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Consumption Analysis of Caffeine Using Mobile Application

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Abstract. Coffee is one of popular drinks in public because of its unique taste and flavor. Coffee contains caffeine, a psychoactive that is used to reduce fatigue and sleepiness. Daily caffeine consumption showed that average caffeine consumption of a person was 180.94 mg to 319.32 mg per day. Excessive caffeine consumption can disturb health of an individual. Coffee is a major source of caffeine throughout the world. Indonesia has traditional coffee preparations, namely “kopi joss” Ideal proportion of coffee consumption of the ‘kopi joss’ can be determined based on body weight. Therefore, a mobile application is developed in order to help users in determining amount of caffeine contained in coffee powder based on weight of the coffee, and especially to know ideal amount of coffee consumption based on a bodyweight.

Keywords: Kopi Joss, Coffee, Caffeine, Traditional coffee preparations.

1. Introduction

Coffee is one of most widely consumed drinks in the world [6]. Data of the Association of Indonesian Coffee Exporters and Industry noted that coffee demand in 2015 was estimated to increase to 280 million kilograms from 2014, an estimated 260 million kilograms of coffee of one year [4]. Coffee can be classified as psychostimulant drink causing a person to stay awake, reduce fatigue, and induce a relaxed feeling [11]. Coffee contains chlorogenic acid, a dominant antioxidant of coffee bean in the form of esters formed from trans-cinnamic acid and quinic acid [12].

Coffee is a major source of worldwide caffeine [14]. Caffeine is a psychoactive that can be used to reduce fatigue and sleepiness [14]. Caffeine of coffee is used to stimulate central nervous system and heart muscle. It can cause diuresis and relaxes smooth muscles of bronchus. Standard doses of caffeine of 50-200 mg primarily affect outer layer of the brain. This influence may reduce fatigue [11].

Usual consumption of caffeine for children and youth contained in drinks such as soda is (30-55 mg of caffeine per 12 oz/355 ml) and recently, 'energy drinks' has higher concentration of caffeine than soda, namely (70-130 mg of caffeine per 12 oz/355 ml), and specifically marketed for young people [2]. For comparison, a regular espresso coffee 1 oz/30 ml contains 40-75 mg of caffeine and a generic cup of coffee of 12 oz/355 ml contains 145-250 mg of caffeine [1]. Energy drinks sale and consumption had increased sharply over the last [1].

Various servings of coffee provide variation of flavors and tastes of the coffee itself. One unique serving of coffee in Yogyakarta is called as ‘Kopi Joss’. A heat charcoal is put into a cup of black coffee. Charcoal that is burned in high temperature will naturally become active carbon with function of binding



pollutants and toxins of the body [5]. The charcoal or activated carbon has been known as a potent natural remedy to eliminate poison [10].

2. Literature review

Computer modeling has been successfully applied to the field of health such as to calculate oxygen levels of water and also calculation of air quality [8], [17], [16], [7]. Previous researches had widely discussed consumption of foods and drinks containing caffeine such as tea, soda, coffee, and energy drinks [1],[2]. A study addressing an ideal amount of daily caffeine consumption had been conducted [13] Based on the literature review, a research of calculating ideal amount of coffee consumption of 'kopi joss' based on bodyweight is proposed.

3. Theoretical

Charcoal is recognized as a binder of drugs and other toxic substances in digestive tract and it has been used in medicine since ancient times [10]. Activated carbon is a universal antidote to most poisons [10]. The use of activated carbon to treat poisoning has been known since 1830 by the French chemist Bertrand [10]. The activated carbon is produced through a pyrolysis process of material containing carbon and activated by oxidation with high temperatures steam. Activated carbon has a surface area of approximately 1000 m²/g and it has ability to absorb a lot of drugs substances [5].

Caffeine content of drinks and foods increased in terms of dosages and availability, with latest estimation of total daily caffeine consumption showed that average person consumed 180.94 mg to 319.32 mg of caffeine per day [3]. Caffeine content of coffee can be determined by extracting caffeine from tea and coffee with chloroform as extraction solvent [15].

