

## ORIGINAL ARTICLE

## ASSOCIATION OF ANAEMIA WITH OXIDIZED TEA DRINKING IN AFFLUENT PAKISTANI FEMALE UNIVERSITY STUDENTS

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**Background:** Tea intake ranks as a major beverage globally. It has positive as well as negative impact on human health. There are many dietary factors in apparently healthy women to be anaemic and worsening the anaemic conditions. The present study aimed at prevalence of anaemia, its association with tea intake and comparison of the observed values with cut-off set by WHO. **Methods:** It was a cross-sectional, case control study. A questionnaire for survey was distributed among 17–25 year old single and/or unmarried girl students after informed consent. Subjects suffering from any disease or on medication/minerals/vitamins were excluded. Blood samples were collected and analysed for complete blood count, and haematological indices. Anthropometric indicators were recorded. Data were analysed on SPSS-21. Results were tabulated as Mean±SD. Paired *t*-test was applied to compare data parameters and  $p < 0.05$  was taken as statistically significant. **Results:** The overall prevalence of anaemia was observed 80.77%, Haemoglobin and Red blood cells count (RBCs) were found less in tea drinkers (TDs) ( $10.84 \pm 1.34$  g/dl  $4.09 \pm 0.32$  million/mm<sup>3</sup> respectively) as compared to Non tea drinkers (NTDs) ( $11.08 \pm 0.88$  g/dl,  $4.11 \pm 0.36$  million/mm<sup>3</sup> respectively), Mean corpuscular volume (MCV) was significantly lower in TDs ( $78.87 \pm 7.10$  μm<sup>3</sup>), as compared to NTDs ( $82.63 \pm 7.91$  μm<sup>3</sup>), ( $p = 0.03$ ). The study could not find the significant difference in white blood cell count (WBCs) and anthropometric indices in aforementioned groups. **Conclusion:** Anaemia prevails among girls in our region and tea drinking is associated with its worsening.

**Keywords:** Anaemia, Anthropometric indices, Tea drinkers, Non tea drinkers

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## INTRODUCTION

Tea is a popular beverage worldwide, is usually the major source of population flavonoid intake.<sup>1</sup> Tea is generally used in two forms, green and black, both are brewed from the same tea plant *Camellia sinensis*.<sup>2</sup> The brewed tea contains a wide range of phytochemicals particularly polyphenols with potential beneficial bioactivities following consumption.<sup>3</sup>

Tea reduces the risk of coronary heart diseases, arthritis, diabetes and obesity.<sup>4–6</sup> There is an increasing evidences that flavonoids in tea could be an important contribution to vascular health.<sup>2</sup> Flavonoids present in tea reduces cancer risk<sup>7</sup>, polyphenols in tea have ability to lower the blood pressure<sup>8</sup>, flavonoids component of tea has vasodilator and anti-oxidant effects<sup>9</sup>, tea has also proven to express a cardio-protective and lipid lowering effect.<sup>10–11</sup> There is consistent epidemiological evidence that consumption of these hot beverages is associated with a reduced risk of type 2 diabetes and coronary heart diseases. Hot tea consumption is inversely associated with obesity; tea consumers had lower mean waist circumference (WC) and lower Body Mass Index (BMI).<sup>10</sup> Black tea intake resulted in significantly lower systolic and diastolic blood pressure.<sup>2</sup>

Conversely, it might have some harmful effects on health. Artificial sweeteners or milk used with tea is associated with higher BMI. Coffee and tea drinkers who added sugar/sweeteners to their beverages had higher BMI and WC values (only in men)

compared to those who do not or never used sweeteners.<sup>12</sup> Moreover, excessive tea consumption can impair metabolism of iron and increase the risk of iron deficiency anaemia in human<sup>13–14</sup>, polyphenolic compounds such as chlorogenic acids, flavonoids and polyphenols polymerization widely present in tea also inhibit dietary non-heme iron absorption.<sup>15</sup>

The present study explored the prevalence of anaemia and its association with tea drinking in young affluent Pakistani female university students.

