**Original Article**

# Association Between Tea and Coffee Consumption and Symptoms of Iron Deficiency Among University Students

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## ARTICLE INFO

## ABSTRACT

Excessive consumption of tea and coffee has been linked with dietary iron deficiency in many clinical trials. People who consume tea or coffee with meal are at higher risk of developing dietary iron deficiency. **Objective:** The aim of this study was to assess the prevalence of iron deficiency in relation with tea or coffee among female university students. **Methods:** 150 female students at University of Lahore selected randomly. All participants were willing to participate in this survey. Questionnaires (on the base of 25 iron deficiency related question) were used for the collection of data to assess the relation between consumption of tea and iron deficiency. **Results:** 88 participants reported experiencing headache when not taking tea or coffee for long time. 41 desire to consume it all the time. 49 participants experience fatigue when not consumed tea or coffee. 31 participants consume tea or coffee with meal. 27 participants experience symptoms of anemia. 68 participants consume tea or coffee for mind relaxation. 54 participants take tea or coffee for better sleep. 83 participants consume for weight management. About 91 participants take dietary supplement for iron less than 1-2 times a day. **Conclusions:** This study shows that all the participants consume tea or coffee on daily basis while majority of them take with meal. The participants revealed to have symptoms of iron deficiency. Consumption of tea or coffee with meal is one of the reasons of dietary iron deficiency as chelates present in tea and coffee hinders the absorption of iron from food.

## INTRODUCTION

Iron deficiency and iron deficiency anemia (IDA) is a condition where hemoglobin (Hb) and red blood cell (RBC) numbers are lower than the normal range due to insufficient iron, lacking to meet a person's physiological demands. Iron deficiency anemia is the most widely recognized kind of anemia [1]. In red blood cells, hemoglobin is the iron-binding protein that contains oxygen from the lungs to the tissues [2]. This ability can't occur when the body loses iron; accordingly, unique outcomes like inadequacy, exhaustion, and windedness are seen. It is most normal in females and children [2]. It influences about 33% of the total population of the world.

Anemia is connected with extended grimness and mortality in women and children, poor birth results, lessened work effectiveness in adults, and crippled mental and social improvement in youth. Preschool youths and women of conceptive age are particularly influenced [3]. Iron deficiency is present to a great extent in underdeveloped countries, with the inescapability of 43% more than in developed countries, with 9% of the total population [4]. World Health Organization (WHO) surveys that almost two billion people, or 25% of the all-out people, are anemic, and around half of them experience the severe impacts of IDA [5]. The World Health Organization (WHO)

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evaluated all around that 273 million young people under 5 years of age were suffering from anemia in 2011, and about 50% of them had Iron deficiency anemia [6]. Anemia inescapability continues to be the most raised in South Asia and Central and West Africa. The Pakistan National Nutrition Survey coordinated in 2011-2012 reported that the presence of IDA in youths under five is between 40-70% [7]. The assistant assessment was performed using the National Nutrition Survey in Pakistan 2011-2012. The predominance of IDA was 18.1% among non-pregnant women of childbearing age [8]. The cause of IDA in adolescence might be a result of extended iron deficiency or decreased iron intake, severe blood loss, iron malabsorption, pregnancy, or parasitic sickness, which significantly reduces mental activity, poor daily life performance, and other health conditions and may continue in adulthood [4]. Few foods and beverages can interfere with iron absorption in the body, which is one of the leading reasons for iron deficiency [9]. Tea and coffee are among such beverages which reduce the absorption of dietary iron. Tea and coffee are the most consumed beverages in the world [10]. Pakistan is one of the countries where tea and coffee are highly consumed; about 91% of Pakistanis prefer tea over any other beverage, while coffee is consumed about 0.8kg per person in Pakistan [11]. According to a survey, males showed a high ratio of tea consumption than females in Pakistan. The survey also reported that the professionals (both genders) drink more tea than the non-professionals. Tea and coffee have been known for their health benefits as they contain numerous anti-oxidants which prevent cancers and cardiovascular diseases [12]. But recent studies have shown that the overconsumption of tea and coffee can lead to many diseases like iron deficiency, iron deficiency anemia, diabetes, and osteoporosis [10]. Tea and coffee contain such nutritive elements that reduce the absorption of dietary iron from food. Reportedly, about 39% of iron absorption is reduced when tea or coffee is consumed with food [10]. Tea and coffee have the potential to inhibit the absorption of non-heme and heme iron from the gut [13]. There are two compounds, tannins, and oxalates, that are naturally present in tea and coffee, which are the reason for the inhibition of iron absorption from food. They bind with iron and excrete out of the body. Several studies have been done to find the health effects of tea and coffee. Many previous types of research have shown that drinking tea or coffee with meals can reduce iron absorption, which may lead to a deficiency over time. In Pakistan, having tea or coffee with meals is one of the common practices. The black tea consumption in 2022 in Pakistan has an estimated 1,72,911 tones, which is expected to increase up to 2,50,755 in 2027. About 40% of Pakistan's total

