Factors Associated with Consumption of Caffeinated-Beverage among Siriraj Pre-Clinical Year Medical Students, A 2-Year Consecutive Survey

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Background: *Previous studies showed that significant proportion of medical students consumed caffeine to face sleep-deprived daily schedules.*
Objective: *To monitor the trend of caffeinated-beverage consumption among Siriraj medical students as well as to study possible factors associated with caffeine dependency.*
Material and Method: *The questionnaire was distributed to a class of medical students for 2 consecutive years. Statistical analysis was performed for descriptive purpose.*
Results: *269 (89.7%) and 225 (74.5%) questionnaires were returned in year 1 and year 2, respectively 16.2% refused to take caffeine-beverages totally. 13% of those who consumed caffeinated-beverages developed caffeine dependence. From logistical analysis, positive history of smoking-family member and female sex were the only other two factors associated with caffeine dependency (OR 2.19, 95% CI 1.04-4.61 and 1.76, 95% CI 1.01-3.07, respectively). Other investigated factors included: exercise (p = 0.08); sleep hours (p = 0.24); reading beverage labels (p = 0.87); alcohol consumption (p = 0.59); class performance (p = 0.87); family member coffee-drinking habits (p = 0.66); family member alcohol-drinking habits (p = 0.18); and family income (p = 0.06).*
Conclusion: *Caffeinated-beverage consumption was common among Siriraj medical students. No significant change was detected in the pattern of caffeinated-beverage consumption within the study period. Positive history of smoking family members and female sex were found as the only other two factors correlated with caffeine dependency.*

Keywords: *Caffeine dependence, Caffeine consumption, Medical student, Self-report, Caffeine labeling*

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The pattern of caffeine consumption in one population links closely to behavioral as well as cultural factors[1]. Previous studies reported that 80% of adult US population regularly consumes caffeine with mean daily caffeine consumption of 285 mg/day[2]. Even though caffeine consumption leads very rarely to severe health risks, studies have shown that only 30 mg or less of caffeine can alter mood and affect behavior. At high dose of caffeine, typically greater than 300-400 mg, it can cause arrhythmia, sleeping-disorder, anxiety as well as trigger psychosis[3].

In the central nervous system, caffeine counteracts with adenosine-a neurotransmitter inhibitor. This process increases brain stimulators including acetylcholine, epinephrine, dopamine, and serotonin. The withdrawal of these stimulators results in several psychiatric syndromes e.g. caffeine intoxication, caffeine withdrawal, caffeine dependence, caffeine-induced sleep disorder, and caffeine-induced anxiety disorder[4,5].

Recreationally, caffeine is used to provide a "boost of energy" or a feeling of heightened alertness. Previous studies showed that significant proportion of medical students consumed caffeine to face sleep-deprived daily schedules[6,7]. The present study aimed to investigate the amount of caffeine intake, caffeine dependence as well as factors influencing caffeinated-beverage consumption among Siriraj medical students.

Objective

To monitor the trend of caffeinated-beverage

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consumption among Siriraj medical students as well as to investigate possible factors that associated with caffeine dependency.

Material and Method

The present study was approved by Siriraj ethical committee-755/2553 (EC2). In order to study the outcomes of interest, a pilot questionnaire was developed. The first part of the questionnaire was designed to obtain baseline characteristics of the study population including sex, age, GPA, body weight, and height (Table 1).

There was also a part of self-evaluating for caffeine dependency, adapted from the shorter PROMIS questionnaire[8,9], incorporated in this survey. The diagnostic criteria for caffeine dependence include withdrawal symptoms after cessation and at least one of the following 3 criteria:

1) Endorsed use despite knowledge of physical or physiological problems associated with caffeine

2) Tolerance to caffeine

3) Desire or unsuccessful attempts to control use[10].

Caffeine ingredients of various beverages were also provided within the questionnaire (Table 2) for which medical students could estimate their own amount of caffeine consumption.

The pilot study was first performed in a sample group of 2nd year medical students in December 2010. The adjusted questionnaire was distributed to the same class of medical students for 2 consecutive years. As getting high response rate was critical, the authors scheduled the survey dates to be on the same day that all medical students would be gathered in one lecture hall. Three research assistants were assigned to collect the questionnaires after announcing a brief purpose of the project.