## METHODOLOGY

A survey based cross-sectional/case control study was conducted in 6 months from June to November 2017. The data was collected from girl students at University of Sindh, Jamshoro, Pakistan by having informed written consent. A self-structured questionnaire for survey was distributed to female subjects aged 17–25 years. The sample comprised of only unmarried girls. Girls on medication (suffering from any disease), on multivitamins/mineral supplements, and smokers were excluded from the study. Blood sample was collected in an EDTA (K<sub>2</sub>EDTA) tube (ATLAS-LABOVAC Italiāno) from median cubital vein in a sterilised condition in haematology laboratory of Department of Physiology and Medical Laboratory Technology, University of Sindh, Jamshoro, Pakistan. Blood Complete Picture (CP) was analysed by automatic blood analyser (Model: Medonic M-series M32).

Weight was measured on digital weighing scale with  $\pm 100$  gm accuracy (Model: PS16, Beurer, Germany) with minimal clothing and height by portable stadiometer (SECA 217, Pakistan) with 1 mm accuracy. BMI was calculated by the formula (Weight/Height<sup>2</sup>). Hip circumference at the broadest part of hips from the back side, by keeping feet together, with normal respiration, and waist circumferences at the point between the ribs and iliac crest, from the front side were measured with flexible and non-stretchable plastic measuring tape.

Data are presented as Mean $\pm$ SD and percentages; n represents the number subjects. The data were tested and analysed using SPSS-21. Unpaired *t*-test was employed and  $p \leq 0.05$  was taken statistically significant.

## RESULTS

This survey-based cross-sectional/case control study focused on prevalence of anaemia and/or the effects of tea on haematological parameters. To this end two groups were randomly selected.

For this study, 85 girls were recruited. Seven out of 85 questionnaires were incomplete/not filled properly or refused to provide blood samples for analysis, hence were not included in the study. Out of the total, 43 (55.13%) participant were not consuming any kind of tea while 35 (44.87%) were having at least 3 cups (450 ml) of oxidized tea/day for at least five years.

The mean age of participant was 20.5 $\pm$ 1.64. The overall prevalence of anaemia in female was 63 (80.77%). Out of 63 girls, 28 (35.89%) were mild (haemoglobin <12 g/dL), 34 (43.59%) were moderate (haemoglobin <11 g/dL) and 1 (1.28%) was severe anaemic (haemoglobin <8 g/dL) (Table-1).

Sixty-three (80.77%) girls were having haemoglobin <12 g/dl while remaining 15 (19.23%) had normal haemoglobin level. Those having RBC count <4.2 million/mm<sup>3</sup> were 49 (62.82%) whereas normal RBC count was observed in 29 (37.18%) subjects. Thirty-three (42.31%) girls had microcytosis and 45 (57.69%) had normocytosis (Table-2).

Age, weight, height, waist, hip, BMI, WHR and WHtR were not significantly different in both groups (Table-3).

Mean corpuscular volume (MCV) in NTDs (82.63 $\pm$ 7.91) was significantly higher than TDs (78.87 $\pm$ 7.10), ( $p=0.03$ ). Mean haemoglobin and RBC count were (11.08 $\pm$ 0.88 g/dl and 4.11 $\pm$ 0.36 million/mm<sup>3</sup> respectively in NTDs were higher than TDs (10.84 $\pm$ 1.34 g/dl and 4.09 $\pm$ 0.32 million/mm<sup>3</sup> respectively, however it was not reaching to significant level. Not any difference was observed in WBCs count in both groups. Out of 43 NTDs, 40 (51.28%) were having normal menstrual cycle while 3 (3.85%) were having irregularities in their menses. Among the TDs group 34 (43.59%) had normal

menstrual flow; only one (1.28%) girl was suffering from excessive menstrual flow. The study did not establish any relevancy between two groups in terms of menstrual cycle.

