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Evaluation of the relationship between habitual consumption of coffee with reduced risk of diabetes

Vijayalaxmi BM[1], Nikitha Shajahan[2], Shrikant L Patil[1*]

[1]Department of Physiology, K. S. Hegde Medical Academy, Nitte University, Mangalore, Karnataka, INDIA
[2]III MBBS Student, K. S. Hegde Medical Academy, Nitte University, Mangalore. Karnataka, INDIA

ABSTRACT

The large number of people around the world drink coffee, a great concern exists regarding the possible role of coffee on human and public health, since small effects in people could have a large impact on public health. Knowledge of both positive and negative health effects of coffee is important to allow individuals to make informed choices regarding coffee consumption. The associations between coffee and caffeine, the fame compound of coffee, with common chronic diseases have been examined through epidemiological, clinical, or experimental research. During the recent decades, research has attempted to evaluate the harms or benefits received from coffee. Although various health effects of coffee have been extensively investigated unfortunately the association of coffee consumption and glucose metabolism has not been thoroughly studied. As caffeine stimulates thermogenesis and increases energy expenditure, which may facilitate weight reduction and maintenance; coffee consumption may be related to diabetes. This promoted us that caffeine can adversely affect the insulin sensitivity and glucose metabolism. Our study reveals that chronic consumption of coffee may help to maintain normal blood glucose level. This study describes the association of habitual coffee consumption with developing diabetes among individuals.

Keywords: Coffee, habitual coffee consumption, glucose metabolism, diabetes.

[*]***Corresponding Author:***
Email: shrikantlpatil@gamil.com

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INTRODUCTION

There is no doubt that coffee is one of the most desired and consumed beverages in the world and Indians seems to consume the most with 11.6 kg per capita, while the Asian average is 5 kg per capita [1]. Caffeine (1, 3, 7-trimethylxanthine), an alkaloid plant toxin, stimulates by blocking neuro receptors for adenosine that exerts its effects both centrally and peripherally because it crosses the blood-brain barrier. Caffeine contains water, 2- ethylphenol, quinic acid, 3,5-dicaffeoylquinic acid, dimethyl disulfide , acetylmethyl carbinol, putrescine, trigonellline, niacin.

Caffeine is naturally found in certain leaves, seeds and fruits of over 60 plants worldwide. The common sources of caffeine are coffee, tea leaves, cocoa beans, cola and energy drinkers. Among coffee, plain and brewed coffee contains the highest caffeine -135 mg and among soft drinks –Mountain Dew, 55.5 mg. During the recent decades, research has attempted to evaluate the harms or benefits of coffee [2, 3]. Knowledge on both the positive and negative health effects of coffee is important; it allows individuals to make informed choices regarding coffee consumption [4-6]. Even though other, more abundant components of coffee, may also have many biological effects but may have not yet been extensively studied.

Blood glucose level is the amount of glucose present in the blood. Normally in human, the body maintains the blood glucose level at a reference range between 70 and 115 mg/dl. Blood glucose levels are tightly regulated as a part of metabolic homeostasis.

Glucose levels are usually lowest in the morning, before the first meal of the day (fasting glucose) and rise after meals for an hour or 2 by a few milligrams. The risk of developing Type 2 Diabetes mellitus has increased dramatically in the past decades. Diet and lifestyle are primary determinants of risk for type 2 diabetes, in addition to overweight and obesity. Type 2 diabetes is the most common form of diabetes and a major health problem, associated with excess morbidity and mortality, resulting in substantial health care costs.

Several studies have been done to study the effect of coffee consumption and the prevalence of type 2 diabetes. Most of the controlled clinical trials have revealed that acute administration of caffeine will impair glucose tolerance and insulin sensitivity [7-10].