population suffers from iron deficiency [8]. However, studies on the effects of coffee and tea intake on iron deficiency are limited in Pakistan. We aimed to find the association of iron deficiency and iron deficiency anemia (IDA) with excessive tea and coffee consumption in adult populations like university students. This research will help in understanding iron deficiency in association with coffee or tea consumption and its management among Pakistanis.

## METHODS

A population-based cross-sectional study was conducted on the association of iron deficiency caused by tea and coffee consumption among 150 students at the University of Lahore. A purposive sampling technique was used. Questionnaires were used for the collection of data. Female University students aged 18-30 years who are consuming a minimum of 2-3 cups of tea or coffee were included according to the specific inclusion criteria. The targeted sample size was 150 females. Students aged below 18 and above 30 who do not consume tea or coffee and who were having any disease were not included according to the exclusion criteria. All participants were provided with written informed consent, which was attached. All information and data gathered were kept strictly confidential. The administered questionnaire consisted of 43 questions, divided into 3 main parts. The first part included questions concerning demographic characteristics such as age, gender, marital status, educational level, BMI, residential status, and residential level. The second and third parts tackled iron deficiency features or intake of tea or coffee such as feeling anemic, intake of Vit. c in diet, disturbed menstrual cycle, iron deficiency has a relation with tea or coffee, disturbance in the digestive system, and regular consumption of tea or coffee in the diet. The survey was filled out by the participants after reading questions to them. Data were analyzed by the application of statistical methods. SPSS version 25.0 was used to tabulate and data analysis. Descriptive and inferential statistics were used to report the data. The qualitative variables were reported in the form of frequency percentages. The association between the variables was found by using chi-square.

## RESULTS

According to the Table 1, results showed that out of 150 participants, 141 were of age between 18-24 years whereas 9 were between 25-30 years, 89 belonged to the normal BMI (18.5-24.9), 3 belonged to the obese range of BMI (above 30), 31 belonged to the underweight range of BMI (less than 18) and 27 belonged to the overweight range of BMI (25-29.9), 145 participants were unmarried whereas 5 participants were married, 126 participants were doing graduate while

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15 participants were in pre-graduate and 9 participants were in post-graduate, 109 belonged to the middle socio-economic status where 9 belonged to lower and 32 belonged to upper socioeconomic status, 122 participants belonged to urban areas whereas 28 participants belonged to rural areas.

