Original article

Caffeine addiction and mental health of employees in an organization in Bangkok

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Background: Heavy caffeine consumption is the cause of caffeine addiction that might affect sleep quality and mental health. However, people, especially employees in various companies, may want to gain daily energy for efficient work and productivity by drinking high number of caffeinated beverages such as coffee.
Objectives: To explore coffee consumption, mental health, sleep quality, and factors related to caffeine addiction among employees.
Methods: A total of 321 employees at a company in Bangkok were asked about their demographics, coffee consumption and caffeine addiction by using newly developed instruments, namely Caffeine Addiction Questionnaire. Depression and sleep quality were assessed by using the Patient Health Questionnaire (PHQ-9) and the Pittsburgh Sleep Quality Index (PSQI), respectively. Factors related to caffeine addiction with $P < 0.05$ were considered as statistically significant.
Results: Of 321 samples, all (100.0%) were coffee drinkers and 248 (77.3%) had caffeine addiction. Most of employees (55.4%) had no depression and 29.9%, 13.4% and 1.3% of the samples had mild, moderate and high levels of depression, respectively. In addition, 302 (94.1%) had poor sleep quality. Female coffee drinkers were more likely to have caffeine addiction than male drinkers. Employees who consumed brewed coffee, cappuccino and more frequent or higher amount of coffee (i.e., 4 - 7 days/week, 2 - 4 cup/day) and reporting reasons for coffee drinking as a habit or to be awaked were more likely to have caffeine addiction. Having depression and poor sleep quality were associated with caffeine addiction.
Conclusion: Employees who drink coffee at a higher amount or frequency tend to have caffeine addiction which might relate to their sleep quality and mental health. Therefore, factors related to caffeine addiction should be avoided in order to improve mental health and sleep quality which are important to the work performance.

Keywords: Caffeine, coffee, employees, depression, sleep quality.

Coffee is one of the most widely consumed beverages in the world. Thailand is ranked the 41st in the world with the most average coffee consumption per person per year (e.g., 300 cups/person/year). Caffeine, a psychoactive stimulant, is a major substance/pharmacologically active compound in coffee. The caffeine in coffee has been found to improve concentration, increase energy, refresh, and awake. Caffeine affects sleep hygiene and mental health depending on the amount of caffeine taken.

Drinking excessive coffee for a long time can cause the body to be dependent to caffeine. Caffeine is classified as a drug/substance under the DSM-5 criteria. [1]

Since the COVID-19 pandemic, economics and business of various companies around the world were severely affected. In addition, the lifestyle of consumers has changed into a new normal lifestyle according to the pandemic. These changes affect not only the organization, but also the employees at the company. Employees had more responsibilities due to changing structure of the company and working styles that needed to be attentive to the given tasks to maintain quality of their working performance. The more workloads can cause stress, fatigue and pressure that affected employees' physical and mental health. The COVID-19 pandemic had affected for individual,

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collective health, emotional and social functioning. [2] Pungpapong G, et al.[3] found significant associations between being female and depression and anxiety. It had a dramatic effect on working during pandemic such as lack of a safe environment in the workplace, heavy workloads, home situations, and concerns about job stability that lead to anxiety, depression, and even suicide. [4] Office workers who worked at home during lockdown had more working hours than before lockdown phase, resulting to chronic stress of living that caused physical symptoms, e.g., headaches, insomnia, digestive problems, hormonal imbalances, and fatigue. [5]

Thus, drinking coffee to get the simulant effect from caffeine could be one of the choices that workers or employees used to improve their concentration and performance at work. Coffee drinking might turn into habitual behavior and addiction. The more amount or cups of coffee consumption, the more the body will receive caffeine that causes long-term effects on health without their awareness.

The purpose of this study was to examine coffee consumption, caffeine addiction, mental health, sleep quality, and the factors related to caffeine addiction in employees at a company in Bangkok, Thailand. The results of this study could be useful for the organization to encourage their employees, e.g., physical and mental health behavior regarding coffee consumption. Thus, healthy employees can lead an organization to success. In addition, we developed an instrument to assess caffeine addiction that can be used in further studies regarding caffeine-related disorder.

Materials and methods
Subjects

A cross-sectional descriptive research design was applied. We sent online questionnaires via Google form to 1,406 employees of a large company in Bangkok, Thailand and received 347 responses back. Of 347 samples, 321 (92.5%) completed the questionnaire and passed the criteria to be included into the study and all of them were coffee drinkers. Employees who were taking a vacation, sickness leave, personal leave, and drinking the other type of caffeine except for coffee were excluded. There were 19 employees who did not drink coffee and were excluded due to incomplete data or consumed other types of caffeine except coffee.

