Original Article

Prevalence of anemia and its social determinants among the male residents of an urban area in Tamil Nadu, India

Jithin Philip, Sandhiya Venkatesan, Karthikeyan Shanmugam

Department of Community Medicine, Institute of Medical Sciences and Research Coimbatore, Tamil Nadu, India

Abstract

Introduction: India has a high burden of anemia among the South Asian countries. Anemia has been extensively studied in the female and child population, with less attention given to males. The present study aims to assess the prevalence of anemia among males residing in an urban area and associated social determinants. **Methods:** A community-based cross-sectional study was conducted among 300 males (during September and October 2021) in an urban area of Coimbatore, Tamil Nadu. A portable hemoglobin photometer was used to detect the prevalence of anemia. A structured questionnaire was used to collect details on social determinants of anemia such as dietary practice, education, income, and sanitary practices. **Results:** The mean age of study participants was 34 ± 5.23 years. The prevalence of overall anemia among men was 20.3% (95% confidence interval [CI]: 15.9–25.3%), with moderate and severe anemia being 5.7% (95% CI: 3.3–8.9%) and 1% (95% CI: 0.2–2.9%), respectively. Belonging to a lower socioeconomic class (odds ratio [OR] = 6.50, $P < 0.05$) and consuming more than two cups of tea (OR = 7.28, $P < 0.05$) were significantly associated with anemia. **Conclusion:** Our study depicts a high burden of anemia among males. Health education on the role of dietary factors contributing to anemia needs to be emphasized with special focus on the frequency of tea intake. Primary care physicians can include screening for anemia in their routine practice for men belonging to lower socioeconomic groups. Consideration should be made to include male populations also under the National Anemia Control program.

Keywords: Anemia, India, male, prevalence

Introduction

The Global Burden of Disease Study, done in 2019 found the prevalence of anemia to be 1.8 billion, that is, 231.7 per 1,000 population worldwide, accounting for 50.3 million years of life lived with disability (YLDs). The highest burden of anemia was seen in South Asia, western, and eastern Sub-Saharan Africa.[1] India was one of the countries with a much higher burden of anemia than expected accounting for a quarter of all cases globally,[2] hence, anemia is a major public health issue that needs to be studied effectively.

Address for correspondence: Dr. Karthikeyan Shanmugam, Department of Community Medicine, PSG Institute of Medical Sciences and Research, Coimbatore - 641 004, Tamil Nadu, India.
E-mail: karthikmsdr@gmail.com

Received: 22-09-2023 **Revised:** 14-12-2023
Accepted: 22-12-2023 **Published:** 04-04-2024

Access this article online

Quick Response Code:

Website: http://journals.lww.com/JFMPC

DOI: 10.4103/jfmpc.jfmpc_1575_23

Anemia is caused by nutrient deficiencies, infections (acute and chronic), and genetic hemoglobin disorders. Among these, iron deficiency anemia is considered to be the most common cause globally, which is easily prevented with iron supplementation and food fortification.[3,4] Anemia caused by deficiencies of vitamin B12 and folic acid and intestinal nematodes are also treatable.[5] Despite several measures taken by the Government of India, anemia continues to be a major challenge.[6] Thus, arises the necessity to reanalyze the factors contributing to the same.

Several population-based studies on anemia have been done in India, mostly focusing on women and children, while men with anemia have received less attention despite its adverse effects on health, wellbeing, and economic productivity. In the current scenario, the burden of anemia among the male population should also be assessed along with its associated factors that can

How to cite this article: Philip J, Venkatesan S, Shanmugam K. Prevalence of anemia and its social determinants among the male residents of an urban area in Tamil Nadu, India. J Family Med Prim Care 2024;13:1068-72.

help in implementing appropriate preventive action. The present study aims to assess the prevalence of anemia among males residing in an urban area and study the social determinants such as dietary practices, education, income, and sanitary practices.

Methods

Study design and sampling

A cross-sectional study was conducted during September and October 2021 in an urban area attached to the Urban Health Center of the Department of Community Medicine of a teaching hospital in Coimbatore, Tamil Nadu. The study was carried out with a team of health care workers, which included a health nurse, sectoral health nurse, medical social worker, and doctors. With reference to the National Family Health Survey (NFHS)-5, the prevalence of anemia among urban males in India was 20.4%.[7] Using the formula $n = 4pq/d^2$, where p is 20.4, q is 79.6 (100-p), and absolute precision d was taken as 5%, the sample size was calculated to be 260. With a 10% non-response rate, the final sample was 285 which was rounded off to 300. All men aged above 18 and less than 50 years residing in the urban area surrounding the health care center were included in the study, while those not giving consent for investigation were excluded. Convenient sampling was done to recruit the subjects for the study based on the inclusion and exclusion criteria until the required sample size was reached.

