Original Research Article

The invisible burden: Investigating anaemia in apparently healthy males

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Abstract

Introduction: The National Health Mission's "Anaemia Mukt Bharat (AMB) 2008" initiative primarily focuses on addressing anaemia among females. Efforts are taken to exterminate anaemia but much efforts need to be put in. Anaemia is at high in females and male population is prejudice to be devoid of this condition however it is not so. Almost three males out of ten are anaemic.

Aim: The present study was aimed to investigate the incidence of anaemia among 700 apparently healthy male industry workers in 18 and 59years age group.

Result: Among the 700 apparently healthy male industrial workers, 342 (48.86%) were anaemic. Based on concentration of Hb, 18.71% were classified as mildly anaemic, 22.29% as moderately anaemic and 7.86% as severely anaemic. Anaemia prevalence was notably higher among individuals belonging to low- and moderate-income groups, with an incidence rate of approximately 60%. Within the 462 participants who regularly consumed tea, coffee, or tobacco, 21.55% exhibited severe anaemia, while 17.93% were moderately anaemic. Furthermore, among the 154 alcohol consumers, 13% were severely anaemic, and 6% demonstrated moderate anaemia. These findings underscore the potential influence of lifestyle habits and socioeconomic factors on anaemia prevalence in male industrial workers, emphasizing the need for targeted nutritional interventions and awareness programs.

Conclusion: The findings of this study highlight that apparently healthy males are equally susceptible to anaemia, although not traditionally being considered a high-risk group. Several contributing factors, including occupational constraints, dietary habits, and lifestyle choices, appear to increase their vulnerability. Additionally, socioeconomic limitations, habitual consumption of tea, coffee, or tobacco, and poor sanitary practices further worsen the condition. These insights emphasize the need to expand public health initiatives, such as Anaemia Mukt Bharat, to comprehensively include males, ensuring a more equitable approach to anaemia prevention and management.

Keywords: Haemoglobin, Anaemia, Males, Industrial workers, Alcoholism, Tobacco consumer

1. Introduction

The National Health Mission's "Anaemia Mukt Bharat (AMB) 2008"[1] initiative primarily focuses on addressing anaemia among females. A prevalence rate of anaemia among females is higher to 58% compared to 39% among males. A systematic review and meta-analysis published in BMC Public Health (April 2025) analysed results from 1995 to 2023 highlighted significant regional and age-group variations in anaemia prevalence.[2] Anaemia is a known serious health issue among Indians. A report from an Indian survey (2016) specifies an average prevalence of anaemia is 51.0% among females and 57.3% among children of less than 5 year age.[3,4] The ICMR study conducted across eleven states in India reveals 84.9% women experience anaemia during pregnancy, among them 9.9% suffering from severe anaemia.[5] A similar study conducted by Nutrition Foundation of India in seven different states during 2002-2003 reported 86% anaemia prevalence of which 9.3% were severely anaemic.[6] Two decade study conducted on 9 to 36 month babies in urban slum area by Kapur et al(2002) presented 64% prevalence and having 7.8% severely anaemic.[7]

Thus various surveys conducted time to time suggests, anaemia is very common in childhood, adolescent females and adult females in India.[8] However, anaemia among males remains an overlooked public health concern. A 2018 Cross sectional study indicates anaemia prevalence among adult males in South India ranges from 22% to 39%,[9] varying across age group and region. Another study (2022) conducted on rural males in eight states of India reveals, three

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individuals out of ten males are anaemic.[10] Despite this disparity, the burden of anaemia in men warrants equal attention, as it affects family care, overall health, workforce productivity and economic development. Investigating anaemia prevalence among males is also crucial for comprehensive public health strategies under the "Anaemia Mukt Bharat" mission.

When hemoglobin content of blood decreases than normal it is called Anaemia. It may be due to lack of one or more essential nutrients[11,12] along with other environmental and habitual factors. Hemoglobin facilitates oxygen transport, which is vital for nutrient oxidation and subsequent energy production in the body. Consequently, iron availability significantly influences an individual's health and overall efficiency. Lethargy, persistent fatigue, frequent infections and a lack of motivation to perform tasks are among the key factors affecting an individual's productivity. Collectively, these symptoms contribute to a decline in workforce efficiency and may impede a nation's economic growth. While various underlying causes can lead to such manifestations, nutritional deficiencies play a crucial role. Iron, an essential micronutrient required in trace amounts, is fundamental for hemoglobin synthesis. A study published in the European Journal of Clinical Nutrition (January 2025) claims other factors like Folate and vitamin B_{12} deficiency, undetected blood loss, air pollution, and hemoglobinopathies also playing role.[13] Lot of effort are taken by government organisations [GO] and Non-Government Organisations [NGO] to bring down the percentage incidence of anaemia in female population of India. Even after extensive nutritional programmes conducted by GO and NGOs, nothing much have changed in the numbers from 1993 to 2024.[3,4,14] Complete focus of anemia elimination is on female population. On the other hand male population is prejudiously considered to be devoid of this condition but it is not so. Community survey reports from various parts of world also suggest prevalence of anaemia in apparently healthy males is equally bad.[15] The present study was aimed to investigate the incidence and cause of anaemia among healthy looking male industry workers from North-West Karnataka state.

