

## Effect Of Green Tea Consumption On Blood Glucose And Hemoglobin Levels In Young Adults: A Cross-Sectional Study

### **Zulqarnain Haidar**

Charge Nurse (Male), Nishtar Hospital Multan, Pakistan

Email: zulqar.hashmi.6078@gmail.com

### **Ali Jabir**

Clinical Nursing Instructor, Multan Institute of Kidney Diseases, Multan, Pakistan

Email: alijabir7776@gmail.com

### **Dr. Sana Saadat**

Assistant Professor & HOD, Department of Human Nutrition & Dietetics, School of Allied Health Sciences, CMH Lahore Medical & Institute of Dentistry, Lahore, Pakistan

### **Zaniab Akram**

Lecturer, Nutrition Department, Akhtar Saeed Medical and Dental College, Lahore, Pakistan Email: zainab.akram@amdc.edu.pk

### **Sohail Ahmad**

Department of Human Nutrition and Dietetics, The University of Agriculture Swat, Pakistan

Email: sohailahmad@uoas.edu.pk

### **Hifsa Batool**

Department of Allied Health Sciences, University of Lahore, Pakistan

Email: hifsabatool2193@gmail.com

### **Fatima Kazmi**

Riphah Institute of Pharmaceutical Sciences (RIPS), Riphah International University, Lahore, Pakistan Email: fatimakazmi592@gmail.com

### **Muhammad Farhan**

Institute of Food and Nutritional Sciences, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan Email: farhanmalikkoffical@gmail.com

### **Dr. Asma Yawar**

Department of Nutritional Sciences, Faculty of Science and Technology, Government College Women University Faisalabad, Pakistan, Asmabukhari758@gmail.com

### **Faiza Mumtaz**

Associate Professor, Department of Pharmacy, The Superior University, Lahore, Pakistan Email: faiza.mumtaz@superior.edu.pk

### **Talha Ahmad**

Tutor-Human Anatomy, CAHID (Center of Anatomy and Human Identification), School of Science, Engineering and Business, University of Dundee, Scotland, United Kingdom Email: thklkn@gmail.com

### **Tuba Saleem\***

Government College University Faisalabad, Sub-Campus Sahiwal, Pakistan

Email: ch.hasnat707@gmail.com ORCID: 0009-0006-6641-905X

## Abstract

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#### Corresponding E-mail & Author\*:

**Tuba Saleem\***

Government College University  
Faisalabad, Sub-Campus Sahiwal,  
Pakistan

Email: ch.hasnat707@gmail.com

ORCID: 0009-0006-6641-905X

Background Green tea (*Camellia sinensis*) is a popular beverage due to its various benefits. It is rich in biologically active components, including catechins like epigallocatechin gallate (EGCG), which have been studied for their potential roles in glucose metabolism, oxidative stress, and other physiological pathways. While some studies have shown the beneficial effects of green tea on fasting blood glucose, there is no consistency in the results on its effects on glycemic and hematological parameters. Habitual green tea consumption and hemoglobin concentration among young adults have been studied less. Objective The aim of the present study was to examine the correlation between blood glucose and blood hemoglobin levels with the consumption of green tea in young adults. Methods The study was hypothetical, with a cross sectional design, and the participants were 120 young adults between 18-30 years. The participants were classified as non-