Operational definition

Dependent variable: anemia was detected based on blood hemoglobin level using a portable hemoglobin photometer. Based on the World Health Organization (WHO),[8] the diagnostic cutoff for anemia was less than 13 g/dl. Anemia was further classified as mild (11–12.9 g/dl), moderate (8–10.9 g/dl), and severe (less than 8 g/dl).

Independent variable: based on a review of a literature,[9-11] following variables were included in the study:

(a) Sociodemographic and anthropometric variables – age was categorized in two groups (18 to 30 years and 31 to 50 years). Socioeconomic class was calculated based on per capita income using the modified BG Prasad scale[12] and grouped as classes I, II, III, IV, and V. Educational status was grouped as up to high school level (less than or equal to 8th standard) and above high school level. Body mass index (BMI) was classified as underweight (<18.5 kg/m^2), normal (18.5 kg/m^2 to 22.9 kg/m^2), and overweight (>23 kg/m^2).
(b) Dietary practice – type of diet consumed was based on vegetarianism or non-vegetarianism. Details of intake of tea, fruits, green leafy vegetables, and meat were collected.
(c) Personal habits – history of smoking and intake of alcohol was documented
(d) Sanitary practice – details collected were handwashing practice after using the washroom and before eating, and the use of footwear, if present or not.

Procedure

Hemoglobin estimation was assessed after getting consent from study participants. The left middle finger was cleaned with cotton and with the help of a sterile needle, finger prick was made. After wiping out the first drop, the second drop of whole blood was drawn up into the micro cuvette by capillary action and inserted into the hemoglobin photometer. Results were displayed after 45 to 60 seconds in g/dl on an LCD display. Following this, the cuvette holder was removed and pulled out into its loading position. A pointed object was used to carefully depress the small catch positioned in the upper right corner of the cuvette holder, and the analyzer was cleaned with an alcohol wipe. The cuvette holder was dried before being replaced. The lancets, cotton balls, paper waste, gloves, and containers were disposed of as per biomedical waste management methods. The instrument was verified with controls (daily optic check self-test and weekly low and high external liquid controls) to ensure the readings were within acceptable limits before testing any patient or client samples. A questionnaire related to social determinants of anemia was asked and data were entered in Google Forms using mobile phone by the principal investigator and medical social worker. Height and weight of the study participants were measured using standard procedure, and the weighing scale was calibrated every day of data collection. Anthropometric measurements and blood sample collection were done by the staff nurse.

Ethical consideration

An ethics clearance certificate was obtained prior to the study from the Institutional Human Ethics Committee, PSG IMS and R (Ref. No.: PSG/IHEC/2021/Appr/Exp/090). Informed consent was obtained from all individual participants included in the study.

Statistical analysis

The data collection was done using Google Forms which were retrieved in MS Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) 24. The prevalence of anemia was expressed in proportion and 95% CI, while the independent variables were reported in frequency and proportions. Chi-square test was used to find out the significance of the association between social factors and anemia with a P value <0.05 considered to be statistically significant.

Results

The mean age of study participants was 34 ± 5.23 years, with 57.7% educated more than high school and 45% belonging to the lower socioeconomic class. The prevalence of overall anemia among men in the present study was 20.3% (95% CI: 15.9%–25.3%) with moderate and severe anemia being 5.7% (95% CI: 3.3–8.9%) and 1% (95% CI: 0.2–2.9%), respectively [Figure 1].

None of the sociodemographic and anthropometric variables were significantly associated with anemia except for socioeconomic

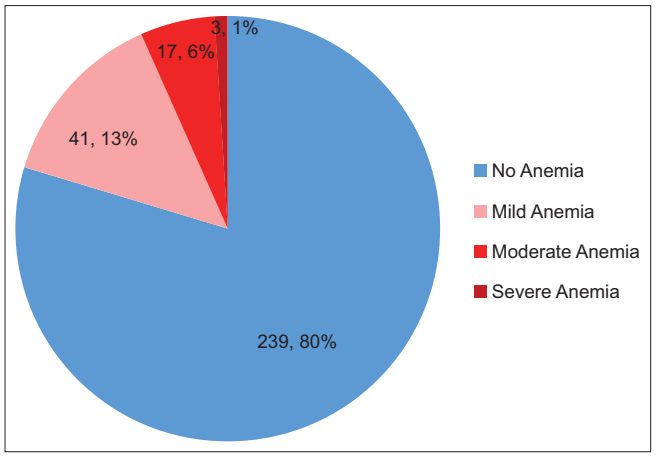

Figure 1: Prevalence of anemia among the study participants

status in which men belonging to classes IV and V had a greater risk of 6.5 times that of those from classes I, II, and III [Table 1]. Among the dietary practices, individuals consuming more than two cups of tea had a statistically significant association with anemia with an OR of 7.28. Other dietary practices such as type of diet and frequency of intake of fruits, greens, and meat were not significant [Table 2].