Table 1. caffeine from tea and coffee [15]

Sl.no	Sample	Amt of sample(g)	Amt of caffeine after solvent extraction(g)
1.	Tea	5	0.
2.	Coffee	5	0.252

$$\text{Rumus : Kadar kafein} = \frac{\text{massa kafein}}{\text{berat awal}} \times 100\%$$

The formula calculation the percentage caffeine [15]

Intake caffeine in bw for every day in the sample calculated be 5.3 mg per kilogram bb per day, an average intake 3.7 mg per kilogram bb per day [13].

Table 2. Consumption of foods and beverages contributing to caffeine intake and the resulting caffeine intake (n=700), all

Food category	Food intake (ml/g per day)					Caffeine intake (mg per day)			
	Mean	s.d.	Median	95 percentile	n*	Mean	s.d.	Median	95 percentile
	Coffee total	485.0	593.1	400.0	1382.3	520	217.3	313.1	160.0
Ice coffee	36.4	119.0	0.0	228.2	222	9.1	29.7	0.0	57.1
Tea	53.5	160.3	0.0	400.0	185	13.1	31.1	0.0	68.6
Ice tea	298.3	565.9	49.3	1250.0	404	14.9	28.3	2.5	62.5
Colas	343.2	481.7	148.3	1285.7	542	33.8	46.2	15.7	130.0
Energy drinks	133.9	271.9	35.7	500.0	432	42.6	90.1	11.4	160.0
Energy shots	0.4	4.8	0.0	0.0	17	0.6	7.3	0.0	0.0
Coffee-based beverages and cocoa	60.5	187.7	0.0	464.3	166	9.1	28.2	0.0	69.6
Chocolate	43.4	108.6	13.8	158.2	537	7.8	19.6	2.5	28.5
Coffee-based foods	15.9	69.4	0.0	114.3	100	0.6	2.8	0.0	4.6
Other foods	0.8	6.7	0.0	0.0	32	0.4	3.3	0.0	0.0
Drugs, pills (no. per day)	0.2	0.8	0.0	0.4	328	8.1	35.1	0.0	21.4
Total caffeine intake (mg per day)						357.4	400.4	258.5	957.2
Total caffeine intake (mg/kg bw)						5.33	5.98	3.7	14.46

4. Methodology

The proposed research is a mobile application development for calculation of 'kopi joss' consumption per day. Calculation of caffeine contained in 'Kopi joss' was performed by extracting caffeine to determine its amount in the coffee [15]. The extraction was conducted by using chloroform as solvent extraction [15]. The extraction showed that amount of caffeine found in 5 g coffee was 0.252 g.

4.1 Calculation of caffeine contained in 'Kopi Joss'

Teaspoon is used as measurement instrument. Composition of the 'Kopi Joss' is 2 teaspoons of coffee powder. Caffeine of the 'Kopi Joss' is calculated by using equation as follow::

1 teaspoon coffee = 4 grams of coffee.

2 teaspoons of coffee x 4 g = 8 grams coffee

5 grams of coffee = 0.252 grams caffeine

1 gram of coffee = $0.252/5 = 0.0504$ grams of caffeine

8 grams of coffee x 0.0504 grams of caffeine = 0.4032 grams of caffeine.

0.4032 grams are converted to milligram = 403 mg

So, one serving of 'Kopi Joss' contains 403 mg of caffeine

Table 3. Consumption of foods and beverages contributing to caffeine intake and the resulting caffeine intake (n=700), all

Food category	Food intake (ml/g per day)				n*	Caffeine intake (mg per day)			
	Mean	s.d.	Median	95 percentile		Mean	s.d.	Median	95 percentile
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Coffee-based foods	15.9	69.4	0.0	114.3	100	0.6	2.8	0.0	4.6
Other foods	0.8	6.7	0.0	0.0	32	0.4	3.3	0.0	0.0
Drugs, pills (no. per day)	0.2	0.8	0.0	0.4	328	8.1	35.1	0.0	21.4
Total caffeine intake (mg per day)						357.4	400.4	258.5	957.2
Total caffeine intake (mg/kg bw)						5.33	5.98	3.7	14.46

5. Designing and Application

The application is designed to run on smartphones with Android operating system. Menus of the application design are:

1. Calculation of Kopi Joss Consumption,
2. Computing Caffeine,
3. About,
4. Help

Menus that will be displayed in the application can be seen in **Figure 1**.