**Table-1: Frequency distribution of subjects**

Variables	Number	Percentage
Non Anaemic	15	19.23
Anaemic		
Overall	63	80.77
Mild	28	35.89
Moderate	34	43.59
Sever	1	1.28

**Table-2: Frequency of participants having anaemic indicators (n=78)**

Anaemic	Non anaemic
Hb $\leq 12$ g/dl= 63 (80.77%)	Hb $\geq 12$ g/dl= 15 (19.23%)
RBC Count $\leq 4.2$ million/mm <sup>3</sup> = 49 (62.82%)	RBC Count $\geq 4.2$ million/mm <sup>3</sup> = 29 (37.18%)
MCV $\leq 80$ $\mu$ m <sup>3</sup> = 33 (42.31%)	MCV $\geq 80$ $\mu$ m <sup>3</sup> = 45 (57.69%)

**Table-3: Anthropometric measurements of participants (Mean $\pm$ SD)**

Anthropometric indices	Non-tea drinkers NTDs	Tea drinkers TDs	<i>p</i>
Age (Year)	20.3 $\pm$ 1.57	20.7 $\pm$ 1.74	0.2
Weight (Kg)	48.15 $\pm$ 9.25	51.31 $\pm$ 9.63	0.1
Height (Cm)	155.32 $\pm$ 5.39	156.25 $\pm$ 5.45	0.4
Waist (Cm)	68 $\pm$ 9.58	69.6 $\pm$ 9.62	0.4
Hip (Cm)	87.93 $\pm$ 9.49	90.77 $\pm$ 9.20	0.1
BMI (Kg/m <sup>2</sup> )	20.30 $\pm$ 4.27	21.01 $\pm$ 4.08	0.4
WHR	0.77 $\pm$ 0.06	0.77 $\pm$ 0.05	0.5
WHtR	0.44 $\pm$ 0.08	0.44 $\pm$ 0.77	0.9

**Table-4: Haematological parameters of participants (Mean $\pm$ SD)**

Haematological parameters	Non-tea drinkers (NTDs)	Tea drinkers (TDs)	<i>p</i>
Haemoglobin (g/dl)	11.08 $\pm$ 0.88	10.84 $\pm$ 1.34	0.3
Haematocrit (%)	33.35 $\pm$ 2.82	32.54 $\pm$ 3.82	0.2
RBCs (million/mm <sup>3</sup> )	4.11 $\pm$ 0.36	4.09 $\pm$ 0.32	0.8
MCV ( $\mu$ m <sup>3</sup> )	82.63 $\pm$ 7.91	78.87 $\pm$ 7.10	0.03*
MCH (pg)	26.94 $\pm$ 2.97	26.96 $\pm$ 3.35	0.9
MCHC (%)	33.25 $\pm$ 1.34	33.59 $\pm$ 1.02	0.2
WBCs (per mm <sup>3</sup> )	7462 $\pm$ 1355.94	7260 $\pm$ 1661.36	0.5
Neutrophils (%)	66.65 $\pm$ 5.92	65.74 $\pm$ 5.65	0.4
Lymphocytes (%)	29.17 $\pm$ 5.99	30.00 $\pm$ 5.65	0.5
Eosinophils (%)	1.74 $\pm$ 0.44	1.66 $\pm$ 0.48	0.4
Basophils (%)	0.13 $\pm$ 0.46	0.14 $\pm$ 0.42	0.9
Monocytes (%)	2.65 $\pm$ 0.72	2.6 $\pm$ 0.14	0.7

## DISCUSSION

Anaemia is a major health concern across the world; it affects almost all age group people particularly females.<sup>16-17</sup> Several studies have been carried out on pregnant women<sup>18-19</sup>, however very limited literature is available on the prevalence of anaemia in young, apparently healthy and normally menstruating affluent girls, and whether tea drinking impacts on the blood parameters. To this end the overall prevalence of anaemia was monitored according to standard set by WHO<sup>20</sup>, although various local studies indicated the

prevalence of anaemia. The current study indicates the prevalence of anaemia and its deterioration with tea drinking. About 80.77% young girls were suffering from anaemia; majority (35.89%) of them were mildly anaemic and only <2% were severe anaemic.

Our results are consistent with some international communities<sup>17,18</sup> and other Pakistani<sup>19</sup> studies. On the contrary, the prevalence of anaemia was found higher than some developed communities.<sup>21–22</sup> There are two possible aspects of the study, either the young girls suffer from anaemia due to malnourished food (particularly their iron status) despite no apparent indications for anaemia, or there is a need to conduct a giant survey in order to reset the actual cut-off value suitable to Pakistani population.