All medical students were also informed that the decision to enroll in the present study was entirely voluntary and those who did not wish to complete the questionnaire could leave the lecture hall without hesitation. The same questionnaire process was repeated in the following year when the class returned as 3rd year medical students.

Medical student identity was hidden totally. The data were secured in a locked cabinet until the 2nd collecting process was completed. The statistical analysis was performed using SPSS. To compare continuous and categorical data, student t-test and chi-square test were used as appropriate.

Table 1. Baseline characteristic of participants

	Female (SD)	Male (SD)
Age (year)	20.00 (0.72)	20.00 (0.74)
Weight (kg)	51.80 (6.70)	64.50 (9.90)
Height (m)	1.60 (4.69)	1.73 (6.14)
BMI (kg/m^2)	20.20 (2.44)	21.40 (3.02)
Sleep hour/night	6.00 (0.84)	6.10 (0.82)
Exercise session per week	1.60 (1.35)	1.60 (1.34)
GPA	(%)	(%)
>3.8	16.60	20.90
>3.5-3.8	32.20	30.00
>3.0-3.5	42.00	32.50
>2.5-3.0	8.80	8.70
<2.5	0.40	2.90
Night life activity	(%)	(%)
Never	61.80	58.50
<2 time/year	15.00	11.60
2-10 time/year	19.10	25.10
11-50 time/year	3.50	4.00
>50 time/year	0	0.70
Family income (baht/month)	(%)	(%)
>100,000	30.70	32.20
50,000-100,000	52.50	45.80
<50,000	16.80	22.00

Table 2. The provided information of caffeine ingredients

Beverage	Caffeine ingredients
Tea bag	30-80 mg/2 g
Instant tea	18-26 mg/0.7 ml
Thai ice tea	16-158 mg/250 ml
Green tea	21-51 mg/250 ml
Coca cola	29-65 mg/325 ml
Hot cocoa	5-30 mg/50,180 ml
Chocolate products	3-10 mg/50 g
Starbucks espresso	35 mg/30 ml
Starbucks espresso decaffeinated	5 mg/30 ml
Starbucks caffe latte, short	35 mg/240 ml
Starbucks caffe, latte, tall	35 mg/360 ml
Starbucks caffe latte, grande	70 mg/480 ml
Starbucks Americano, short	250 mg/240 ml
Starbucks Americano, tall	375 mg/360 ml
Starbucks Americano, grande	550 mg/480 ml
Instant coffee	22-97 mg/2 g
Instant coffee, decaffeinated	0.5-2 mg/2 g
Canned coffee	94-131 mg/180 ml
Canned milk coffee	47-167 mg/180 ml

Adapted from http://www.mayoclinic.com/health/caffeine/AN01211

Results

269 (89.7%) and 225 (74.5%) questionnaires were returned in year 1 and 2, respectively. Most medical students use caffeinated-beverages in certain degree ranging from less than once a week to more than twice a day. 16.2% of medical students did not take caffeinated beverages at all. 55.7% drank caffeinated beverages for energy-boosting purposes.

13% of those who consume caffeinated beverages developed caffeine dependency. Comparing male and female (Table 1); there were no statistical differences of GPA, the amounts, and the purposes of caffeine consumption. However, more proportion of female than male admitted that coffee-shop marketing strategy had significant impact on their caffeine-consumption habit (p = 0.01).

Within 2-year study period, there was no significant change in the amount of caffeine consumption across the group (p = 0.34, Fig. 1). Similarly, there was neither change in the overall pattern of caffeinated-beverage consumption nor the proportion of caffeine dependence (p = 0.97). Among all caffeinated products, tea was the most popular product followed by cocoa, soda, coffee and energy drinks, 87.5, 82, 70.9, 60.4 and 11.1%, respectively; 19.9% always monitored caffeine-ingredient labels in routinely.

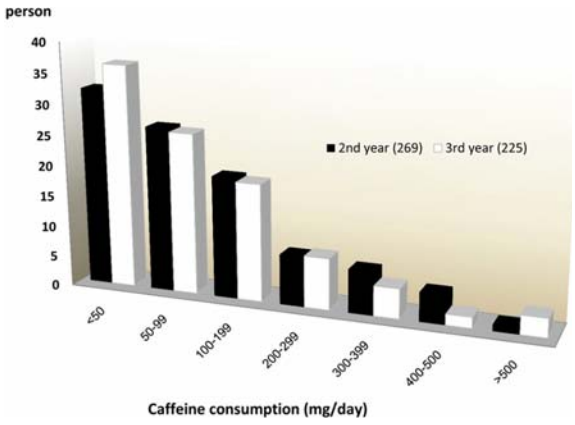

Fig. 1 2-year pattern of caffeine consumption.