Figure 1. Application Menu

5.1 Computing the 'Kopi Joss'

Caffeine computation is a calculation to determine amount of caffeine contained in a Kopi Joss. After quantity of the caffeine is known, then calculation of maximum consumption of coffee joss based on bodyweight is performed. Figure 2 is design of the application.



Figure 2. Computation of Kopi Joss

Calculation of caffeine quantity and maximum amount of Kopi Joss consumption by bodyweight uses following formula:

$$x = a \times 5.33 \text{ mg caffeine}$$

$$x = 75\text{kg} \times 5.33 \text{ mg}$$

$$x = 399.75 \text{ mg}$$

where: x = maximum amount of caffeine intake per day based on bodyweight

a = bodyweight

Thus, maximum quantity of caffeine intake per day for a person with bodyweight of 75 kg is 399.75 mg of caffeine a day. After getting the maximum amount of caffeine consumption, then look for quantity of caffeine contained in one serving of Kopi Joss.

1 teaspoon coffee = 4 grams of coffee.

2 teaspoons of coffee \times 4 g = 8 grams of coffee

5 grams of coffee = 0.252 grams of caffeine

1 gram of coffee = $0.252/5 = 0.0504$ grams of caffeine

8 grams of coffee \times 0.0504 grams of caffeine = 0.4032 grams of caffeine.

0.4032 gram is converted to milligrams = 403 mg

Maximum amount of coffee consumption based on a portion of Kopi Joss can be known with.

$$W = x / 403$$

$$W = 399.75/403$$

$$W = 1$$

Thus, maximum amount of coffee consumption for a person with bodyweight of 75 kg is 1 portion of Kopi Joss a day

5.2 Caffeine Computation

Calorie calculation can be used to determine quantity of caffeine of coffee based on weight of coffee powder in gram unit. This is display of caffeine computation in smart phone. Figure 3 Caffeine Computation.



Figure 3. Caffeine Computation

Computation of caffeine quantity contained in coffee in gram unit can be conducted as follow.

$$5 \text{ grams of coffee} = 0.252 \text{ grams of caffeine}$$

1 gram of coffee = $0.252/5 = 0.0504$ grams of caffeine

8 grams of coffee x 0.0504 grams of caffeine = 0.4032 grams of caffeine.

Table of Ratio of Kopi Joss Portion

Table 4. Table of Ratio of Kopi Joss Portion

Bodyweight	Max Caffeine Quantity (mg/kg BW)	Portion of Kopi Joss
50	266.5	0.66
60	319.8	0.79
75	399.75	0.99
80	426.4	1.06
100	426.4	1.06

From the results above, amount of Kopi Joss to consume per day can be known quickly. Someone who wants to maintain a healthy body can determine easily amount of coffee joss for consumption per day. He can only input his bodyweight, then he knows amount of Kopi Joss portion he can consume.

5.3 Help

The Help menu contains information of menus of the applications and steps of using the application. On the Help menu, it is described the first step to do

1. What should be input by user in the page of Kopi Joss Computation and what is the output.
2. Then, Caffeine Computation, in this menu it will be explained *what to input* by user and in *what unit*.

6. Conclusion

Based on trials that had been carried out, it can be concluded that calculation to determine amount of maximum caffeine needed by the body can be successfully identified and then, it was used to calculate ideal amount of Kopi Joss consumption. Development of the mobile application can help user to keep amount of caffeine consumption, especially contained in Kopi Joss.

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