Personal habits (smoking and alcohol) and sanitary practice of hand washing before and after eating and using the toilet as well as the use of footwear outside the house were found not to be significantly associated with anemia [Tables 3 and 4].

Discussion

Anemia among the male population has not been studied extensively when compared to the female population in relation to their reproductive health and newborn outcomes. The impact of anemia on males is also significant, as it causes fatigue, difficulty in concentrating at work, and lethargy which not only reduces the quality of life but also decreases economic productivity since most of the men are the breadwinners in our country. Anemia can result from nutrient deficiencies, acute and chronic infections, genetic hemoglobin disorders, and other medical conditions. Assessing the cause and factors contributing to the same is important for implementing effective measures. The overall prevalence of anemia in the present study was 20.3%, with 5.7% and 1% having moderate and severe anemia, respectively, which is comparable to a nationwide study done in 2016, in which 23.2% had any anemia while moderate and severe anemia was documented among 4.6% and 0.5%, respectively.[13] The burden of anemia among urban males in Tamil Nadu and for the whole of India as per the NFHS-5 data were 15% and 20.4%, respectively.[7] The proportion of anemia in our setting is higher than the state average while comparable to the national level. Our study highlights the need for further studies to assess the cause and type of anemia using other hematological parameters and diagnostic test for confirmation. A systematic analysis of the global burden of anemia reported iron deficiency to be the most common cause among the South Asian countries followed by hookworm infection, sickle cell disorders, thalassemia, malaria, chronic kidney disease, gastric ulcers, and peptic disorders.[4] Serum ferritin is the most useful marker for iron deficiency

Table 1: Sociodemographic and anthropometric variables association with anemia among the study participants (*n*=300)

Variable	Anemia		OR	*P*
	No (%)	Yes (%)		
Age				
18–30 years	98 (81.7)	22 (18.3)	Reference	0.48
31–50 years	141 (78.3)	39 (21.7)	1.23	
Education				
Up to high school level	100 (78.7)	27 (21.3)	Reference	0.77
Above high school level	137 (80.3)	34 (19.7)	0.90	
Socioeconomic status				
Classes I, II, and III	117 (86)	19 (14)	Reference	0.01*
Classes IV and V	122 (74.4)	42 (25.6)	6.5	
BMI				
Normal	70 (79.5)	18 (20.5)	Reference	
Underweight	23 (76.7)	7 (23.3)	1.18	0.79
Overweight	146 (80.2)	36 (19.8)	0.95	0.89

OR=odds ratio

Table 2: Dietary practice associated with anemia among the study participants (*n*=300)

Variable	Anemia		OR	*P*
	No (%)	Yes (%)		
Type of diet				
Non-vegetarian	223 (79.1)	59 (20.9)	Reference	0.54
Vegetarian	16 (88.9)	2 (11.1)	0.472	
Intake of tea				
≤2 per day	224 (84.5)	41 (15.5)	Reference	0.00*
>2 per day	15 (42.9)	20 (57.1)	7.28	
Intake of fruits				
≥3 per week	220 (79.4)	57 (20.6)	Reference	1.00
<3 per week	19 (82.6)	4 (17.4)	0.81	
Intake of greens				
≥3 per week	178 (81.7)	40 (18.3)	Reference	0.16
<3 per week	61 (74.4)	21 (25.6)	1.53	
Intake of meat				
≤2 per week	48 (88.9)	55 (22.4)	Reference	0.06
>2 per week	191 (77.6)	6 (11.1)	0.43	

OR=odds ratio

Table 3: Personal habits associated with anemia among the study participants (*n*=300)

Variable	Anemia		OR	*P*
	No (%)	Yes (%)		
Smoking				
No	14 (77.8)	4 (22.2)	Reference	0.84
Yes	212 (75.1)	70 (24.8)	0.86	
Alcohol				
No	11 (68.7)	5 (31.2)	Reference	0.37
Yes	220 (77.4)	64 (22.5)	1.56	

