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Dietary caffeine intake and BMI among a sample of students in Jazan University

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ABSTRACT

Introduction: Caffeine is a stimulant compound found in coffee, tea, cocoa, and kola, soft drink, and certain medicines. **Objectives:** the objectives of the present study were to examine the relation between caffeine intake from Arabic coffee, other dietary sources and body mass index (BMI) of female students in Jazan University.
Design: A cross sectional study was employed. The study included 158 male and female student (18-25 years old) that were chosen conveniently from Jazan University campus. **METHODS:** A demographic questionnaire and food frequency questionnaire (FFQ) were distributed among the studied sample. The researchers took anthropometric measurements. All data were entered and analyzed through SPSS program version 22. The samples were classified according to caffeine intake as group 1: no intake (0 mg/d), group 2: low intake (<300 mg/d), and group 3: high intake (≥300 mg/d). **RESULTS AND CONCLUSION:** The mean BMI among subjects was (21.2 & 22.02) kg/m^2 in males and females respectively, mean age of 22.72 years. The mean caffeine consumption was (132.93 & 59.96) mg/d among males and females, respectively. About 21.2% of the samples showed high caffeine consumption (N=82). The study showed that high caffeine consumption has significant effect on anthropometric measurements ($p<0.05$).
Keywords: Caffeine, coffee; Arabic coffee; tea; soft drinks; chocolate; body mass index.

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INTRODUCTION

Caffeine is defined by **Habibi Asl, et al., (2014)** as "a methyl-xanthine with brain stimulant effect which unlike ketotifen increases alertness and concentration, and is considered as a stimulant of energy expenditure which can increase thermogenesis and fat oxidation and can alter the energy balance by improving energy consumption

In the United States, a research review regarding caffeine consumption concluded that a moderate daily caffeine intake of ≤400 mg was among the healthy adult population **(Heckman, et al., 2010).** Additionally, data from the National Health and Nutrition Examination Survey (NHANES) 2007–2010 indicate that 2.7% of the US population used a caffeine-containing

energy product, providing approximately 150–200 mg/day of caffeine per day in addition to caffeine from traditional sources like coffee, tea, and colas **(Bailey, et al., 2014).**

Many studies reported that caffeine can reduce weight through inhibition of the enzyme phosphodiesterase, which is responsible for catalyzing the conversion of cyclic AMP to AMP, and inhibition of negative effects of adenosine on increased noradrenaline release, which promotes lipolysis. Caffeine can decrease the weight through the increase in thermogenesis, fat oxidation and lipid turnover **(Habibi Asl, et al., 2014., Acheson, et al., 2004, Zheng, et. al. 2004 and Davoodi, 2014).** Many, but not all, of the effects of caffeine on lipid mobilization in resting conditions can be interpreted in these mechanisms.

The thermogenic effect of Catechin- and Caffeine-Rich Teas (CCRT) has the potential to produce significant effects on fat absorption and energy intake, The (CCRTs), such as green, oolong, and white teas, as well as caffeine effects may be of precise importance during weight maintenance after weight loss **(Hursel, et al., 2013).** While in the study conducted by **Habibi Asl, et al., (2014)** there is evidence that moderate caffeine intake might be valuable in anti-obesity effect by inhibiting proliferative activity in white adipose tissue and due to the additive and/or synergistic inhibitory activity of caffeine on intracellular lipid accumulation

On a meta-analytic study, **Onakpoya, et al., (2011)** reported that Green Coffee Extract (GCE) can be used as a weight loss supplement with significant weight loss over two years among those who consume GCE compared to a placebo group. In **Al-Othman, et al., (2012)** both males and females, who were heavy coffee drinkers (8–12 cups weekly), significantly had lower BMI, lean and soft body mass as compared to those who were drinking coffee less. BMI mean value significantly decreased in heavy coffee drinkers when compared to moderate (5–8 cups weekly) and low coffee drinkers (0-4 cups weekly). The author concluded that coffee intake might reduce BMI due to decreasing the amount of fat tissue by elevating thermogenesis and stimulating the sympathoadrenal system**. In 2014, Schubert, et al.,** conducted a study on 14 active participants with BMI 22.7 kg/m2. To evaluate the effect of exercise alone and exercise with caffeine supplementation on the energy and metabolism. The study suggested that combining caffeine with exercise creates a greater acute energy deficit, and the implications of this protocol for weight loss or maintenance over longer periods in overweight/obese populations should be further investigated. The implications of this protocol for weight loss or maintenance over longer periods in overweight/obese populations should be further investigated**.**