2. Materials and Methods

This cross-sectional, non-interventional, observational and descriptive study was conducted on apparently healthy male industrial workers from the Dharwad industrial area (North West Karnataka) to assess the incidence and potential causes of anaemia. The sample size was determined using the formula n = [Z²Npq / (N - 1)d² + Z²pq], where Z = 1.96, p = 50%, q = (100 - 50) = 50, and d = 0.05.[16] Based on this calculation, the minimum required sample size was 684 participants, hence a total of 700 male individuals were included in the study.

The study received ethical approval from the institutional ethics committee. Prior to participation, the purpose of the study was explained to each individual, and written informed consent was obtained from all volunteers. Data collection was performed using a structured questionnaire with yes/no response options, which was distributed among participants and collected within two days. The responses were then subjected to statistical analysis using SPSS version 2.1, and independent t-tests were employed to compare group values.

The study included apparently healthy male industrial workers aged 18 to 59 years from various factories. Participants were required to self-exclude if they were below 18 years or above 60 years, or if they had pre-existing blood disorders, severe organ insufficiency, terminal illness, or were diagnosed with malaria, dengue, filariasis, or were undergoing medical treatment that could potentially alter haemoglobin levels. Females of all age groups and males who did not voluntarily participate were excluded from the study.

Demographic data was collected through a structured questionnaire, while additional relevant information was verified through the HR departments of the respective factories to ensure accuracy and completeness.

To estimate haemoglobin level 20microlit of blood was collected on Whatman filter paper by finger prick method as explained in Dacie & Lewis.[17]

Haemoglobin levels were estimated on colorimeter using cyanmethemoglonin method.

In view of National consultation on control of nutritional anaemia in India,[18,19] study population was categorised in to following four groups.

1. Normal [haemoglobin above 12.0gm/dl]
2. Mild anaemic [haemoglobin level 10.1 to 12.0gm/dl],
3. Moderately anaemic [haemoglobin level 8.0 to 10.0 gm/dl] and
4. Severely anaemic [haemoglobin less than 8.0gm/dl]

3. Results

The present study included 700 apparently healthy male industrial workers aged 18 to 59 years, with a mean age of 40.8 ± 13.6 years. The average body weight of participants was 51.7 ± 9.3 kg. Among the study population, 65 individuals (9.29%) were classified as bulky or obese, while 37 individuals (5.29%) were identified as slim or underweight for their respective age groups.

The mean haemoglobin level among participants was 11.3 ± 4.8 g/dl. Of the 700 individuals, 342 participants (48.86%) were found to be anaemic, while 358 participants (51.14%) had normal haemoglobin levels. Among the anaemic individuals, 131 (18.71%) were classified as mildly anaemic, 156 (22.29%) as moderately anaemic, and 55 (7.86%) as severely anaemic.(**Table 1**)

When Incidence of anaemia among apparently healthy male industrial workers on comparing with their monthly income was analysed, the prevalence of severe anaemia was found to be highest among the low-income group (11.06%), whereas the middle-income group exhibited the lowest prevalence (5.35%). When comparing anaemia incidence across the three income groups, individuals in the low- and moderate-income categories demonstrated a significantly higher occurrence (approximately 60%), while the middle-income group showed a lower incidence (35%). These findings highlight the potential association between socioeconomic status and anaemia prevalence, emphasizing the need for targeted interventions among economically vulnerable populations.(**Table 2**)

Frequency of anaemia amid apparently healthy male industrial participants consuming more than 5 cups of tea/coffee per day or habituated to either chewing or smoking of tobacco shows among the 700 individuals studied, 462 participants (66%) reported habitual consumption of more than five cups of tea or coffee daily or frequent chewing or smoking of tobacco. Within this subgroup, 21.55% were classified as severely anaemic, 17.93% as moderately anaemic, and 15.05% as mildly anaemic, while only 11.47% exhibited normal haemoglobin levels. These findings suggest a possible association between habitual caffeine and tobacco consumption and the risk of anaemia, warranting further investigation into their potential effects on iron metabolism and haemoglobin synthesis.(**Table 3**)

Rate of anaemia analysed among industrial workers who disclosed habit of alcohol consumption indicated among the 700 male industrial workers, 154 participants (22%) reported alcohol consumption, with drinking frequency ranging from occasional to regular intake. Within this subgroup, 13% were classified as severely anaemic, 6% exhibited moderate anaemia, 1% had mild anaemia, and only 2% maintained normal haemoglobin levels. These findings suggest a potential association between alcohol consumption and anaemia and its impact on haemoglobin synthesis and overall nutritional status.(**Table 4**)

Table 1: Incidence of Anaemia among apparently healthy looking males.