Measurements

All subjects were invited to provide information through online self-report questionnaires in the Thai version including 8 questionnaires. Firstly, a demographic questionnare was 10 items, such as gender, age, marital status, highest education, average salary/month, years' experience, working hours, job position, congenital disease, and psychiatric history. A coffee consumption questionnaire was 11 items asking about a routine of coffee intake including drinking coffee or not, age to start drinking coffee, amount of coffee/day, type of preference coffee, type of preference coffee process, preference coffee menu, sweetness of coffee, decaffeinated coffee, coffee consumption frequency (days/week), reasons to drink coffee, and drinking another caffeinated beverage. A Caffeine Addiction Questionnaire was 11 items developed by using the wording from the Alcohol section of the Mini International Neuropsychiatric Interview; M.I.N.I - lifetime which was developed by Kalayasiri R, et al. In this study, the words were changed according to coffee context and content. Validity was analyzed by using the index of item-objective congruence (IOC) with Cronbach's α coefficient at 0.72. Respondents, were ask to rate their coffee addiction for 1 year ago, who responded with "Yes" in 2 or more items meant caffeine addict.

For hygiene information, the Patient Health Questionnaire (PHQ-9) was 9 items. Participants were asked to rate items to assess depressive symptoms for 2 weeks ago on a Likert scale at 0 (never) and 3 (every day). The sensitivity rate was 0.84 and the 0.77 specificity rate. Respondents who had scored 19 or more meant having high mental health symptoms. The Pittsburgh Sleep Quality Index (PSQI) was 9 items including 7 components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction, which were summed together to make up an overall sleep quality score. The score ranged between 0 - 21 to rate sleep quality 1 month ago. Summed score that more than 5 meant poor sleep quality. For Thai language version was applied with Cronbach's alpha at 0.83. The sensitivity rate was 89.6% and the 86.5% of specificity rate.

For drug use information, the Fagerstrom Test for level of Nicotine Dependence (FTND) was 6 items with reliability at 0.64. It was used to assess the level of nicotine dependence among respondents who currently smoke. The score ranged from 0 to 10 and summed score of more than 7 meant higher nicotine dependence. The Alcohol Use Identification Test (AUDIT) was 10 items asking about alcohol consumption for 1 year ago to evaluate the risk of

having alcohol use problems. For Thai language version was applied with Cronbach's alpha at 0.86. The score ranged between 0 to 40. Respondents with a summed score of more than 19 meant alcoholic. Lastly, the drug use history was assessed by using a drug use questionnaire. Respondents were asked for a list of drugs used 1 month ago including hypnotic drugs, cannabis, amphetamines, ice (meth) kratom, heroin (opioids), ecstasy, ketamine, volatile, and other addictive substances.

Statistical analysis

The analyses were conducted using the SPSS program version 25. Statistical analyses of collected data included descriptive statistics using for describing the characteristics of the sample population, e.g., number, percentage, mean, standard deviation (SD), minimum, and maximum. Chi-square using for testing the correlations among factors related to caffeine addiction, and Pearson correlation coefficients using for the examination of the relationships among all variables. Unpaired Student t - test compare mean between groups. Logistics regression was used to predict the relationship between caffeine addiction and factors related to it by using the Forward Likelihood ratio. $P < 0.05$ was considered as significant difference.

Results

All of the 321 employees drank coffee and most of them aged between 31 - 40 years, were female, single and had Bachelor's Degree and a salary range between 30,001 - 50,000 THB. Most of the subjects had duration of work at this company less than

11 years, worked 8 - 9 hours per day and worked at practitioner levels. 75.4% did not have medical diseases and 92.8% did not have history of psychiatric disorders.

Regarding the caffeine addiction questionnaire, 248 samples (77.3%) had caffeine addiction according to 11 items of the caffeine addiction questionnaire; responding with "Yes" in 2 or more items.