Table 3. Odds ratio of developing caffeine dependency comparing to those who consume caffeine less than 100 mg/day

Amount of caffeine consumption (mg/day)	Odds ratio (95% CI)
>400	4.88 (1.56-15.23)
300-399	8.58 (3.08-23.93)
200-299	5.35 (1.94-14.74)
100-199	2.81 (1.16-6.79)

28% of those who consumed >400 mg per day developed caffeine-withdrawal signs and symptoms including headache, sleepiness, fatigue, difficulty in concentrating, irritability, and depressed mood. The analysis also showed the more amounts of caffeine consumption per day, the more chances of developing caffeine dependency (Table 3).

Logistic analysis showed smoking habits of family members and female sex correlated with caffeine dependency (OR 2.19, 95% CI 1.04-4.61 and 1.76, 95% CI 1.01-3.07, respectively). Other investigated factors included: exercise (p = 0.08); hours of sleep (p = 0.24); reading beverage labels (p = 0.87); alcohol consumption (p = 0.59); class performance (p = 0.87); family member coffee-drinking habits (p = 0.66); family member alcohol-drinking habits (p = 0.18); and family income (p = 0.06).

Discussion

In humans, caffeine acts as a central nervous system stimulant, temporarily restores alertness, and increases muscle performance. On the other hand, addiction or dependence may occur with repetitive use. Withdrawal symptoms including headache, irritability, inability to concentrate, drowsiness and insomnia may appear within 12 to 24 hours after discontinuation of caffeine intake, and roughly peak at 48 hours, and usually last more than 2 days[11].

As the word "addiction" conveys the meaning that regular consumption is irresistible and that it creates problems, caffeine use would not fit this profile. Accordingly, the present study uses the term "dependence" instead of "addiction" throughout the report. The present study also explored for possible factors including environmental, behavioral, socio-demographic status and physical risks that might be associated with a caffeine-drinking habit[12].

From the present study, caffeinated-beverage consumption was common among Siriraj medical students; more than half of the respondents admitted that they used caffeinated beverages specifically for energy-boosting purpose. However, the majority of the present study population consumed only mild to moderate amounts of caffeine (<100 mg of caffeine/day). The trend of this behavior did not change much after 1-year follow-up (Fig. 1). This might be explained through the fact that the study period was not long enough as well as the pre-clinical life-styles of 2nd and 3rd year medical students were not much different.

Even though we found correlations between amounts of caffeine consumption per day and caffeine dependency, the authors did not include this factor in the logistic analytical model, as it was unclear whether this variable took place as a cause or as an effect. The findings correlated well with previous study which had showed that consuming less than 100 mg per day had lower risk to develop dependency while consuming more than 400 mg of caffeine per day could lead to adverse effects[13].

Positive history of smoking family members and female sex were found as the only other two factors correlated with caffeine dependency. Whether this was a causal or associational finding, it could not be determined from the present study. Nevertheless, previous studies did show that the factor of parental smoking could desensitize the youth to be less aware of addictive agents[14].

Getting research into policy and practice

With an increasing trend of global consumption of caffeine, currently estimated more than 120,000 tons per year, it makes it the world's most popular psychoactive substance. The motivation from advertisements together with lack of public health information leaves most people unaware of their total daily caffeine consumption. Beneficially, the new labeling legislation of European Union and FDA will require additional caffeine labeling for high caffeine drinks and foods[15].

Since Thailand-labeling regulations do not require a statement about caffeine content, most caffeinated beverages do not reveal this specific information. Unsurprisingly, the authors found only 19.9% of medical students monitored caffeine-ingredient labels in routinely. As the data was exclusive to Siriraj medical students, this proportion could not reflect the real situation of the general population. Even though the authors found no correlation between the habit of monitoring the caffeine-ingredient and the pattern of caffeine consumption, announcing the recommended maximum caffeine daily intake would still be valuable for society[16].

Limitations

As our questionnaire was designed using self-survey to evaluate caffeine-dependency and to approximate the amount of caffeine consumption for each individual, over or under estimations of the conditions could occur. However, self-recognition for other types of dependence has been well accepted for screening purpose[17]. In addition, medical students may be considered as a highly educated, reliable population; thus, the results from the present study would not be severely flawed.