OR=odds ratio

Table 4: Sanitary practice associated with anemia among the study participants (*n*=300)

Variable	Anemia		OR	*P*
	No (%)	Yes (%)		
Hand washing before eating				
Yes	237 (80.3)	58 (19.7)	Reference	0.06
No	2 (40.0)	3 (60.0)	6.12	
Hand washing after using toilet				
Yes	238 (80.1)	59 (19.9)	Reference	0.11
No	1 (33.3)	2 (66.7)	4.01	
Use of footwear outside				
Yes	235 (80.2)	58 (19.8)	Reference	0.15
No	4 (57.14)	3 (42.85)	0.32	

OR=odds ratio

anemia which can be recommended for patients with moderate to severe anemia to confirm their diagnosis.[14]

Our study found no significant association between age, sex, and BMI with anemia, while those belonging to the lower socioeconomic class had a greater risk of anemia (OR = 6.5). Other similar studies[10,11,15,16] have also documented lower economic status as associated with anemia. Little *et al.*,[10] Kumar *et al.*,[11] and Ismail *et al.*[16] reported elder men aged above 35 years, 40 years, and 60 years, respectively, to be at greater risk of anemia. These studies also found underweight to be associated with anemia. The proportion of underweight men in our study was lower which could possibly be the reason for BMI not being associated with anemia.

Men consuming more than two cups of tea per day were at a greater risk of anemia in our study. A study by Mehta *et al.*[17] found that an average consumption of 3.7 cups of tea per day had a statistically significant association with tea. Bansal *et al.*[18] also reported that the practice of consuming tea immediately after food increased the risk of anemia among pregnant mothers. Hence, there is a need to create awareness about the habit of tea consumption and its role in causing anemia by inhibiting iron absorption. Other dietary factors such as intake of greens, fruits, and meat were not associated with the presence of anemia in the present study. Little *et al.*[10] found people consuming non-vegetarian diet to have decreased chances of getting anemia, whereas people with increased grain and sugar consumption had increased chances of getting anemia. Kant *et al.*[19] did not find green leafy vegetables and fruits intake to be associated with anemia, while Little *et al.*[10] and Kumar *et al.*[11] in their study found that a diet rich in green leafy vegetables and meat, respectively, was protective against anemia. These dietary factors are analyzed for their association with anemia since they are known to affect the iron absorption in the body, thus indicating iron deficiency anemia. Tatala *et al.*[20] assessed the value of serum erythrocyte protoporphyrin level (>125 μmol/mol heme) and found it to be associated with anemia which signifies iron deficiency in the diet. The study also emphasized that dietary assessment for iron intake would be inaccurate due to the presence of many iron inhibitors such as phytate and polyphenols. Erythrocyte protoporphyrin levels can be used as a screening test for iron deficiency anemia over hemoglobin and mean cell volume since it has better sensitivity and specificity.[21]

Intake of alcohol and smoking was not associated with anemia in our study. Similar results were documented by Ismail *et al.*[16] and Kant *et al.*[19] Sanitary practice of hand washing before and after eating and using the toilet or wearing footwear were found to reduce the burden of anemia among the adolescent age group[20,22] but none of these were found to be a risk factor contributing to anemia in the present study, similar to the study of Kant *et al.*[19] since helminthiasis is not an important cause of anemia among the adult population.

The study highlighted the prevalence and social factors associated with anemia among the adult males in our setting. The study has a few limitations. First, cross-sectional design of the study cannot confirm the cause-effect relationship. Second, the dietary practice was self-reported by the participants based on the previous week's intake, which might not reflect the true practice. Lastly, we had to take a convenient sampling of study participants due to the availability of the male during the survey period and the short duration of the project.

Conclusion

The study findings depict a high prevalence of anemia among the working male population in an urban area. Males belonging to the lower socioeconomic status and consuming more than 2 cups of tea per day were found to be statistically associated with anemia. Further studies need to be done to identify other factors contributing to this condition. Based on our study findings, health education on the role of dietary factors contributing to anemia needs to be emphasized with special focus on the frequency of tea intake. Screening for anemia could be done at the primary care level for early detection and treatment.

Acknowledgements

The authors thank the study participants for giving consent to this study.

Financial support and sponsorship

This study was supported by the Indian Council of Medical Research, Short-Term Students Research Fund (ICMR-STS) – 2022.

Conflicts of interest

There are no conflicts of interest to declare.

References

1. Safiri S, Kolahi AA, Noori M, Nejadghaderi SA, Karamzad N, Bragazzi NL, *et al.* Burden of anemia and its underlying causes in 204 countries and territories, 1990–2019: Results from the Global Burden of Disease Study 2019. J Hematol Oncol 2021;14:185.

