. Caffeine intake by the US population. 2010. Available at: http://www.fda.gov/downloads/AboutFDA/CentersOffices/OfficeofFoods/CFSAN/CFSANFOIAElectronicReadingRoom/UCM333191.pdf. Accessed January 14, 2013.
17. Arce M, Brunet K, Jimenez A, Mansilla P, Sheplan P, Vanoni A et al. El uso de estimulantes con o sin receta para el aprovechamiento académico entre estudiantes de medicina en Puerto Rico. Rev Puerto Med Salud Pub 2011;26:24-33.
18. O'Brien MC, McCoy TP, Rhodes SD, Wagoner A, Wolfson M. Caffeinated cocktails: energy drink consumption, high-risk dinking, and alcohol-related consequences among college students. Acad Emerg Med 2008;15:453-460.
19. 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;6:1-10
20. Barraza Macías, A. Un modelo conceptual para el estudio del estrés académico. Rev Electr Psicol Iztacala 2006;9:110-129.
21. Guo YJ, Wang SC, Johnson V, Diaz M. College students' stress under current economic downturn. Coll Stud J 2011;45:536-543.
22. Pettit ML, DeBarr KA. Perceived stress, energy drink consumption, and academic performance among college students. J Am Coll Health 2011;59:335-341.
23. Smith HJ, Cotton JR, Hughes SC, Rogers PJ. Mood and cognitive performance effects of "energy" drink constituents: caffeine, glucose and carbonation. Nutr Neurosci 2004;7:127-139.