Another limitation was a non-comprehensive list of products containing caffeine which for example did not include sport/energy drinks. As a result, this could underestimate the overall amount of caffeine consumption. There was also a level of researcher imposition; therefore, the authors might not include all factors that are of importance. For example, the present study period was at the very beginning of the social network trend; we did not include screen time/wired time in our questionnaire[18].

Conclusion

Caffeinated-beverage consumption was common among Siriraj medical students. No significant change was detected in the pattern of caffeinated-beverage consumption within the present study period. With a relatively low amount of caffeine consumption compared to other populations, still 13% of those who consume caffeinated beverages developed caffeine dependency. Positive histories of smoking family members and female sex were found as the only other two factors correlated with caffeine dependency.

Acknowledgement

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Potential conflicts of interest

None.

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Appendix *A survey on consumption of caffeinated-beverage among Siriraj pre-clinical year medical students*

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1. Sex ☐ *Male* ☐ *Female*

*2. Undergrad year*_____ *Age* _____

3. Please choose the relevant beverages and drinking frequency of your routine choice (you could x more than 1)

	More than twice a day	*Every morning*	*Every night*	*4-5 serving per week*	*2-3 serving per week*	*Less than twice a week*	*Never*
coffee							
tea							
cocoa							
soda							
Energy drink							
others…….....							

4. You drink caffeinated beverage for energy boosting purpose (hoping for effective longer study time)

☐ *Yes, mostly* ☐ *Yes, sometimes* ☐ *No, I just like the taste*

☐ *I don't drink caffeinated beverage at all (please skip to question 11)*

5. Have you ever had the following signs and symptoms of caffeine dependency: headache, sleepiness, fatigue, difficulty in concentrating, depressed ?

☐ *Yes, certainly* ☐ *Uncertain* ☐ *Certainly not*

6. How much do you pay for those beverages in question No. 3 _____*baht/week*

7. Marketing strategy and society trend for coffee drinking have some influence on you

☐ *Yes, certainly* ☐ *Uncertain* ☐ *Certainly not*

8. Have you ever paid attention for caffeinated beverages labels?

☐ *5 Always* ☐ *4 Often* ☐ *3 Sometimes* ☐ *2 Rarely* ☐ *1 Never*

9. The following caffeine ingredients would guide you to make a gross estimation for your amount of caffeine consumption per day

Beverage	*Caffeine ingredients*
Tea bag	*30-80 mg/ 2 g*
Instant tea	*18-26 mg/ 0.7 ml*
Thai ice tea	*16-158 mg/ 250 ml*

Green tea	*21-51 mg/ 250 ml*
Coca cola	*29-65 mg/ 325 ml*
Hot cocoa	*5-30 mg/ 50180 ml*
Chocolate products	*3-10 mg/50 g*
Starbucks espresso	*35 mg/30 ml*
Starbucks espresso decaffeinated	*5 mg/30 ml*
Starbucks caffe latte, short	*35 mg/240 ml*
Starbucks caffe, latte, tall	*35 mg/360 ml*
Starbucks caffe latte, grande	*70 mg/480 ml*
Starbucks Americano, short	*250 mg/240 ml*
Starbucks Americano, tall	*375 mg/360 ml*
Starbucks Americano, grande	*550 mg/480 ml*
Instant coffee	*22-97 mg/2 g*
Instant coffee, decaffeinated	*0.5-2 mg/2 g*
Canned coffee	*94-131 mg/180 ml*
Canned milk coffee	*47-167 mg/180 ml*

☐ *more than 500 mg/day* ☐ *400-500 mg/day* ☐ *300-399 mg/day*

☐ *200-299 mg/day* ☐ *100-199 mg/day* ☐ *50-99 mg/day*

☐ *less than 50 mg/day*

10. Anyone of your family member/life influencer (father, mother, favorite teacher, celebrities)…?

Smoke cigarette ☐ *Yes* ☐ *No*

Drink alcohol regularly ☐ *Yes* ☐ *No*

11. I do exercise_____time/week each session lasts_____hour_____min

☐ *I rarely do exercise*

12. In average, I sleep_____hour/night

13. Family income

☐ *>100,000 baht/month* ☐ *50,000-100,000 baht/month* ☐ *<50,000 baht/month*

14. How often do you drink alcohol

☐ *<2 time/year* ☐ *2-10 time/year* ☐ *12-50 time/year* ☐ *>50 time/year* ☐ *I do not drink alcohol.*