2. Kassebaum NJ, Arora M, Barber RM, Bhutta ZA, Brown J, Carter A, *et al.* Global, regional, and national disability adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: A systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016;388:1603–58.
3. WHO. Nutritional Anaemias: Tools for Effective Prevention. Geneva: World Health Organization; 2017. Available from: https://www.who.int/publications/i/item/9789241513067. [Last accessed on 2023 Aug 01].
4. Kassebaum NJ, Jasrasaria R, Naghavi M, Wulf SK, Johns N, Lozano R, *et al.* A systematic analysis of global anemia burden from 1990 to 2010. Blood 2014;123:615-24.
5. Hall A, Horton S, de Silva N. The costs and cost-effectiveness of mass treatment for intestinal nematode worm infections using different treatment thresholds. PLoS Negl Trop Dis 2009;3:e402.
6. Rai RK, Kumar SS, Gupta SS, Parasannanavar DJ, Anish TS, Barik A, *et al.* Shooting shadows: India's struggle to reduce the burden of anaemia. Br J Nutr 2023;129:416-27.
7. National Family Health Survey (NFHS-5) 2019-2021. Ministry of Health and Family Welfare. Government of India. Available from: https://main.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf. [Last accessed on 2023 Aug 01].
8. Assessing the iron status of populations. Report of a Joint World Health Organization/Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population level, 2nd ed. Geneva: World Health Organization; 2007. Available from: https://apps.who.int/iris/bitstream/handle/10665/75368/9789241596107_eng.pdf?sequence=1 and isAllowed=y. [Last accessed on 2023 Aug 01].
9. Kumar P, Sharma H, Patel KK. Prevalence and risk factors of anaemia among men: A study based on empowered action group states, India. Nutr Health 2021;27:191-8.
10. Little M, Zivot C, Humphries S, Dodd W, Patel K, Dewey C. Burden and determinants of anemia in a rural population in south India: A Cross-Sectional Study. Anemia 2018;2018:7123976.
11. Kumar P, Sharma H, Sinha D. Socio-economic inequality in anaemia among men in India: A study based on cross-sectional data. BMC Public Health 2021;21:1345.
12. Majhi MM, Bhatnagar N. Updated BG Prasad's classification for the year 2021: Consideration for new base year 2016. J Fam Med Prim Care 2021;10:4318-9.
13. Didzun O, De Neve JW, Awasthi A, Dubey M, Theilmann M, Bärnighausen T, *et al.* Anaemia among men in India: A nationally representative cross-sectional study. Lancet Glob Health 2019;7:e1685-94.
14. Snook J, Bhala N, Beales IL, Cannings D, Kightley C, Logan RP, *et al.* British society of gastroenterology guidelines for the management of iron deficiency anaemia in adults. Gut 2021;70:2030-51.
15. Ahmad N, Kalakoti P, Bano R, Aarif SM. The prevalence of anaemia and associated factors in pregnant women in a rural Indian community. Hindu 2010;208:276-9.
16. Ismail IM, Kahkashan A, Antony A, Sobhith V. Role of socio-demographic and cultural factors on anemia in a tribal population of North Kerala, India. Int J Community Med Public Health 2017;3:1183-8.
17. Mehta SW, Pritchard ME, Stegman C. Contribution of coffee, and tea to anemia among NHANES II participants. Nutr Res 1992;12:209-22.
18. Bansal R, Bedi M, Kaur J, Kaur K, Shergill HK, Khaira HK, *et al.* Prevalence and factors associated with anemia among pregnant women attending antenatal clinic. Adesh UnivJ Med Sci Res 2020;2:42-8.
19. Kant S, Kumar R, Malhotra S, Kaur R, Haldar P. Prevalence and determinants of anemia among adult males in a rural area of Haryana, India. J Epidemiol Global Health 2019;9:128-34.
20. Tatala S, Svanberg U, Mduma B. Low dietary iron availability is a major cause of anemia: A nutrition survey in the Lindi District of Tanzania. Am J Clin Nutr 1998;68:171-8.
21. Mei Z, Flores-Ayala RC, Grummer-Strawn LM, Brittenham GM. Is erythrocyte protoporphyrin a better single screening test for iron deficiency compared to hemoglobin or mean cell volume in children and women?. Nutrients 2017;9:557.
22. Siva PM, Sobha A, Manjula VD. Prevalence of anaemia and its associated risk factors among adolescent girls of central Kerala. J Clin Diagn Res 2016;10:LC19-23.