The Chi-square and Fisher's exact test were applied to examine the correlation between caffeine addiction and factors related. The results showed that the gender, amount of coffee consumption per day, drinking freshly brewed coffee/canned coffee/ iced coffee/ blended coffee/espresso/cappuccino, frequency of coffee drinking per week, reasons of drinking coffee (e.g., as a habit, for being awake, to improved quality of work performance or liking the smell and taste), smoking tobacco, drinking alcohol, sleep quality and mental health level were associated with caffeine addiction ($P < 0.05$). Fisher's exact test was applied in case of the expected count had more than 20.0%. Most non-caffeine addiction groups consumed coffee only one cup or less per day, compared to the caffeine addiction group. The types of beverages were associated with a caffeine addiction. Almost 90.0% of the caffeine addiction group frequently consumed coffee 4 - 6 days/week or every day. The caffeine addiction group had a higher ratio of drinking coffee as a habit and drinking to improve quality of work performance than the non-caffeine addiction group. Employees with caffeine addiction were more likely to currently smoke cigarettes and drink alcohol than those without (Table 1).

Table 1. The number and percentage of general information and Chi-square and Fisher's exact test results of the correlation between related factors and caffeine addiction.

Characteristics	Non-caffeine addiction (n = 73)		Caffeine addiction (n = 248)		P - values
	N	%	N	%	
Gender					
Female	46	63.0	190	76.6	0.021*
Male/others	27	37.0	58	23.4	
Age (years)					
≤ 30	22	30.1	94	37.9	0.447
31 - 40	40	54.8	117	47.2	
≥ 41	11	15.1	37	14.9	
Marital status					
Single	48	65.8	166	66.9	0.888[a]
Married, separated, widowed, divorced, death	25	34.3	82	33.1	

Table 1. (Con) The number and percentage of general information and Chi-square and Fisher's exact test results of the correlation between related factors and caffeine addiction.

Characteristics	Non-caffeine addiction (n = 73)		Caffeine addiction (n = 248)		P - values
	N	%	N	%	
Education					
≤ Bachelor degree	45	61.6	177	71.4	0.116[a]
Higher than Bachelor Degree	28	38.4	71	28.6	
Average salary/month (THB)					
≤ 30,000	15	20.6	53	21.4	0.242
30,001 - 50,000	27	37.0	115	46.4	
≥ 50,001	31	42.5	80	32.3	
Years' experience (years)					
< 11	61	83.6	221	89.1	0.202
≥ 11	12	16.4	27	10.9	
Average working hour (hrs.)					
≤ 9	66	90.4	225	90.7	0.935
≥ 10	7	9.6	23	9.3	
Position (level)					
Practitioner	43	58.9	125	50.4	0.416
Management	23	31.5	98	39.5	
Supervisor	7	9.6	25	10.1	
No congenital disease	60	82.2	182	73.4	0.125
Age to start drinking coffee (years)					
≤ 19	35	48.0	147	59.3	0.212
20 – 29	33	45.2	90	36.3	
≥ 30	5	6.9	11	4.4	
Amount of coffee/day (1 cup: 250 ml.)					
≤ 1	62	84.9	128	51.6	< 0.001***
≥ 2	11	15.1	120	48.4	
Type of coffee					
Freshly brewed coffee	60	82.2	241	97.2	< 0.001***
Canned coffee	10	13.7	61	24.6	0.049*
Instant coffee	23	31.5	109	44.0	0.060[a]
Hot	38	52.1	152	61.3	0.176[a]
Cold	58	79.5	234	94.4	< 0.001***
Blended	14	19.2	80	32.3	0.040[a]*
Espresso	14	19.2	98	39.5	0.001[a]**
Americano	29	39.7	124	50.0	0.143[a]
Cappuccino	13	17.8	109	44.0	< 0.001[a]***
Mocha	22	30.1	69	27.8	0.768[a]
Latte	36	49.3	126	50.8	0.894[a]
Caramel Macchiato	15	20.6	65	26.2	0.326
Other e.g., Thai traditional coffee, dirty, cold brew, orange espresso	4	5.5	6	2.4	0.186
Sweetness of coffee					
Not sweet	22	30.1	72	29.0	0.338
Less-less sweet	25	34.3	73	29.4	
Less sweet	18	24.7	53	21.4	
Normal	8	11.0	50	20.2	
Decaffeinated coffee					
Never	59	80.8	199	80.2	0.913
Sometime/often	14	19.2	49	19.8	

Table 1. (Con) The number and percentage of general information and Chi-square and Fisher's exact test results of the correlation between related factors and caffeine addiction.