MATERIALS AND METHODS

Research Design

Cross sectional Study.

Research Variables

Independent Variables: Dietary caffeine intake.

Dependent Variables: body mass index (BMI).

Background Variables: 18-25 years old healthy female (not pregnant, lactating or following a special diet) and located in Kingdom of Saudi Arabia, Jazan City, Jazan University.

Research Sample

Research sample is male and female students at Jazan University from most collages. The research was conducted on 180 healthy male and female students at Jazan University, age ranged from 18 to 25 years, submitted viable version of the questionnaires. Twenty-two of the subjects were excluded of the study due to either having diseases, following a diet, lactating or pregnant.

Research Instruments

Anthropometric Measurements

Body weight and height measured using Detecto Weight Scale with Height Rod.

BMI calculated using BMI equation: $\frac{\text{Weight (Kg)}}{\text{Height (m2)}}$ (WHO).

Food Frequency Questionnaire (FFQ)

FFQ was designed to estimate the consumption of different sources of caffeine over the last month and to measure the amount and frequent consumption of dietary caffeine **(Albar et al., 2021).**

Research Procedures

Initially, selecting subjects to participate in the research by convenient sampling technique. Subsequently, the demographic questionnaire and FFQ distributed and filled by the sample while the researchers had taken anthropometric measurement.

Data Entry

For the determination of participants' caffeine intake, the caffeine content from the various foods and beverages included in the FFQ was calculated using information from several website and studies that collected their data from the food industry companies and food analysis (Agricultural Research, 2019). Caffeine intake calculated based on average content of caffeine found in the beverage and food. The levels of dietary caffeine intake stated as mg per day. The intake levels were as follows: no intake (0 mg/day), low intake (<300 mg/d), high intake (≥300 mg/d) groups **(Albar, et al., 2021).** BMI categorized into seven groups according to **WHO standards (WHO, 2014)** as shown in Table (1).

Table 1: BMI Standards

BMI			
Severely underweight	< 16.5 kg/m^2	**Obese grade 1**	30-34.9 kg/m^2
Underweight	16.5-18.4 kg/m^2	**Obese grade 2**	35-39.9 kg/m^2
Normal	18.5-24.9 kg/m^2	**Obese grade 3**	≥40 kg/m^2
Overweight	25-29.9 kg/m^2		

Statistical Analysis

Using SPSS version 22 for statistical analysis. Chi-square test considered to determine the significance of association between different dietary caffeine consumption levels and BMI were threshold of significance was set at <0.05. Moreover, due to the nature of the research variables, Analysis of Variance (ANOVA) test conducted to analyze the data collected, test the research hypotheses, and answer the research questions. Anthropometric and caffeine intake were analyzed using (ANOVA). Data was statistically analyzed and was established at $p<0.05$.

Ethical Issues

Asking the permission of participants to participate in this research and they have the right withdraw of the research. Giving a brief explanation about the research and procedures that will be used on participants. Assuring the security and confidentially of participants' records.

RESULTS

Characteristics of the research sample are clarified in the following tables and figures:
Chart-1: Shows that no= 60 (37.97%) of the participant were from females while no=98 (62.02%) of them were from Males.

