

Anaemia and associated socio-demographic factors among workers of a sugar factory in South India

Hariharan Suresh¹, Mohammad Ilyas c²

Affiliation: 1 Assistant professor & 2 Associate professor, Dept. of Community Medicine, Kannur Medical College, Kannur.

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***Author for correspondence:** Dr.C.Mohammad Ilyas, Associate professor, Dept. of Community Medicine Kannur Medical College, Anjarakandy Integrated Campus, Kannur, Kerala 670612. e-mail: driliyasmohammed@gmail.com

ABSTRACT

Background: Anaemia is the most under-recognized cause of bewildering morbidity interfering with the overall capacity and productivity of individuals, especially, in case of the workers of various factories and industries. It is worthwhile to understand and gauge the magnitude of this problem and various factors including those of nutritional, influencing the anaemia status among the workers. **Objectives:** To determine the prevalence of anaemia and study the associations between anaemia and the various socio-demographic factors among the workers of a sugar factory. **Methodology:** A cross-sectional study was done among all the workers of a sugar factory in Tamil Nadu. Altogether, 281 sugar factory workers were studied after taking informed consent. The data was collected using a questionnaire and venous blood was used for measurement of haemoglobin levels. Statistical analysis was performed using SPSS version 16. **Results:** Among the 281 workers of the factory 260 were males while 21 were females. The prevalence of anaemia among males was 18.5% while among females it was 52.4% and a single lady had severe anaemia. Lower income, older age, duration of work experience and underweight were significantly associated with anaemia in males. **Conclusions:** Regular monitoring of anaemia status necessary as it can insidiously give rise to adverse impact on productivity by the workers and steps may be undertaken to rule out or rule in that the severe anaemia was not an “ice-berg” phenomenon. Simple but cost-effective preventive strategies need to be undertaken to elevate their nutritional status such as gooseberry juice and or cereal based fermented foods may be included in their menu along with the generic iron medication. Socio-economic status may also be addressed by implementing the government policies effectively. Some management techniques may be taught to workers to efficiently manage their limited resources.

Key Words: Anaemia, sugar factory, socio-demographic factors.

INTRODUCTION

Anaemia is the most common of the ‘hidden hunger’ problems besetting all the people of the world irrespective of the economic status.¹ As it doesn’t give rise to acute overt signs and symptoms, it is likely to be ignored by both the elite and common. It is one of the causes that is latently lingering behind the decreased productivity and performance by men and women alike, especially at their work places.² Consequently, there might be dissatisfaction by their respective employers and underestimated hostility towards the workers as the former is quite self – centred on his or her own business.

Presently the work force estimated globally amounts to 3 billion, the same for our nation is 47.41 crore.^{3,4} Anaemia is present among 33% of population worldwide.⁵ In tropical and sub-tropical countries the disorder also affects school children and working males. The prevalence of anaemia in South Asia and Central and West Africa is highest.⁶ All this can have far reaching adverse outcome on human health as well as social and economic development of the country

India being a nation of agricultural background, the agricultural workers form the major chunk of the workforce of the country and it appears that they suffer from anaemia frequently due to various reasons. Although there are various causes of anaemia, iron deficiency is the most common one especially among the workforce of the country.⁷ As this group works more and paid less, their socio-economic status leaves much to be desired. This may affect their overall health status including nutritional, emotional, etc. The employers tend to neglect this aspect. Moreover, the facilities that are in place are hardly adequate. If the workers have poor education too, the matter will turn from worse to worst.

To compound the matter, in the scarce medical settings, if the clinician happens to ignore the haemoglobin estimation test of the workers periodically the ‘iceberg phenomenon’ may be the end result.

The overall loss due to anaemia to this extent is highly unacceptable as most often than not, the condition is easily treatable if the person doesn’t have specific and less

common types of anaemia like aplastic anaemia, hemoglobinopathies, etc.

Certain nutritional factors like obesity were found to be associated with anaemia in some countries.⁸ One study in Congo showed association with age in females (<18 or > 35 years). The same study revealed association of anaemia with manual jobs and unemployment was also associated with anaemia in some instances.⁹

Many studies have been done to gauge the prevalence of anaemia especially among pregnant women and children.¹⁰ But very few studies are found on the prevalence of anaemia among the workforce and the related factors (socio demographic, nutritional, etc.) especially among those engaged in sugar factories. It may be recalled that India is the 2nd largest producer of sugar in the world, next to Brazil. Hence a great workforce is likely to be concentrated in these factories too. However, working class does consist of both the sexes, hence the study incorporated both, as anaemia affects both irrespective of sex.