Characteristics	Non-caffeine addiction (n = 73)		Caffeine addiction (n = 248)		P - values
	N	%	N	%	
Coffee consumption frequency (days/week)					
4 - 7	40	54.8	220	88.7	< 0.001***
2 - 3	14	19.2	19	7.7	
≤ 1	19	26.0	9	3.6	
Reasons to drink coffee					
Habitual drinking	24	32.9	186	75.0	< 0.001[a]***
Less drowsy	40	54.8	188	75.8	0.001[a]**
Improved work quality	30	41.1	144	58.1	0.011[a]*
Smell and taste	42	57.5	197	79.4	< 0.001***
Drinking another caffeinated beverage					
Tea, cocoa, chocolate, soft drink, milk tea, and energy drink	64	87.7	233	94.0	0.073
Cigarette smoking					
Never	57	78.1	188	75.8	0.038*
Quit	14	19.2	31	12.5	
Current smoking	2	2.7	29	11.7	
Alcohol	48	65.8	202	81.5	0.005**
Drugs	18	24.7	70	28.2	0.548
Sleep quality					
Good	8	11.0	11	4.4	0.038*
Poor	65	89.0	237	95.6	
Depression					
No symptoms	51	69.9	127	51.2	0.007*
Mild	18	24.7	78	31.5	
Moderate/high	4	5.48	43	17.3	

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$,   [a] Fisher's Exact test.

Mental health was positively correlated with sleep quality ($r = 0.578$, $P < 0.001$). Sleep quality and mental health scores between the non-caffeine and the caffeine addiction groups were significant different at 0.036 and 0.001 respectively (Table 2).

When analyzed in each group of non-caffeine addiction group (Table 3) and caffeine addiction group (Table 4), having depression was associated with poor sleep quality in the two groups with different statistically significant levels ($P = 0.05$ and $P = 0.001$, respectively).

Table 2. Sleep quality and mental health and mean difference between the two groups (n = 321).

Measures	Non-caffeine addiction (n = 73)		Caffeine addiction (n = 248)		P - value
	M	SD	M	SD	
Sleep quality	1.22	0.34	1.31	0.33	0.036*
Depression	0.53	0.49	0.80	0.54	< 0.001**

*$P < 0.05$, **$P < 0.001$

Table 3. Mental health and sleep quality among non-caffeine addiction group (n = 73).

Variables	Sleep quality				P - values
	Poor (n = 65)		Good (n = 8)		
	N	%	N	%	
Depression					
No	43	66.2	8	100.0	0.049[a]*
Yes	22	33.9	0	0.0	

*$P < 0.05$, [a] Fisher's Exact test.

Table 4. Mental health and sleep quality among caffeine addiction group (n = 248).

Variables	Sleep quality				P - values
	Poor (n = 237)		Good (n = 11)		
	N	%	N	%	
Depression					
No	116	49.0	11	100.0	0.001[a]**
Yes	121	51.1	0	0.0	

**$P < 0.01$, [a] Fisher's Exact test.

The logistic regression was applied to predict the association between coffee addiction and related factors. The related factors which had statistically significant include gender, amount of coffee/day, freshly brewed coffee, canned coffee, cold, blended, espresso, cappuccino, coffee consumption frequency (days/week), habitual drinking, less drowsy, improved work quality, smell and taste, cigarette smoking, alcohol drinking, sleep quality, and depression. In this study, the logistic regression analysis was adjusted by these related factors. The forward likelihood ratio was used to control external factors or other variables. The resulting in the coffee addiction were predicted by being female, drinking 2 - 4 cups of coffee per day and 4 - 7 days per week, drinking freshly brewed coffee/cappuccino, drinking coffee as a habit or for being awake and having poor sleep quality and depression (Table 5).

Table 5. The prediction of the correlation between caffeine addiction and related factors tested by Logistic regression (n = 321).

Variables	B	S.E. (B)	P - value	Adjusted OR	95% CI Lower	95% CI Upper
Female	0.870	0.374	0.020*	2.387	1.147	4.966
Drinking coffee 2 - 4 cups/day	1.131	0.410	0.006**	3.099	1.387	6.920
Freshly brewed coffee	1.814	0.610	0.003**	6.136	1.857	20.279
Cappuccino menu	0.771	0.391	0.049*	2.162	1.005	4.651
Drinking coffee 4 - 7 days/week	1.263	0.397	0.001**	3.534	1.624	7.689
Drinking coffee as a habit	1.017	0.369	0.006**	2.765	1.343	5.694
Drinking coffee to stay awake	0.748	0.347	0.031*	2.113	1.070	4.173
Poor sleep quality	1.199	0.597	0.045*	3.316	1.030	10.682
Having depression	0.788	0.363	0.030*	2.200	1.080	4.481
Constant	-5.020	1.012	0.000	0.007		

*$P < 0.05$, **$P < 0.01$

Discussion

The present study revealed that employees consumed caffeine most commonly from coffee. Drinking coffee as a habit and to stay awake are the most reasons of drinking coffee that might predict caffeine addiction. The result is congruent with the previous study showing that adult employees with higher office hours consumed coffee every day, especially females. These are consistent with Fattore L, et al.[6] that caffeine is a positive reinforcer in both males and females. However, female showed a higher tendency to develop dependence or addiction to caffeine.