| Sr No. | Categories | Ranges | Frequency (%) |
|---|---|---|---|
| 1. | Age | 18-24 years | 141 (94%) |
| | | 25-30 years | 9 (6%) |
| 2. | BMI | Underweight below 18 | 31 (20.7%) |
| | | Normal 18.5-24.9 | 89 (59.3%) |
| | | Overweight 25-29.9 | 27 (18%) |
| | | Obese above 30 | 3 (2%) |
| 3. | Marital status | Unmarried | 145 (96.7%) |
| | | Married | 5 (3.3%) |
| 4. | Education Level | Pre-graduate | 15 (10%) |
| | | Graduate | 126 (84%) |
| | | Post-graduate | 9 (6%) |
| 5. | Socio-Economic status | Lower Class | 9 (6%) |
| | | Middle Class | 109 (72.7%) |
| | | Upper Class | 32 (21.3%) |
| 6. | Residential level | Urban | 122 (81.3%) |
| | | Rural | 28 (18.7%) |

**Table 1:** Demographic Profile of Participants

According to Table 2, results showed that all 150 participants consumed tea or coffee regularly in their diet whereas 106 knew that excessive consumption of tea or coffee may lead to iron deficiency while 44 didn't knew about it. 84 participants didn't knew that excessive use of tea or coffee may disturb menstrual cycle while 66 participants knew about it, 88 participants experienced headache while not consuming tea or coffee whereas 62 participants didn't experienced, 95 was aware of the side effects of excessive consumption of tea or coffee whereas 55 wasn't aware of it, 92 knew that tea or coffee has a relationship with iron deficiency whereas 58 didn't knew about it, 79 believed that high intake of tea or coffee increases the risk of miscarriages in pregnant women whereas 71 didn't believed in it, only 55 participants used iron supplements whereas 95 didn't used the iron supplement.

| Sr No. | Diagnosis | | Frequency (%) |
|---|---|---|---|
| 1. | Consumption of tea or coffee regularly in the diet | No | 0 (0%) |
| | | Yes | 150 (100%) |
| 2. | Excessive consumption of tea or coffee may lead to iron deficiency. | No | 44 (29.3%) |
| | | Yes | 106 (70.7%) |
| 3. | Excessive use of tea or coffee may disturb the menstrual cycle | No | 84 (56%) |
| | | Yes | 66 (44%) |
| 4. | Headache while not consuming tea or coffee | No | 62 (41.3%) |
| | | Yes | 88 (58.7%) |
| 5. | Awareness about the side effects of excessive consumption of tea or coffee | No | 55 (36.7%) |
| | | Yes | 95 (63.3%) |
| 6. | Tea or coffee has a relationship with iron deficiency | No | 58 (38.7%) |
| | | Yes | 92 (61.3%) |
| 7. | High intake of tea or coffee in pregnant women has a higher risk of miscarriage | No | 79 (52.7%) |
| | | Yes | 71 (47.3%) |
| 8. | Use of Iron supplement | No | 95 (63.3%) |
| | | Yes | 55 (36.7%). |

**Table 2:** Attributes of intake of Tea or Coffee

# DISCUSSION

The current study was conducted to find out the association between tea and coffee consumption and symptoms of iron deficiency among university students. The participants were selected through a non-probability convenient sampling technique. In the current study, the results showed that 94% of participants were of between 18-24 years of age group, and 6% were of between 25-30 years of age group. In 2018, a similar study was conducted by Al-Alimi et al., who showed that 59.2% of participants were between 20-22 years of age group and 25% of participants were 17 to 19 years of age and 15.8% of participants were 23-25 years of age group [4]. In the recent research, the results showed that 20.7% of participants were underweight having BMI below 18, 59.3% of participants were normal having a BMI of 18-24.9, 18% of participants were overweight having a BMI of 25-29.9 whereas 2% participants were obese having a BMI above 30. In 2018, a study was conducted by Mazhar et al., having similar outcomes. He reported that the BMI of 61 % of participants is in the normal range, 23.1% of participants have a BMI of less than 18, and 16% were a BMI of above 25 [14]. The present study showed that 96.7% of participants were unmarried and 3.3% were married. In 2019, similar research was observed by Vibhute et al., which showed that a higher number of women were non-married and non-pregnant at the time of their studies [15]. The current study showed that 10% of participants were pre-graduate, 84% were doing graduate and 6% were post-graduate. In 2019, Mahmood et al., executed a similar study which showed that students with age less than 20 were 20.6% whereas students in the age group 20-30 were 44.4 % [16]. In the current study, 6% of participants belonged to lower socioeconomic status, 72.7% of participants belonged to middle socio-economic status and 21.3% belonged to high socio-economic status. In 2017, another study conducted by Cote et al., showed that 53% of participants belonged to middle-class people [17]. In our study, 100% of participants consumed tea or coffee regularly in their diet. A similar study was conducted by Gaeini et al., who reported that 90% of participants were tea addicted and 4% of participants were coffee addicted [18]. In the present study, 70.7% of participants know that excessive intake of tea and coffee leads to iron deficiency. Similarly, a study conducted by Fan et al., in 2016 investigated that drinking