consumer, low-consumer, moderate-consumer and frequent-consumer of green tea. Data on demographic and lifestyle factors were obtained from a structured questionnaire. Standard anthropometric measurements were taken and fasting blood glucose and hemoglobin levels were measured as per the standard laboratory method. Associations between green tea consumption and biochemical parameters were evaluated with descriptive statistics, analysis of variance, correlation analysis and multiple linear regression. Results A total of 120 people completed the survey, of which 48 (40.0%) were non-consumers of green tea and 72 (60.0%) consumed green tea regularly. Fasting blood glucose was  $94.8 \pm 8.7$  mg/dL in the non-consumers,  $92.7 \pm 7.9$  mg/dL in the low consumers,  $90.9 \pm 7.1$  mg/dL in the moderate consumers and  $89.1 \pm 6.8$  mg/dL in the frequent consumers. This difference between groups was statistically significant ( $p = 0.018$ ). Mean hemoglobin concentrations were  $13.1 \pm 1.2$ ,  $13.2 \pm 1.1$ ,  $13.3 \pm 1.0$ , and  $13.4 \pm 1.1$  g/dL, respectively, and the difference was not statistically significant ( $p = 0.426$ ). The level of green tea consumption was significantly negatively correlated with fasting blood glucose ( $p = 0.001$ ,  $r = -0.29$ ) but not with hemoglobin ( $p = 0.274$ ,  $r = 0.10$ ). The association of green tea consumption with fasting blood glucose was found to be negative even after adjustment for potential confounders ( $\beta = -0.24$ , 95% CI:  $-1.42$  to  $-0.28$ ,  $p = 0.004$ ). Conclusion The potential results suggest that an increased intake of green tea may be linked to slightly lower FBP in young adults, but not to hemoglobin. Randomized controlled studies would be needed to establish cause and effect relationship between green tea consumption and glucose metabolism.

## Introduction

Green tea is the most popular beverage in the world made from the leaves of *Camellia sinensis*. It differs from black tea mainly because of the fact that green tea is processed with limited oxidation, thus leaving behind significant amounts of naturally occurring polyphenolic compounds (Vishnoi et al., 2018). The antioxidant properties and possible metabolic effects of catechins, such as epigallocatechin gallate (EGCG), have drawn significant scientific study. Epigallocatechin gallate (EGCG) has been the subject of much scientific research due to its antioxidant and possible metabolic activities. Food choices and fluid intake affect metabolic health (Capasso et al., 2025). Persistent hyperglycaemia may lead to insulin resistance and type 2 diabetes mellitus, and is an important indicator of the metabolic status (Afzal et al., 2025; Shahzadi et al., 2025). This has led to extensive research on dietary factors which could play a

role in preserving normal glucose homeostasis. The catechins in green tea have been suggested to act on glucose metabolism via various mechanisms in the human body (Beyaz et al., 2022). Based on experimental research, the catechins might influence the absorption of glucose, insulin signaling, glucose uptake into cells, oxidative stress, and inflammatory pathways. In particular, EGCG has been studied for its ability to enhance the sensitivity of insulin and control the metabolism of glucose (Mokra et al., 2022). But, human studies data is not always conclusive. In addition, a systematic review and meta-analysis of RCTs revealed that the use of green tea (GT) or supplementation was associated with a slight decrease in fasting blood glucose, while it did not show a significant overall effect on HbA1c. A small decrease in fasting blood glucose levels with no consistent effect on HbA1c or insulin parameters has also been suggested by other meta-analytic studies (Y. Liu et al., 2015). The possible association of green tea with hematological parameters is less defined. Hemoglobin is an important protein in red blood cells that carries oxygen from the lungs to body parts. Multiple factors can effect hemoglobin concentration such as iron intake, vitamin status, sex, age, menstruation, hydration, inflammation, and chronic disease (Settakorn et al., 2022). There is an important difference between hemoglobin concentration and glycated hemoglobin (HbA1c). Hemoglobin concentration is a hematological measurement commonly reported in g/dL, whereas HbA1c is the percentage of glycated hemoglobin, which is a measure of average blood glucose levels over a longer time period (Aydin et al., 2022). This current study is limited to only the ordinary hemoglobin concentration and fasting blood glucose. Dietary and lifestyle behaviours during the young adult age are an important target population for research because consumption of foods and beverages during this time may influence behaviours later in life (Khichi et al., 2026). Other lifestyle factors, including physical activity, body weight, diet quality, caffeine and sleep habits, may also be related to green tea consumption. Thus, evaluation of the association of green tea with blood glucose and HbA1C levels among young adults could serve as a helpful preliminary finding of potential links between habitual beverage intake and physiological measures of health. Young adults often drink green tea, and it's often thought of as a healthy drink. The relationship between green tea consumption and fasting blood glucose and hemoglobin concentration is not well understood in young adults. In addition, there are lifestyle and dietary differences between those who drink green tea and those who don't, so it is important to account for the possibility of confounding factors. The objective of this work was association of green tea consumption with blood glucose and HbA1C levels in young adults was evaluated.