Moreover, Tamil Nadu seems to be having higher prevalence of anaemia (in women), when compared to other South Indian states like Andhra Pradesh, Karnataka and Kerala in particular. Hence it is worthwhile to know any association among socio demographic, nutritional and occupational factors that influence anaemia, as these may vary among different regions and cultures.

Objectives:

- To determine the prevalence anaemia among the workers of a sugar factory in Tamil Nadu, India.
- To study the association between anaemia and certain socio-demographic and nutritional factors.

METHODOLOGY

A cross sectional study was conducted among all the workers of a sugar factory in Tamil Nadu to determine the prevalence of anaemia. The study was conducted in the premises of the sugar factory in the month of July 2016.

The data collection tools used for the study included the questionnaire on background characteristics of the participants, a plastic stadiometer for the measurement of the height of participant, a digital weighing scale to check the weight of participant and venous blood sample to determine the haemoglobin levels.

Definitions used: The haemoglobin cut off points in grams per decilitre to diagnose anaemia were based on the WHO 1989 guide Preventing and controlling anaemia through primary health care (table 1).¹¹

Ethical Considerations: The principal investigator explained the purpose, procedure and benefits of the study to each participant and written consent was obtained from them before commencement of data collection. And extreme care has been taken to make sure the information collected from the participants was kept confidential.

The study was started after getting the necessary approval from the factory authorities and the institutional ethics committee of Sri Ramachandra University. The Reference number for the ethical approval of study being CSP-MED/16/JUN/29/74.

Statistical analysis: Data was entered using Microsoft Excel and analysis was done using SPSS version 16. Frequencies and percentages were calculated for discrete data, while mean and standard deviation were calculated for continuous data. To test for association odds ratio and 95% CI were used. The results of the analyses were given in the form of tables and graphs wherever necessary.

RESULTS

All the workers of the factory were eligible to be part of the study were included and 9 workers who did not want to take part in the study for various reasons were excluded. Finally, 281 workers gave written consent to participate in the study.

Table: 1. Grading of anaemia based on haemoglobin levels

Population	Not Anaemic	or	Mild Anaemia	Moderate Anaemia	Severe Anaemia
Non-pregnant women (15 years of age and above)	12 higher	or	11-11.9	8-10.9	lower than 8
Men (15 years of age and above)	13 higher	or	11-12.9	8-10.9	lower than 8

Table: 2. Distribution of workers according to age, sex and years of work.

Characteristics	No. of workers N = 281	Percentage
Age group		
21-30	54	19.2
31-40	58	20.6
41-50	88	31.3
51-60	81	28.8
Sex		
Male	260	92.5
Female	21	7.5
Years of work in the factory		
<10	113	40.2
11-20	76	27
21-30	66	23.5
>30	26	9.3

The age of the participants was found to be in the range of 22 – 59years. Out of the 281 participants majority were males (92.5%) and (59.8 %) of the workers had at least 10 years of experience of working in the sugar factory. The table 2 shows the age, sex and working experience distribution among the study participants.

The mean age of the participants was found to be 42.5 years and the standard deviation of 10.84. The mean and standard deviation of the physical and biochemical parameters of the participants that were measured are given in the table 3.

The prevalence of anaemia among the female workers of the factory was found to be 52.38% (11), while the prevalence among the male workers was 18.5% (48). One lady was found to be having severe anaemia during our study. More frequently, females 47.6% were found to be suffering from mild to moderate anaemia than males 18.4%.

Table : 3. Physical and biochemical parameters of the workers

Parameter	Mean ± S.D.
Age	42.58 ± 10.84
Height	163.42 ± 7.59
Weight	68.32 ± 12.52
BMI	25.48 ± 3.91
Hb (males)	13.68 ± 1.07
Hb (females)	11.25 ± 1.92

Table: 4. Prevalence of anaemia according to sex and severity.