The second aspect of study was to see if the anaemic status is deteriorated by the excessive tea intake or not. The blood analysis revealed that Red blood cell count, haemoglobin concentration, and mean corpuscular volume was less in tea drinking group as compared to non-tea drinking group. Nonetheless, total leukocyte count (TLC), neutrophil, eosinophil, basophil, monocyte and lymphocytes were not statistically different among the subjects. The anthropometric measurements were monitored in order to remove the possibility of excessive and/or less body fat or body mass which could influence the possibilities of impact of anthropometric indicators deteriorating or ameliorating the anaemic conditions. The study could not see any differences in anthropometric indicators of the two groups.

The data was divided in terms of normality or/and irregularity of menstrual cycles in order to kill the plea that heavy and/or irregular menstrual flow could lead to anaemia. The proportion of irregular menstrual cycles in both cases and controls was the same; the study could not reveal any association of anaemia with menstrual irregularities in aforementioned groups. Hence the monthly loss of blood could not be a possible factor leading to anaemia.

Traditional Pakistani tea is a mixture of milk, oxidized tea and cane sugar (sucrose). Tea is associated with microcytic anaemia. Weather sugar or milk is directly linked with anaemia or not could not be established. Tea used abroad is usually green or black without milk, or sometime without sugar. This fact may portray a vivid picture.<sup>23–24</sup>

Our study was a descriptive cross-sectional study in which data was collected in a point of time and the sample size was small. It should be carried out with a larger sample size in different communities in order to paint a clearer picture of the situation. Molecular investigations can be helpful to find out the molecular and hormonal mechanisms behind the prevailing trend of getting fluctuated anthropometric indicators.

## CONCLUSION

The study concludes the current prevalence of anaemia and its deterioration and/or association with tea drinking in young affluent university going female students.

## REFERENCES

1. Naveed M, Bibi J, Kamboh AA, Suheryani I, Kakar I, Fazlani SA, *et al.* Pharmacological values and therapeutic properties of black tea (*Camellia sinensis*): A comprehensive overview. *Biomed Pharmacother* 2018;100:521–31.
2. Hodgson JM, Puddey IB, Woodman RJ, Mulder TP, Fuchs D, Scott K, *et al.* Effects of black tea on blood pressure: a randomized controlled trial. *Arch Intern Med* 2012;172:186–8.
3. Bohn SK, Croft KD, Burrows S, Puddey IB, Mulder TP, Fuchs D, *et al.* Effects of black tea on body composition and metabolic outcomes related to cardiovascular disease risk: a randomized controlled trial. *Food Funct* 2014;5(7):1613–20.
4. Hayat K, Iqbal H, Malik U, Bilal U, Mushtaq S. Tea and its consumption: benefits and risks. *Crit Rev Food Sci Nutr* 2015;55(7):939–54.
5. Griffiths K, Aggarwal BB, Singh RB, Buttar HS, Wilson D, De Meester F. Food antioxidants and their anti-inflammatory properties: A potential role in cardiovascular diseases and cancer prevention. *Diseases* 2016;4(3):pii: E28. doi: 10.3390/diseases4030028.
6. Satija A, Bhupathiraju SN, Spiegelman D, Chiuve SE, Manson JE, Willett W, *et al.* Healthful and unhealthful plant-based diets and the risk of coronary heart disease in US adults. *J Am Coll Cardiol* 2017;70(4):411–22.
7. Xiong J, Lin J, Wang A, Wang Y, Zheng Y, Sang X, *et al.* Tea consumption and the risk of biliary tract cancer: a systematic review and dose-response meta-analysis of observational studies. *Oncotarget* 2017;8:39649–57.
8. Yin JY, Duan SY, Liu FC, Yao QK, Tu S, Xu Y, *et al.* Blood pressure is associated with tea consumption: A cross-sectional study in a rural, elderly population of Jiangsu, China. *J Nutr Health Aging* 2017;21(10):1151–9.
9. Zhang HP, Zhang DD, Ke Y, Bian K. The vasodilatory effects of anti-inflammatory herb medications: A comparison study of four botanical extracts. *Evid Based Complement Alternat Med* 2017;2017:1021284. doi: 10.1155/2017/1021284
10. Vernarelli JA, Lambert JD. Tea consumption is inversely associated with weight status and other markers for metabolic syndrome in US adults. *Eur J Nutr* 2013;52(3):1039–48.
11. Micek A, Grosso G, Polak M, Kozakiewicz K, Tykarski A, Puch Walczak A, *et al.* Association between tea and coffee consumption and prevalence of metabolic syndrome in Poland—results from the WOBASZ II study (2013-2014). *Int J Food Sciences Nutr* 2018;69(3):358–68.
12. Bouchard DR, Ross R, Janssen I. Coffee, tea and their additives: association with BMI and waist circumference. *Obesity Facts* 2010;3(6):345–52.
13. Alzaheeb RA, Al-Amer O. The prevalence of iron deficiency anemia and its associated risk factors among a sample of female university students in Tabuk, Saudi Arabia. *Clin Med Insights Women's Health* 2017;10:1179562X17745088.
14. Ahmad Fuzi SF, Koller D, Bruggaber S, Pereira DI, Dainty JR, Mushtaq S. A 1-h time interval between a meal containing iron and consumption of tea attenuates the inhibitory effects on iron absorption: a controlled trial in a cohort of healthy UK women using a stable iron isotope. *Am J Clin Nutr* 2017;106:1413–21.
15. Thankachan P, Walczyk T, Muthayya S, Kurpad AV, Hurrell RF. Iron absorption in young Indian women: the interaction of iron status with the influence of tea and ascorbic acid. *Am J Clin Nutr* 2008;87(4):881–6.
16. Getaneh Z, Enawgaw B, Engidaye G, Seyoum M, Berhane M, Abebe Z, *et al.* Prevalence of anemia and associated factors among school children in Gondar town public primary schools,