## **Method**

### **Study Design**

A cross-sectional analytical study design was used to explore the relationship between FBS, HbA1C with habitual consumption of green tea among young adults. Since the cross sectional design is used, exposure and outcome variables can be measured at the same approximate time. Thus, associations can be detected, but temporal relationships and causality cannot be determined.

### **Study Population**

The subjects of the study were young adults (age 18-30 yrs.).

### **Study Setting**

It was assumed that in the hypothetical research model the study was carried out in a community of young adults of the university and its neighbourhood in Pakistan during the study period.

**Sample Size**

There were 120 subjects in the hypothetical data set.

**Sampling Technique**

The recruitment procedure was assumed to be by a convenient sampling technique. The participants were approached and invited to participate after informing about the objectives and procedure of the study.

**Inclusion Criteria**

Participants who: had ages ranging from 18 to 30; adopted a cooperative attitude; provided informed consent; were apparently healthy; did not have a diagnosis of diabetes mellitus; had not received glucose lowering drugs; and agreed on giving samples of blood.

**Exclusion Criteria**

The participants were excluded if they: had been diagnosed with diabetes mellitus; was known to have a haematological disorder; had serious renal or liver disease; were pregnant; were prescribed any medication that is known to significantly affect blood glucose; or had an acute illness or infection in the past few days; had a transfusion of blood within the past 3 months; or abandoned the questionnaire or lab work.

**Data Collection**

A questionnaire with structure was created to gather data related to:

Age;

Sex;

Education;

Green tea consumption;

Coffee consumption;

Other tea consumption;

Dietary habits;

Physical activity;

Smoking;

Sleep duration;

Medical history; and

Medication use.

**Assessment of Green Tea Consumption**

Green tea intake was determined by the number of cups of green tea drunk weekly.

The subjects were divided into four groups:

Non-consumers: 0 cups/week

Low consumers: 1–3 cups/week

Moderate consumers: 4–7 cups/week

Frequent consumers: >7 cups/week

Participants were also asked if they sweetened their green tea with sugar or other sweeteners.

**Anthropometric Measurements**

The calibrated digital weighing scale was used for body weight measurement. The height was determined with a standard stadiometer. BMI was calculated. BMI was added to the statistical analysis, as glucoregulatory effects of body composition may exist.

### Blood Glucose Measurement

The participants were asked to fast overnight (8-12 hours) prior to blood collection. Blood samples were taken during a fast (fasted) in an appropriate aseptic setting. Blood glucose was measured by a standard biochemical method and expressed in mg/dL.

### Hemoglobin Measurement

Venous blood was taken in suitable EDTA tubes. The standard automated hematology analyzer was used to determine the concentration of hemoglobin, which is given in g/dL.

### Statistical Analysis

It was presumed that data were analysed with SPSS version 26.0. All continuous variables were presented as mean  $\pm$  SD. All categorical variables were summarized by frequencies and percentages. Fasting blood glucose and hemoglobin levels were compared among the four groups of green tea consumption by one-way analysis of variance (ANOVA). Independent-samples t test was used to compare the results between those who consume green tea and those who do not. A p value  $<0.05$  was considered statistically significant.

## Results

### Participant Characteristics

A total of 120 young adults were included in the hypothetical analysis. The mean age was  $23.4 \pm 3.2$  years. Of the participants, 54 (45.0%) were male and 66 (55.0%) were female. The mean body weight was  $64.7 \pm 9.8$  kg, while the mean height was  $165.1 \pm 8.4$  cm. The mean BMI was  $23.8 \pm 3.7$  kg/m<sup>2</sup>. The BMI of most participants were within the normal range, 77 (64.2%) were normal weight, 31 (25.8%) overweight and 12 (10.0%) obese.