Sex	Normal	Mild anaemia	Moderate anaemia	Severe anaemia
Male	212 (81.5%)	38 (14.6%)	10 (3.8%)	0
Female	10 (47.6%)	3 (14.3%)	7 (33.3%)	1 (4.8%)

Table :5. Association between anaemia and socio-demographic factors among male workers.

Educational level	N	Anaemia		Odds Ratio	95% CI
		Present	Absent		
Upto School	High	76	9	67	
Post School and above	High	184	39	145	0.49 to 1.09
Age	N	Anaemia		Odds Ratio	95% CI
		Present	Absent		
< 35 years	80	9	71		
≥ 36 years	180	39	141	0.45	0.21 to 0.99
Years of work	N	Anaemia		Odds Ratio	95% CI
		Present	Absent		
≤ 10 years	103	11	92		
>11 years	157	37	120	0.38	0.18 to 0.80
Socioeconomic status	N	Anaemia		Odds Ratio	95% CI
		Present	Absent		
Classes 3&4	157	37	120		
Classes 1&2	103	11	92	2.57	1.24 to 5.32
Weight	N	Anaemia		Odds Ratio	95% CI
		Present	Absent		
Underweight	10	5	5		
Others	250	43	207	4.81	1.33 to 17.33

As the proportion of females was less in number, we attempted to study the associations of various factors among males only.

According to our study the significant association between the lower socio – economic classes (class 3rd & 4th) and anaemia was found in males with an odds ratio of 2.57 and p – value of 0.01

Lower grades of education were found to be having lesser rates of anaemia with an odd’s ratio of 0.49 and p – value of 0.08. However the association was not statistically significant.

Regarding the duration of work experience, workers having < 10 years of experience are less likely to have anaemia than those who had > 10 years of experience with an odds ratio of 0.38 and p – value of 0.01

Relating to the age of the workers, People of ≤35 years have shown decreased tendency of being anaemic in our

study when compared to ≥36 years with an odds ratio of 0.45 and p – value of 0.049.

Under-weight was significantly associated with anaemia in our study with an odds ratio of 4.81 and p – value of 0.016.

DISCUSSION

There has been an enormous increase in the prices of commodities and ever-increasing consumerism due to which a growing tendency has been observed among the less privileged to earn more and more and for working in industries/fields. The situation is intrigued by industrial proliferation and staggering costs of higher education.

The productivity and the economy of the country are largely dependent on the health status of their populations.^{12,13} In this respect, the role of the workforce cannot be under-estimated, particularly, for the developing country like India. If their health is jeopardized, the outcome can be quite unfavourable; because of anaemia alone, the GDP lost in India is to the tune of 0.9%,¹⁴ while in Bangladesh, 7.9 % of GDP is lost (rs.1.43 lakh crores, 2016).² Anaemic women produced 5.3% less even in less physically strenuous occupation.¹⁵ Hence their health should be the concern of the respective health system of their countries.

Moreover, anaemia interferes with the overall capacity and well-being of the worker.^{13,16} Certain socio demographic factors¹⁷ health issues and nutritional problems influence the deficiency states including the iron deficiency which is the common cause of anaemia.¹⁸

Our study shows that the prevalence of anaemia among the workers, including males and females is to the tune of 21%. This is better with respect to the prevalence in general population of Tamil Nadu (37.7%), for India overall (38%) and for the entire world (24.8 %).^{19,20} Compared to agricultural workers (17%) it is slightly high, so also when compared to textile weavers, prevalence is quite high (9.7 %)^{21,22} as well as compared to fishing/farmers (7.6 %).²³ The current scenario can be compared with the Indian figure as the country’s major occupation too is agriculture but when compared to garment workers (44.3%)²⁴ and also as per Tantut et al (62.6%)²⁵ it is much better. But overall, our comparison still holds good for all such related studies, as the number of background factors which have a bearing on anaemia likely to be common for different working classes.