Anaemia group	Haemoglobin range g/dl	Number of individuals	Percent Incidence
Normal	12.1 to 16.0 or above	358	51.14%
Anaemic	11.3 ± 4.8	342	48.86%
Mildly anaemic	10.1 to 12.0	131	18.71%
Moderately anaemic	8.1 to 10.1	156	22.29%
Severely anaemic	Less than 8.0	55	7.86%

Table 2: Incidence of anaemia among apparently healthy male when compared with monthly income.

Income group Rs per month	Number of individuals	Normal n [%]	Anaemic n [%]	Mildly anaemic	Moderately anaemic	Severely anaemic
5000 to 9000 Low Income gr.	199(28.43%)	80(40.20)	119(59.80)	45(22.61%)	52(26.13%)	22(11.06%)
9001 to 15000 Middle income gr.	318(45.43%)	206(64.78)	112(35.22)	41(12.89%)	54(16.98%)	17(5.35%)
15001 and above Moderate income gr	183(26.14%)	72(39.34)	111(60.66)	45(24.59%)	50(27.32%)	16(8.74%)
Total	700(100%)	358(51.14)	342(48.86)	131(18.71%)	156(22.29%)	55(7.86%)

Table 3: Incidence of anaemia among apparently healthy male Tea/Coffee or tobacco consumers.

Habit of Tea/coffee or tobacco	Normal	Mildly anaemic	Moderately anaemic	Severely anaemic
[462/700] 66%	11.47%	15.05%	17.93%	21.55%

Table 4: Frequency of anaemia among apparently healthy male alcohol consumers.

Habit of Alcoholism	Normal	Mildly anaemic	Moderately anaemic	Severely anaemic
[154/700] 22%	02 %	01 %	06 %	13 %

4. Discussion

Anaemia can be defined as a condition in which the Haemoglobin (Hb) content of blood is lower than normal. This can be due to deficiency of one or more essential nutrients, irrespective of the cause of such deficiencies.[11,20] Anaemia is a significant public health issue that extends beyond the traditionally recognized high-risk groups, such as pregnant and lactating women, adolescent girls, and growing children. Milder forms of anaemia often remain asymptomatic ("silent"), challenging early detection. However, severe anaemia presents noticeable clinical symptoms, including fatigue, weakness, dizziness, and drowsiness, along with paleness of the skin, lips, tongue, and nails.

The high frequency of anaemia (48.86%) observed in the present study highlights the influence of poor dietary habits, including consumption of stale food, low-quality meals, excessive tea, coffee, and tobacco use. Additionally, poor sanitation and low socioeconomic status contribute to the progression of anaemia.

Among the common causes, nutritional deficiencies and parasitic infestations play a crucial role in the development of anaemia. Iron deficiency remains one of the most prevalent nutritional factors, as diets that are monotonous and rich in phytates inhibit the absorption of dietary iron, further exacerbating the condition.[21] Excessive consumption of tannin rich tea, coffee[22] and alcohol also decreases bioavailability of dietary Iron. Poor bioavailability of iron is the major factor responsible for very high prevalence of anaemia in the country,[23,24] Even overcooking of food which destroys heat labile vitamins, inadequate iron intake due to lesser consumption of green vegetables and frequent consumption of alcohol without adequate diet are some additional factors responsible for anaemia.[21] Unhygenic condition leading to Hookworm infestation and schistosomiasis also contribute to anaemia. A report states that approximately 44 million pregnant women have hookworm infestation and 20 million people are severely infected with schistosomiasis.[25,26]

A study conducted points out Gutkha, tobacco, Naswar aggravates anaemia and reports prevalence of 56% anemia among rural Panjabi males.[15] When Hemoglobin levels were compared between smokers and non-smokers, a slight contradictory result reveals the higher levels of methemoglobin in smokers which mask anaemia this may be to increase in red cell production against tobacco smoke and to compensate altered haemoglobin.[15,27] Another study concludes smoking hinders iron absorption which may contribute to iron deficiency anaemia.[28]

High incidence of anaemia found in low income group indicates poor dietary habits[29] but increased frequency of anaemia among high income group may point towards secondary causes like diabetes, cardiac or renal problems[30] which need to be evaluated.

5. Conclusion

The findings of this study highlight that apparently healthy males are equally susceptible to anaemia, although not traditionally being considered a high-risk group. Several contributing factors, including occupational constraints, dietary habits, and lifestyle choices, appear to increase their vulnerability. Additionally, socioeconomic limitations, habitual consumption of tea, coffee, or tobacco, and poor sanitary practices further worsen the condition.

Due to social responsibilities and workplace demands, many individuals may neglect early symptoms, allowing the condition to progress unnoticed to more severe stages. This study underscores the urgent need for increased awareness, early screening, and targeted nutritional interventions among male industrial workers.

Addressing nutritional deficiencies, improving dietary diversity, and reducing exposure to risk factors such as tobacco and excessive caffeine intake could be crucial steps toward preventing anaemia and enhancing workforce productivity. These insights emphasize the need to expand public health initiatives, such as "Anaemia Mukt Bharat", to comprehensively include males, ensuring a more equitable approach to anaemia prevention and management.

6. Source of Funding

7. Conflict of Interest

None.

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