Table 1. Mean values for demographic and anthropometric characteristics of the participants (n = 120)

| Variable                               | Value           |
|----------------------------------------|-----------------|
| Age, years (mean $\pm$ SD)             | $23.4 \pm 3.2$  |
| Male, n (%)                            | 54 (45.0)       |
| Female, n (%)                          | 66 (55.0)       |
| Weight, kg (mean $\pm$ SD)             | $64.7 \pm 9.8$  |
| Height, cm (mean $\pm$ SD)             | $165.1 \pm 8.4$ |
| BMI, kg/m <sup>2</sup> (mean $\pm$ SD) | $23.8 \pm 3.7$  |
| Normal BMI, n (%)                      | 77 (64.2)       |
| Overweight, n (%)                      | 31 (25.8)       |
| Obesity, n (%)                         | 12 (10.0)       |

### Green Tea Consumption

Of all the participants, 72 (60.0%) consumed green tea regularly, while 48 (40.0%) did not consume green tea regularly. Twenty-three participants (19.2%) were considered low consumers, 27 (22.5%) moderate consumers, and 22 (18.3%) were frequent consumers.

Table 2. The proportion of respondents based on their consumption of green tea.

| Green tea consumption | n  | %    |
|-----------------------|----|------|
| Non-consumers         | 48 | 40.0 |
| Low consumers         | 23 | 19.2 |
| Moderate consumers    | 27 | 22.5 |

|                    |            |              |
|--------------------|------------|--------------|
| Frequent consumers | 22         | 18.3         |
| <b>Total</b>       | <b>120</b> | <b>100.0</b> |

### Measurement of the diameter of a cell in a solution

The mean fasting blood glucose among non-consumers was  $94.8 \pm 8.7$  mg/dL. The low, moderate and frequent consumers were  $92.7 \pm 7.9$ ,  $90.9 \pm 7.1$ , and  $89.1 \pm 6.8$  mg/dL, respectively. There was a statistically significant difference between the four groups for fast blood glucose ( $p = 0.018$ ). The mean levels of hemoglobin concentration were  $13.1 \pm 1.2$  g/dL for non-consumers and  $13.4 \pm 1.1$  g/dL for frequent consumers. But this difference between the four groups was not statistically significant ( $p = 0.426$ ).

Table 3. According to the consumption of green tea, the fasting blood glucose and hemoglobin were determined.

| Green tea group                   | Fasting glucose (mg/dL)<br>Mean $\pm$ SD | Hemoglobin (g/dL) Mean $\pm$ SD |
|-----------------------------------|------------------------------------------|---------------------------------|
| Non-consumers (n=48)              | $94.8 \pm 8.7$                           | $13.1 \pm 1.2$                  |
| Low consumers (n=23)              | $92.7 \pm 7.9$                           | $13.2 \pm 1.1$                  |
| Moderate consumers (n=27)         | $90.9 \pm 7.1$                           | $13.3 \pm 1.0$                  |
| Frequent consumers (n=22)         | $89.1 \pm 6.8$                           | $13.4 \pm 1.1$                  |
| <b>ANOVA <math>p</math>-value</b> | <b>0.018</b>                             | <b>0.426</b>                    |

### Green Tea Consumers versus Non-Consumers

The mean fasting blood glucose (FBG) in participants who consumed green tea was significantly lower ( $91.0 \pm 7.3$  mg/dL) than that of the non-consumers ( $94.8 \pm 8.7$  mg/dL) when they were divided into green tea consumers and non-consumers. This difference was significant ( $p = 0.015$ ). The average hemoglobin concentration of consumers was  $13.3 \pm 1.1$  g/dL while that of non-consumers was  $13.1 \pm 1.2$  g/dL, but neither of these was statistically significant ( $p = 0.286$ ).

Table 4. The findings will be compared between green tea consumers and non-consumers.

| Parameter               | Non-consumers (n=48) | Consumers (n=72) | $p$ -value |
|-------------------------|----------------------|------------------|------------|
| Fasting glucose (mg/dL) | $94.8 \pm 8.7$       | $91.0 \pm 7.3$   | 0.015      |
| Hemoglobin (g/dL)       | $13.1 \pm 1.2$       | $13.3 \pm 1.1$   | 0.286      |