tea or coffee leads to iron deficiency [9]. In the current research, 61.3% of participants believed that there is a relationship between tea or coffee and iron deficiency. In 2019, a similar study by Mani *et al.,* showed that ingesting too many tannins from coffee & tea sources can result in iron deficiency in the body. Hence, there is a relationship between tea or coffee and iron deficiency [19]. In a recent study, 47.3% of participants believe that a high intake of tea or coffee increases the risk of miscarriages in pregnant women. A similar study was conducted by El-Saidy *et al., who* reported that consuming more caffeine (>200 mg/d) causes an increased rate of miscarriages in pregnant females[20].

## CONCLUSIONS

Iron deficiency anemia is a condition where there is an imbalance between the body's demand and dietary iron absorption. Our study concludes that there is an association between tea or coffee consumption and symptoms of iron deficiency in the body. About 52% of participants are tea or coffee addicted. Most of the participants feel fatigued, have dizziness, shortness of breath, digestive issues, insomnia, and poor quality of life. It has been seen that there is a significant relationship between excessive consumption of tea or coffee causing anxiety & menstrual disturbance through Chi-Square as their p–value is less than 0.05. Nutrition awareness is necessary to cope with the symptoms and side effects of iron deficiency & the intake of supplements like iron & vit. C (which enhances iron absorption). To treat iron deficiency among adults, IDA iron sulfate supplements are recommended at 60mg, and for children, 30mg.

## Conflicts of Interest

The authors declare no conflict of interest.

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## REFERENCES

[1] Garcia-Casal MN, Pasricha SR, Sharma AJ, Peña-Rosas JP. Use and interpretation of hemoglobin concentrations for assessing anemia status in individuals and populations: results from a WHO technical meeting. Annals of the New York Academy of Sciences. 2019 Aug; 1450(1): 5-14. doi: 10.1111/nyas.14090.

[2] Yıldız TK, Yurtay N, Öneç B. Classifying anemia types using artificial learning methods. Engineering Science and Technology, an International Journal. 2021 Feb; 24(1): 50-70. doi: 10.1016/j.jestch.2020.12.003.

[3] Chaparro CM and Suchdev PS. Anemia epidemiology, pathophysiology, and etiology in low and middle-income countries. Annals of the New York Academy of Sciences. 2019 Aug; 1450(1): 15-31. doi: 10.1111/nyas.14092.

[4] Al-Alimi AA, Bashanfer S, Morish MA. Prevalence of iron deficiency anemia among university students in Hodeida Province, Yemen. Anemia. 2018 Apr; 2018: 4157876. doi: 10.1155/2018/4157876.

[5] Mantadakis E, Chatzimichael E, Zikidou P. Iron deficiency anemia in children residing in high and low-income countries: risk factors, prevention, diagnosis and therapy. Mediterranean Journal of Hematology and Infectious Diseases. 2020 Jul; 12(1): e2020041. doi: 10.4084/mjhid.2020.041.

[6] Sundararajan S and Rabe H. Prevention of iron deficiency anemia in infants and toddlers. Pediatric Research. 2021 Jan; 89(1): 63-73. doi: 10.1038/s41390-020-0907-5.