Few researchers compared the acute effects of caffeine or coffee ingestion on glucose metabolism and found impaired glucose tolerance following both. While caffeine ingestion resulted in higher glucose, insulin, and C peptide responses compared to both placebo and decaffeinated coffee, regular coffee consumption only resulted in an attenuated response for glucose and insulin when compared with decaffeinated coffee, but no difference compared to the placebo [11]. Although most of the short term trials of coffee and caffeine ingestion demonstrate the negative impacts on glucose tolerance and insulin sensitivity, epidemiological

studies reveal that chronic consumption of coffee may help to maintain normal glucose tolerance.

As caffeine stimulates thermogenesis and increases energy expenditure, which may facilitate weight reduction and maintenance; coffee consumption may be related to diabetes. This promoted us that caffeine can adversely affect the insulin sensitivity and glucose metabolism.

This study describes the association of habitual coffee consumption with developing type 2 diabetes among individuals. The study examined the association between coffee consumption and different parameters of glucose metabolism.

MATERIALS AND METHODS

Selection of the subject Baseline surveys were carried out in urban as well as rural areas of Mangalore, with the help of Community Medicine Department of Medical Academy, Mangalore. The samples were randomly drawn from the population aged 25-64 yrs. and was stratified into the coffee consuming volunteers and non-consuming volunteers so that in each category at least 30 subjects were chosen from both sexes. The study has got the approval from Institutional Ethics Committee, Informed Consent form were obtained from every individual who has participated in this study.

Questionnaire Along with the invitation to the survey, a self-administered questionnaire was sent to the participants to be completed at home before arrival to the health care center for anthropometric measurements. Then it was checked by researchers at the survey sites. The questionnaire included questions on medical history, socioeconomic factors, smoking habits, physical activity, dietary habits, and education level.

Coffee & tea assessment For the assessment of coffee and tea consumption, the participates will be asked, “How many cups of coffee or tea do you drink per day (1 cup of coffee equal to 1 deciliter; 1 cup of tea equal to 2 deciliter). [6]” Coffee consumption will be categorized into three to five categories (<2, 3-4, 5-6, 7-8 cups/day)

Alcohol consumption was assessed with questions on type (beer, wine, liquor, and spirit), frequency, and amount of alcohol consumed during the previous week. Based on this information, an alcohol index was calculated indicating the intake of absolute alcohol in grams per week.

Smoking Based on the responses, the participants were classified as never, ex-, and current smokers.

Dietary assessment The participants’ diet and food choices were assessed by two type questions. First, the amount of food consumed daily and second, the frequency of consumption

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of vegetables and fruits over the last week (<1 time/week, 1-2 times/week, 3-5 times/week, 6-7 times/week), and the frequency of consumption of sausages over the past 12 month (<1 time/month, 1-2 times/month, 1 time/week, 2 times/week, almost daily, >1 time/day) were inquired.

Anthropometric measurements Measurement of height and weight of the participants was done who had come in light clothing, without shoes by using the standardized WHO protocol. The body mass index (BMI, kg/m^2) was used as a measure of relative body weight as a continuous variable. Blood pressure was measured from the right arm of the participant who was relaxing for 5 min before the measurement using a standard sphygmomanometer.

Estimation of Blood Glucose Level During the study period, blood sample were collected from every individuals participating in the study, and it was processed for analysis of total cholesterol level and blood glucose level.

Statistical Analysis Data obtained from this research study were analyzed by student't' test.

RESULTS

Table.1- Anthropometric measurements from the subject group

Parameter	Non-consuming volunteers (n=30)	Coffee consuming volunteers (n=30)	p
Male/female	14/16	18/12	
Age (years)	37 ± 9	42 ± 12	ns
BMI (kg/m^2)	25.2 ± 1	23.6 ± 0.8	<0.01
Systolic blood pressure (mmHg)	126 ± 4	121 ± 3	0.02
Diastolic blood pressure (mmHg)	78 ± 2	74 ± 3	0.10

Data are expressed as mean ± S.E.M. or median (range).

These volunteers were first interviewed, details about food habit, beverage consumption, smoking, hypertension and any other disorders, were taken in consideration.