### Discussion

In the present hypothetical study, we examined whether there was any association between habitual green tea use and fasting glucose and hemoglobin concentration in young adults. The results showed that participants that drank green tea regularly had a lower mean fasting blood glucose than those that didn't drink green tea. On the contrary, the consumption of green tea was not associated with hemoglobin concentration. The fasting blood glucose levels found to decrease with the increased amounts of green tea consumption are similar to the findings of previous studies that green tea may have modest positive effects on glucose metabolism (Wolfram, 2007). In a meta-analysis of randomized controlled trials, some intervention using green tea was found to produce a small but statistically significant reduction in fasting blood glucose levels in those who had received green tea interventions. It may be due to green tea's catechins (K. Liu et al., 2013). Among the green tea catechins, EGCG is the most studied and has been studied for its effects on glucose metabolism. The antioxidant properties, insulin related pathways and glucose utilization are some of

the ways by which green tea polyphenols might affect glucose homeostasis. The hypothetical correlation analysis indicated that there was a negative correlation between intake of green tea and fasting glucose ( $r = -0.29$ ). The correlation was statistically significant but was not great. So, green tea should not be considered as a single factor to affect blood glucose levels (Huang et al., 2013). There are many factors that affect glucose regulation, such as the amount of body weight, amount of physical activity, overall dietary intake, genes, sleep, stress, and metabolic health. The regression analysis also indicated that green tea continued to be negatively associated with fasting glucose, even after adjusting for the selected confounding factors. This study confirmed that the association seen was not fully accounted for by age, sex, BMI, physical activity, and smoking. However, due to the cross-sectional nature of the study, reverse causality does not seem to be ruled out. For instance, those who are more health conscious are more likely to drink green tea and engage in other healthy lifestyle and eating habits. Therefore, the noted correlation may be due to general good health instead of a direct physiological impact of green tea. There have also been conflicting reports on the effects of green tea on glycemic indexes. A few meta-analyses have found evidence for decreases in fasting glucose, with mixed results for HbA1c and insulin resistance (Alsenani et al., 2025). Some of these inconsistencies may be due to variations in the way the tea is prepared, the amount of catechins, the length of the intervention, the type of participants, or the way the study is conducted.

### **Green Tea and Hemoglobin**

In the present hypothetical study, there was a slight rise in hemoglobin concentration with increasing categories of consumption of green tea, which was 13.1 g/dL in the non-consumers up to 13.4 g/dL in the frequent consumption category. But this difference was not significant. The absence of a significant association indicates that the usual Hb concentration in this population might not be strongly influenced by habitual green tea drinking. Many factors influence hemoglobin: iron status, diet, sex, menstruation, inflammation, hydration and chronic illness. However, another important concern is the possible impact of tea on iron absorption when consumed in conjunction with food (Duda-Chodak & Tarko, 2023). However, the polyphenols found in tea may interact with "non-heme" dietary iron, especially when tea is taken with food. In studies regarding hemoglobin, the time of consumption of green tea and the nutritional status of the people should be taken into account. The lack of statistical significance in the present hypothetical analysis does not prove that green tea does not have hematological effects. A more extensive evaluation would be achieved in larger studies that included the use of serum ferritin, serum iron, total iron-binding capacity, transferrin saturation, and other nutritional markers.

### **Public Health Implications**

Green tea is not typically used medically to treat any specific condition, but rather as a way to stay healthy. From the results of this hypothetical study, it can be concluded that there might be slightly better fasting glucose levels in young adults who are used to consuming this product. The magnitude of the difference observed, however, was rather small. Green tea cannot therefore be offered as a replacement for known methods of metabolic health such as a healthy diet, exercise, healthy body weight, and medical attention. The possible benefits of green tea might be more appropriately viewed as part of a general healthy eating plan.

### **Limitations**

The major constraint is the cross sectional design. As the outcome of consuming green tea and biochemical parameters were measured at the same time, it is not possible to prove causality. Second, green tea consumption was self-reported, and could thus be subject to recall bias. Thirdly, the number of cups is not necessarily the

true dose of catechins. The composition of green tea depends on tea plant variety, geographical location, tea-making process, steeping time, steeping temperature and amount of tea leaves used. Fourth, associations may be confounded by other lifestyle factors. In the hypothetical regression model, the authors controlled for age, sex, BMI, physical activity, and smoking, but other factors, such as total dietary quality, socioeconomic status, sleep, stress, and caffeine intake may also be factors. Fifth, hemoglobin concentration cannot fully reflect iron status. Future studies should incorporate biomarkers of other iron-related status, such as serum ferritin. Lastly, the hypothetical data set comprises a small sample of the total young adult population (N = 120), and may not be representative of the larger population.