The results from the Thai Department of Business Development (DBD) showed that in 2018 coffee business had grown up to 37.7% from 2017 and tends to a higher rate every year. We observed many new coffee shops or cafés on every corner. Café attracted customers by their specialty coffee and café decoration. Most of all café served the freshly brewed coffee with special coffee beans. Nowadays, customers had more choices to consume coffee not only went to the café but they can brew at home or order through food delivery applications. These reasons might induce people to consume more freshly brewed coffee especially new coffee beginners. The new pattern of coffee consumption according to our result that showed most employees consumed freshly brewed coffee more than canned and instant coffee. These might affect their caffeine addiction.

The employees in the current study, 52.3%, were office workers at practitioner level who had been in a job that requires a lot of work, faces the pressure of workload and responsibility. Also, the fear of failure in the job, especially at the time of the COVID-19 pandemic, might drive them to drink coffee to fulfill their responsibility. [7] Due to the hard situation of COVID-19, employees should push more effort than normal into their responsibility. They gained energy from coffee consumption to maintain their work concentration. If they had low energy it might affect their job performance and job evaluation. These results induced employees to consume coffee every day. Job responsibility came with high caffeine desire according to the previous study the higher coffee consumption group relates to the Type A personality, including competitiveness, time urgency, and a tendency toward workaholism. These findings on work performance and caffeine addiction showed the important reasons to consume coffee, i.e., drinking to keep them awake. Although 55.4% of the sample revealed no depression, 44.6%, demonstrated the symptom of mild to a high level of depression which should not be neglected but should be paid more attention to this issue. Daily caffeine intake is correlated with high depression and anxiety. [8, 9] However, the relationship between caffeine/coffee intake and mental health is mixed. Previous studies[10, 11] exhibited that the moderate caffeine intake (< 6 cups/day) might reduce depression, fewer cognitive failures, lower risk of suicide, mortality risk by favorably affecting inflammation, lung function, and insulin sensitivity.

Most employees in this study had poor sleep quality consistent with Clark I, et al. [12] Caffeine not only affects anxiety and panic disorder but influences nighttime sleep with light sleep. Caffeine can also decrease their health by disturbing sleep quality and quantity when consumed within six hours of bedtime. Therefore, when sleep hygiene is deprived, in consequence, it is hard to function efficiently during the day. The result from O'Callaghan F, et al.[13] showed the reciprocal relationship between sleep quality and coffee consumption during the day.

Thus, factors including gender, higher amount and frequency of coffee intake, drinking freshly brewed coffee and cappuccino, reasons of drinking as a habit and to stay awake, having poor sleep quality, having depression could predict caffeine addiction on the employees.

This study was conducted within the COVID-19 pandemic with online questionnaires and data came from specific type of business. Thus, the results might be different from normal situations. Furthermore, there might be some other variables that could be correlated with caffeine addiction to study in the future.

Conclusion

Majority of the subjects had caffeine addiction. Female employees, drinking coffee 2 - 4 cups/day, drinking freshly brewed coffee, cappuccino, drinking coffee 4 - 7 days/week, drinking as a habit and to stay awake, poor sleep quality, and depression were positively associated with caffeine addiction.

This present study emphasizes the relationship between caffeine addiction and mental health including sleep quality and depression. Employees who consumed coffee more frequently tended to have caffeine addiction. Therefore, these results suggested the need of serious concern about factors related to

caffeine addiction on employees. The high priority action should be concern with their mental health because all factors that related to predict caffeine addiction might affect to job performance. Thus, the business owner and employees should be cooperated to improve their quality of life that related to increase the productivity and efficiency of business.

Conflict of interest statement

Each of the authors has completed an ICMJE disclosure form. None of the authors declare any potential or actual relationship, activity, or interest related to the content of this article.

Data sharing statement

The present review is based on the reference cited. Further details, opinions, and interpretation are available from the corresponding authors on reasonable request.

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