Table 2 – Baseline characteristics of participants by volume of coffee consumption

Parameters	Daily consumption of coffee				
	0 cups	**≤ 2 cups**	**3-4 cups**	**5-6 cups**	**7-8 cups**
Age (years)	37 ± 9	38.1 ± 8	36 ± 9	39 ± 11	41 ± 11
BMI (kg/m^2)	25.2 ± 1	24.6 ± 0.7	24.2 ± 0.6	23.8 ± 0.3	23.7 ± 0.6
Systolic Blood Pressure (mmHg)	135 ± 4	131 ± 7	129 ± 3	126 ± 9	121 ± 4
Diastolic Blood Pressure (mmHg)	79 ± 2	78 ± 2	76 ± 2	74 ± 3	72 ± 2

The Subjects (n) in each group, n= 30. The values are expressed as mean ±SD.

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Age- and study year-adjusted in people who drank 0-2, 3-4, 5-6, 7-8 cups of coffee, BMI, systolic blood pressure, alcohol and tea consumption, and smoking), this inverse association still remained significant among women (*P*<0.001 for trend).

Table. 3 – Relationship between daily coffee consumption and blood glucose level

Parameters	Daily consumption of coffee				
	0 cups	≤ 2 cups	3-4 cups	5-6 cups	7-8 cups
Fasting Blood Glucose (mg/dl)	112 ± 11	109 ± 10	105 ± 12	91 ± 11	89 ± 11*
2-hr Blood Glucose (mg/dl)	154 ± 24	148 ± 26	132 ± 33	94 ± 23	96 ± 20*
Total Cholesterol, nmol/l	6.9 ± 1.4	6.3 ± 1.3	6.5 ± 1.3	6.6 ± 1.4	6.6 ± 1.3*

The Subjects (n) in each group, n= 30. Data are expressed as mean ± S.E.M., * p < 0.001

After adjustment for all potential confounding factors (age, BMI, systolic blood pressure), coffee consumption was significantly and inversely associated with fasting glucose, 2-hour plasma glucose and total cholesterol. For the entire subject together, we found that an increment of one cup of coffee per day was associated with 0.29 mg/ml lower fasting glucose, 1.16 mg/ml lower 2-hour glucose.

DISCUSSION

It is well known that obesity is associated with impaired glucose tolerance and development of type 2 diabetes [12, 13]. Excess fat accumulation may lead to increased insulin resistance, thus development of type 2 diabetes is predictable [12].

Greenberg et al. found that caffeinated and decaffeinated coffees were independently associated with weight loss, which may imply that both caffeine and non-caffeine compounds in coffee may help people decrease body weight [14]. This idea is supported by the recent results from this study, which found that increases in caffeine, coffee intake were associated with decreased body mass index as compared to the non-consuming volunteers.

This study compared the effect of habitual coffee consumption in blood glucose level. There several factors which alter the blood glucose level, like food intake, life style, hormones, emotional status etc.

This study hypothesized that habitual coffee consumption maintains the blood glucose level at a lower range compared to that of non-coffee consumers. Blood glucose levels the first and foremost indicator of diabetes, and hence this study also reveals that coffee consumers have comparatively reduced risk of developing Diabetes Mellitus. Although the biological mechanism behind the inverse association between coffee consumption and the risk of type 2 diabetes is unknown.

This study revealed clear evidence for an inverse and graded association between coffee consumption and type 2 diabetes. Coffee consumption was significantly and inversely associated with impaired glucose metabolism, impaired glucose regulation among both men

and women. Habitual coffee drinkers, both middle aged men and women, in the highest category of coffee consumption had the least risk of developing diabetes.

CONCLUSION

There is significant association between habitual coffee consumption and blood glucose level. Although habitual coffee consumption seems to be a safe and useful lifestyle behavior in type 2 diabetes, which has been confirmed by published data from diverse countries, better knowledge of the components of the coffee, human consumption, and bioavailability is still needed in order to properly evaluate the true role of coffee in type 2 diabetes. Eventually, research in this area should lead to dietary recommendations optimized for specific population groups at risk of type 2 diabetes.

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