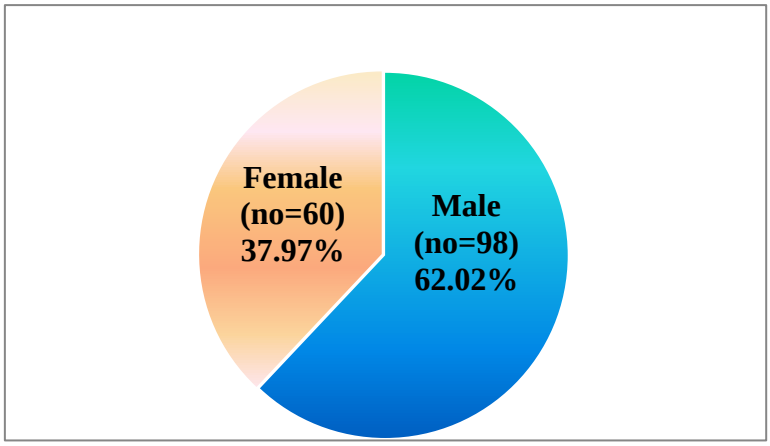

Figure 1: Gender Wise Study Participants

Table 2: Statistical description of the sample

Parameter	Male (n=98)		Female (n=60)	
	Mean	Std. Deviation	Mean	Std. Deviation
Age	22.72	1.233	22.13	1.620
Height	167.9286	10.96104	153.1750	5.54704
Weight	61.0204	6.89685	50.9383	6.40982
BMI	21.208	2.0706	22.023	2.0170
Fat Percentage	17.417	5.5623	25.838	6.7406
Caffeine Intake	132.9388	123.41305	59.9667	71.45604

Data are mean ±SD

The total number of participants in our study was 158 subjects, and their age were between (18-25 years old) and with a mean of (22.72 & 22.13). While (61&50.9) kg were the mean of the sample's weight. For the height, the mean was (167.92&153.17) cm. The mean of BMI was (21.20&22.02) kg/m2 that considered normal. The table above indicates that the mean of the total dietary caffeine intake was (132.93& 59.9667) mg/d from both genders males and females respectively.

Table 3: Physical Characteristics of the Subjects with Caffeine intake from Arabic coffee

		No. of Cups in a day							
		No Intake		Low Intake		High Intake		Total	
		Count	No %	Count	No %	Count	No %	Count	No %
BMI Category	Under Weight	2	22.2	2	22.2	5	55.6	9	5.96
	Normal	76	52.4	40	27.6	29	20.0	145	91.77
	Over Weight & Obesity	4	100.0	0	0.0	0	0.0	4	2.53
	Total	82	51.9	42	26.6	34	21.5	158	100.0
P-value—0.035									

Tables (3) shows the relationship of caffeine intake and BMI. Regarding Caffeine consumption (51.9, 26.6 & 21.5) of the participants consume no, low and high caffeine intake respectively, had a normal BMI (18.5-24.9 kg/m2); however, in underweight participants (≤18.4 kg/m2) the majority (55.6%) were high caffeine consumers. On the other hand overweight participants (25-29.9 kg/m2), (100%) of them were no caffeine consumers. Results were insignificant between BMI and caffeine intake ($p<0.05$). where p-value was 0.035.

Table 4: BMI categories of the subjects with Caffeine intake from Arabic coffee and other sources.

		Caffeine source					
		Arabic Coffee		Others		Total	
		count	No %	Count	No %	Count	No%
BMI Category	Under Weight	8	88.9	1	11.1	9	100.0
	Normal	106	73.1	39	26.9	145	100.0
	Over Weight & Obesity	3	75.0	1	25.0	4	100.0
	Total	117	74.1	41	25.9	158	100.0
P-value—0.577							

Table (4) shows caffeine intake from Arabic coffee and other food sources in relationship to BMI. Regardless BMI category, most of the participants had caffeine intake from Arabic coffee (74%). However, only (25.9%) of the participants had their caffeine intake from other food sources. Underweight, normal, overweight and obese participants, the majority of them consume caffeine from Arabic coffee (88.9%, 73.1% and 75%) respectively.

Statistical analysis shows no significant results between the consumption of caffeine from Arabic coffee or other food sources and BMI Category ($p<0.05$). where p-value was 0.577.