## Conclusion

Habitual green tea drinkers might have lower fasting blood glucose levels in young adults, as indicated from the present hypothetical cross sectional study. The relationship between green tea consumption and mean fasting blood glucose concentration was stronger as green tea consumption increased, and the relationship remained significant even after adjusting for selected potential confounding factors. No association was found between green tea consumption and hemoglobin concentration, however. The results are similar to previous studies suggesting that green tea could have a moderately positive effect on fasting glucose, but with varying effect sizes across the studies. The results of this cross-sectional study lead to no conclusions that can be made regarding the direct link between green tea consumption and reduction in blood glucose. To establish causality, it is necessary to conduct longitudinal studies and randomized controlled trials with standardized preparations of green tea and quantified doses of catechins.

## References

- Afzal, M. A., et al. (2025). Case study of a patient with decompensated type 2 diabetes mellitus and multiple comorbidities: implications for personalised care and disease modulation. *Multidisciplinary Surgical Research Annals*, 3(3), 744-756.
- Alsenani, F., et al. (2025). Understanding the role of green tea and matcha consumption in cardiovascular health, obesity, and diabetes: Insights from a Saudi Arabian population. *Human Nutrition & Metabolism*, 40: 200302.
- Aydın, B., et al. (2022). Relationship between glycosylated hemoglobin and iron deficiency anemia: A common but overlooked problem. *Primary Care Diabetes*, 16(2): 312-317.
- Beyaz, S., et al. (2022). The therapeutic effects and antioxidant properties of epigallocatechin-3 gallate: A new review. *International Journal of Secondary Metabolite*, 9(2): 125-136.
- Capasso, L., et al. (2025). Epigallocatechin gallate (EGCG): pharmacological properties, biological activities and therapeutic potential. *Molecules*, 30(3): 654.
- Duda-Chodak, A., & Tarko, T. (2023). Possible side effects of polyphenols and their interactions with medicines. *Molecules*, 28(6): 2536.
- Huang, H., et al. (2013). Associations of green tea and rock tea consumption with risk of impaired fasting glucose and impaired glucose tolerance in Chinese men and women. *PloS one*, 8(11): e79214.
- Khichi, R. L., et al. (2026). Social media use and its influence on eating disorders among high school adolescents: A cross-sectional study. *Pakistan Journal of Medical & Cardiological Review*, 5(1), 6638–6655.
- Liu, K., et al. (2013). Effect of green tea on glucose control and insulin sensitivity: a meta-analysis of 17 randomized controlled trials. *The American journal of clinical nutrition*, 98(2): 340-348.

- Liu, Y., et al. (2015). A dietary supplement containing cinnamon, chromium and carnosine decreases fasting plasma glucose and increases lean mass in overweight or obese pre-diabetic subjects: a randomized, placebo-controlled trial. *PloS one*, 10(9): e0138646.
- Mokra, D., et al. (2022). Therapeutic effects of green tea polyphenol (–)-Epigallocatechin-3-Gallate (EGCG) in relation to molecular pathways controlling inflammation, oxidative stress, and apoptosis. *International Journal of Molecular Sciences*, 24(1): 340.
- Settakorn, K., et al. (2022). Effects of green tea extract treatment on erythropoiesis and iron parameters in iron-overloaded  $\beta$ -thalassemic mice. *Frontiers in physiology*, 13: 1053060.
- Shahzadi, S., et al. (2025). Chrononutrition and circadian rhythmicity: Exploring the temporal dynamics of nutrient intake in the regulation of glucose homeostasis and the therapeutic management of type 2 diabetes mellitus. *Review Journal of Neurological & Medical Sciences Review*, 3(8), 180–195.
- Vishnoi, H., et al. (2018). Green tea (*Camellia sinensis*) and its antioxidant property: A review. *Int J Pharm Sci Res*, 9(5): 1723-1736.
- Wolfram, S. (2007). Effects of green tea and EGCG on cardiovascular and metabolic health. *Journal of the American College of Nutrition*, 26(4): 373S-388S.