- northwest Ethiopia: A school-based cross-sectional study. *PLoS One* 2017;12(12):e0190151.
17. Derman O, Okstuz-Kanbur N, Yenicesu I, Klink E. Iron deficiency anemia in a group of Turkish adolescents: Frequency and contributing factors. *Int J Adolesc Med Health* 2005;17(2):179–86.
  18. Gupta PM, Hamner HC, Suchdev PS, Flores-Ayala R, Mei Z. Iron status of toddlers, nonpregnant females, and pregnant females in the United States. *Am J Clin Nutr* 2017;106(Suppl 6):1640–6S.
  19. Baig-Ansari N, Badruddin SH, Karmaliani R, Harris H, Jehan I, Pasha O, *et al.* Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. *Food Nutr Bull* 2008;29(2):132–9.
  20. WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity [Internet]. WHO. [cited 2018 Jan 13]. Available from: <http://www.who.int/vmnis/indicators/haemoglobin/en/>
  21. Samaniego-Vaesken ML, Partearroyo T, Olza J, Aranceta-Bartrina J, Gil A, Gonzalez-Gross M, *et al.* Iron intake and dietary sources in the Spanish population: Findings from the ANIBES Study. *Nutrients* 2017;9(3).pii. doi: 10.3390/nu9030203.
  22. Moor MA, Fraga MA, Garfein RS, Rashidi HH, Alcaraz J, Kritiz-Silverstein D, *et al.* Individual and community factors contributing to anemia among women in rural Baja California, Mexico. *PLoS One* 2017;12(11):e0188590.
  23. Goodus M, Sauerbeck AD, Popovich PG, Bruno RS, McTigue DM. Dietary green tea extract prior to spinal cord injury prevents hepatic iron overload but does not improve chronic hepatic and spinal cord pathology in rats. *J Neurotrauma* 2018;35(24):2872–82.
  24. Bohn SK, Croft KD, Burrows S, Puddey IB, Mulder TP, Fuchs D, *et al.* Effects of black tea on body composition and metabolic outcomes related to cardiovascular disease risk: A randomized controlled trial. *Food Funct* 2014;5(7):1613–20.

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