15. How often you go for "night life"

☐ *<2 time/year* ☐ *2-10 time/year* ☐ *12-50 time/year* ☐ *>50 time/year* ☐ *I do not drink alcohol.*

16. What is your GPA?

☐ *>3.8* ☐ *3.8-3.5* ☐ *3.0-3.5* ☐ *2.5-3.0* ☐ *<2.5*

17. Do you realize that there is a syndrome called "caffeine dependent"

☐ *Yes* ☐ *No*

การดื่มเครื่องดื่มคาเฟอีนของนักศึกษาแพทย์คณะแพทยศาสตร์ศิริราชพยาบาล

เด่นหล้า ปาลเดชพงศ์, ศุภภาณุ์ฤกษ์ ไพศาลสุทธิ, สุทธิพล อุดมพันธุรักษ์

ภูมิหลัง: ในปัจจุบันประชากรทั่วไปนิยมดื่มเครื่องดื่มชูกำลังประเภทที่มีคาเฟอีนเป็นส่วนผสมมากขึ้นเรื่อย ๆ การศึกษาในอดีตได้แสดงให้เห็นว่านักศึกษาแพทย์จำนวนไม่น้อยซึ่งจัดเป็นกลุ่มประชากรที่มีตารางชีวิตที่ต้องเผชิญกับการอดนอนอยู่เป็นประจำเลือกที่จะใช้เครื่องดื่มประเภทนี้เพื่อผลกระตุ้นเช่นกัน

วัตถุประสงค์: เพื่อศึกษาความสัมพันธ์ของพฤติกรรมการดื่มกาแฟในนักศึกษาแพทย์คณะแพทยศาสตร์ ศิริราชพยาบาลกับปัจจัยที่อาจมีส่วนเกี่ยวข้องกับภาวะติดกาแฟ

วัสดุและวิธีการ: แบบสอบถามเพื่อเปรียบเทียบความเปลี่ยนแปลงต่อเนื่องเป็นระยะเวลา 2 ปี และวิเคราะห์เชิงพรรณนา

ผลลัพธ์: ผู้นิพนธ์สามารถรวบรวมแบบสอบถามที่ตอบกลับครบถ้วนรวม 269 (89.7%) และ 225 (74.5%) ในปีที่ 1 และปีที่ 2 ของการวิจัยตามลำดับ นักศึกษาแพทย์เพียง 16.2% ที่ปฏิเสธการดื่มเครื่องดื่มคาเฟอีนอย่างเด็ดขาด ในกลุ่มที่ดื่มเครื่องดื่มที่มีคาเฟอีนเป็นส่วนผสม 13% เข้าได้กับภาวะติดกาแฟ ปัจจัยที่พบว่าเกี่ยวข้องกับติดกาแฟได้แก่ การมีบุคคลในครอบครัวสูบบุหรี่และเพศหญิง (OR 2.19, 95% CI 1.04-4.61 และ 1.76, 95% CI 1.01-3.07 ตามลำดับ) ปัจจัยอื่น ๆ ที่ได้ทำการศึกษาและไม่พบความสัมพันธ์ทางสถิติ ได้แก่ การออกกำลังกาย ($p = 0.08$); ชั่วโมงการนอน ($p = 0.24$); อุปนิสัยการอ่านฉลากเครื่องดื่ม ($p = 0.87$); การดื่มสุรา ($p = 0.59$); ผลการเรียน ($p = 0.87$); ประวัติครอบครัวดื่มกาแฟ ($p = 0.66$); ประวัติครอบครัวดื่มสุรา ($p = 0.18$); และรายได้ครอบครัว ($p = 0.06$) นอกจากนี้จากการติดตามกลุ่มประชากรเป็นเวลา 2 ปี ไม่พบความเปลี่ยนแปลงในลักษณะพฤติกรรมการดื่มกาแฟที่มีความสำคัญทางสถิติ

สรุป: ส่วนใหญ่ของนักศึกษาแพทย์ศิริราชดื่มเครื่องดื่มที่มีคาเฟอีนเป็นส่วนผสมพบว่าการมีบุคคลในครอบครัวสูบบุหรี่และเพศหญิง มีความเกี่ยวข้องกับการเกิดภาวะติดกาแฟ