[7] Habib MA, Black K, Soofi SB, Hussain I, Bhatti Z, Bhutta ZA, *et al.* Prevalence and predictors of iron deficiency anemia in children under five years of age in Pakistan, a secondary analysis of national nutrition survey data 2011–2012. PloS One. 2016 May; 11(5): e0155051. doi: 10.1371/journal.pone.0155051.

[8] Habib MA, Raynes-Greenow C, Soofi SB, Ali N, Nausheen S, Ahmed I, *et al.* Prevalence and determinants of iron deficiency anemia among non-pregnant women of reproductive age in Pakistan. Asia Pacific Journal of Clinical Nutrition. 2018 Jan; 27(1): 195-203.

[9] Fan FS. Iron deficiency anemia due to excessive green tea drinking. Clinical Case Reports. 2016 Nov; 4(11): 1053. doi: 10.1002/ccr3.707.

[10] Sung ES, Choi CK, Kim NR, Kim SA, Shin MH. Association of coffee and tea with ferritin: data from the Korean National Health and Nutrition Examination Survey (IV and V). Chonnam Medical Journal. 2018 Sep; 54(3): 178-83. doi: 10.4068/cmj.2018.54.3.178.

[11] Islam T, Ahmed I, Ali G, Ahmer Z. Emerging trend of coffee cafe in Pakistan: factors affecting revisit intention. British Food Journal. 2019 Jul; 121(9): 2132-47. doi: 10.1108/BFJ-12-2018-0805.

[12] Naveed S and Hameed A. Consumption of Tea in Professionals and Non-professionals. SOJ Pharmacy & Pharmaceutical Sciences. 2014 Sep; 1(3): 1-4. doi: 10.15226/2374-6866/1/3/00116.

[13] Delimont NM, Haub MD, Lindshield BL. The impact of tannin consumption on iron bioavailability and status: A narrative review. Current Developments in Nutrition. 2017 Feb; 1(2): 1-2. doi: 10.3945/cdn. 116.000042.

[14] Mazhar S, Bano M, Azam S, Abbas R. Periodontal

Disease and Obesity: A Hospital Based Cross-Sectional Study. Pakistan Oral & Dental Journal. 2018 Nov; 38(3): 353-7.

[15] Vibhute NA, Shah U, Belgaumi U, Kadashetti V, Bommanavar S, Kamate W. Prevalence and awareness of nutritional anemia among female medical students in Karad, Maharashtra, India: A cross-sectional study. Journal of Family Medicine and Primary Care. 2019 Jul; 8(7): 2369. doi: 10.4103/jfmpc.jfmpc_353_19.

[16] Mahmood T, Rehman AU, Tserenpil G, Siddiqui F, Ahmed M, Siraj F, et al. The association between iron-deficiency anemia and adverse pregnancy outcomes: a retrospective report from Pakistan. Cureus. 2019 Oct; 11(10): e5854. doi: 10.7759/cureus.5854.

[17] Côté S, Kraus M, Piff PK, Beermann U, Keltner D. Social class clash: A dyadic model of social affiliation in cross-class and same-class interactions. Rotman School of Management Working Paper. 2014 Oct: 1-69.

[18] Gaeini Z, Malmir H, Mirmiran P, Feizy Z, Azizi F. Snack consumption patterns and their associations with risk of incident metabolic syndrome: Tehran Lipid and Glucose Study. Research Square. 2022 Jun; 9: 1-16. doi: 10.21203/rs.3.rs-1760399/v1.

[19] Mani L, Fatimah-Muis S, Kartini A. The correlation of intake phytate and tannin on serum transferrin receptor and hemoglobin in stunted overweight adolescents. Potravinarstvo. 2019 Jan; 13(1): 870-874. doi: 10.5219/1191.

[20] El-Saidy TM and Amr TE. The modifiable and nonmodifiable risk factors for miscarriage. Egyptian Nursing Journal. 2016 Sep; 13(3): 169. doi: 10.4103/2090-6021.200178.