Table-5: Caffeine intake from Arabic coffee and other sources among non-obese and obese subjects

	Caffeine source					
	Arabic Coffee		Others		Total	
	Count	Row N %	Count	Row N %	Count	Row N %
Non-Obese	103	76.3	32	23.7	135	100.0
Obese	14	60.9	9	39.1	23	100.0
Total	117	74.1	41	25.9	158	100.0
P-value—0.119						

Regarding to non-obese subjects' data in table (5) indicates that 135 of the number of participants were non-obese subjects; the majority of them (76.3%) had their caffeine intake from Arabic coffee however only (23.7%) caffeine intake was from other sources. Regarding Obese participants (23), more than half of them had their caffeine intake from Arabic coffee (60.9%) and only (39.1%) had their caffeine from other sources. Statistical analysis shows no significant results between the consumption of caffeine from Arabic coffee or other food sources and non-obese or obese subjects ($p<0.05$) where p-value was 0.119.

Table-6: Different caffeine intake levels from Arabic coffee among non-obese and obese subjects

	No. of Cups in a day							
	No Intake		Low Intake		High Intake		Total	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
Non Obese	60	44.4%	42	31.1%	33	24.4%	135	100.0%
Obese	22	95.7%	0	0.0%	1	4.3%	23	100.0%
Total	82	51.9%	42	26.6%	34	21.5%	158	100.0%
P-value—0.000								

Table 6. Indicate that among non-obese subjects (44.4%, 31.1& 24.4%) were no, low and high consumers of caffeine from Arabic coffee respectively. On the other hand (95.7%) of obese subjects were no caffeine consumption from Arabic coffee, while only (4.3%) of obese subjects was high caffeine consumption from Arabic coffee. Statistical analysis shows a high significant relation between Arabic coffee consumption and obese or non-obese subjects (P=0.000).

DISCUSSION

This present study was applied among Jazan university students (N=158), aged between 18-25 years old to examine the extent effect of caffeine on weight reduction through its effects on the BMI. The mean BMI were (21.208 & 22.023) kg/m^2 of male and female participants respectively.

Some previous studies had found that caffeine has effect on weight reduction while many studies denied, which in turn create diverse views. This study was conducted to show the extent of the association between dietary caffeine and weight reduction through its effect on the BMI. The research results revealed that there was a significant association between caffeine intake from Arabic coffee and BMI (P=0.035). This finding not compatible with a study reported that coffee consumption was not related to BMI in either gender **(Bouchard, et al., 2010)** ; as well as a study Published in 2012 reported that Green tea preparations which has caffeine as ingredient, appears to induce a small, statistically non-significant weight loss in overweight or obese adults **(Jurgens, et al., 2012).** Moreover, **Westerterp-Plantenga, et al., (2005)** reported a reduction in anthropometrics measurements among high caffeine consumers (>300 mg/d) was more than low caffeine consumers (<300 mg/d), which was considered to be in agreement with the current research findings **(Westerterp-Plantenga, et. al., 2005).** Another study conducted by **Phung, et al. (2010)** reported that green tea catechins in combination with caffeine decrease BMI, body weight and waist circumference.

CONCLUSION AND RECOMMENDATIONS

This present study was applied among Jazan University female and male students (N=158), their ages between 18-25 years old. The normal range of BMI were within the (18.5-24.9 kg/m2) was the majority of research sample. According to the results, the high caffeine intake shows a high significant relation between Arabic coffee consumption and obese or non-obese subjects (P=0.000).

Based on the results the following recommendations are suggested:

Future scientific studies should be conducted including other variants as the impact of caffeine on total caloric consumption, exercise and activity tolerance to further understand the effect of caffeine consumption on reduction BMI.

Research Limitations

The results are specific to Saudi Arabia population groups, where Arabic coffee is consumed.

The cross sectional design, couldn't reveal the actual effect of the caffeine consumption on BMI, and energy intake.

Inaccurate measurement in the assessment of caffeine intake may be occurred due to self-estimated caffeine intake from self-reported FFQ.

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