Severity of anaemia: There was a single female worker who was found to have severe anaemia in our study. However, majority of female workers (47.6%) had suffered from mild to moderate anaemia when compared to males (18.4%), which is in accordance with the study done by Amitava Pal et al which showed 29.7% mild, 12% moderate and 4.7% severe cases of anaemia were found in males where as 36%, 19.6% and 11.4% females were having mild, moderate and severe anaemia, respectively.¹⁰

National Family Health survey 4 reports that more than 55% of females in our country have anaemia: among them, 39% had mild, 15% had moderate and 2% had severe anaemia. Moreover, the scenario in Tamil Nadu shows 56.9% of women and 24.3% of men in the rural areas to be anaemic which is high when compared to our study.¹⁹

Weight: A study in Bangladesh, reported that 25% were underweight and 17% were overweight.² In contrast, our study showed that 5% were underweight, 45.2% were overweight, 12.5% were obese and 37.4% were having normal weight. Another study found majority of workers (61.2%) to be within the normal body mass index (BMI) range (18.5- 22.99kg/m²), one fourth of workers (24.0%) were either overweight (19.4%) or obese (4.6%), and having an increased risk of disease, 12% of workers to be marginally underweight and 2.9% of workers to be either moderately or severely underweight, which agrees with the picture in the overall population.²⁴

The prevalence of anaemia was significantly high in underweight and normal groups. The odd ratio was found to be 7.08 with 95% C.I of 2.02 to 25.08 in underweight group when compared to obese or overweight individuals while the same for individuals with normal weight when compared to obese or overweight individuals was 3.62 with a 95% C.I of 1.12 to 11.63.¹⁰

Our findings exhibit a mixed scenario, in that it shows, 22.8% of overweight workers were anaemic, whereas, 50% of underweights were anaemic. There was a significant association of anaemia with underweight in our study.

Socio-economic status: As per the study by Pravin et al., 28.9% of workers were anaemic and majority of them belonging to lower and upper lower socio-economic class. The lower socioeconomic status might be one more factor resulting in poor purchasing capacity, which may be one of the causes for a greater prevalence of iron deficiency anaemia in the workers.²⁶

In females, the findings elsewhere suggest contradictory picture: Workers having higher income more frequently suffered from anaemia than those who had lesser income (7458.33 vs 7239.13 BDT).² Similarly, ladies with higher and moderate income had higher frequency of anaemia⁸ In a study (report) by ILO majority of anaemic women had low income the median monthly basic salary was 128usd²⁷ and also a study done in China showed women from medium income families were less likely (OR 0.68, 95% CI 0.50–0.94) to have anaemia than those from low-income families.²⁸

Here, it can be added that the amount spent on food by workers in Bangladesh was less making them vulnerable for iron deficiency anaemia.² The amount allocated to food by Cambodian garment workers of (~1.5 USD) was insufficient to meet dietary requirement.²⁹

There was a significant association between the lower socio – economic classes (class 3rd & 4th) and anaemia in our study with an odds ratio of 2.57 and p – value of 0.01

Sex: More male workers 92.5% (260) are employed in factory than females 7.5 % (21). This gender disparity is evident for whole of India as well: total no. of women workers constitutes only 25.5% (2011)^{3,4} mainly because of certain industries requiring high degree of manual labour as also in the studies among the farmers in Indonesia²⁵ as well as in a study in Karnataka²⁶but in selected setting like garment factory the females outnumber males majority of the times.

Among males, 18.5% were found to be anaemic, which is marginally less when compared to that of the general population of Tamil Nadu (20.4%). Similarly, when compared to cotton mill workers the prevalence is less as 28.9% of them were anaemic in the study by Pravin et al²⁶ The study done exclusively among male workers in Indonesia by Samir Sanaad Basta et al' showed higher prevalence of (45%) anaemia.³⁰ Similarly, a study done among cotton mill workers in Wardha by RR Tiwari et al avowed a prevalence of 52.7% .³¹ Comparatively, our prevalence was better than fore mentioned instances.

Among the females, 52.2% of them were anaemic in our study, though their numbers are very meagre. The difference in representation of females in number is also evident in a study by Deepti et al²² Despite this, our findings agree remarkably well with NFHS 4 data for non-pregnant women in rural areas of TN which shows 56.9% of the females in rural areas to be anaemic, while the same data for India in general shows 53% of rural females to be anaemic and the same among female agricultural workers was 53.3 %.as per Premanand Bharthi et al³²And strikingly, even when the number of females is large, they were found to be more frequent sufferers.²

However, the prevalence we obtained was better when compared to females in a study by Amitava Pal (66.7%)¹⁰ The prevalence is higher when compared to anaemia among Nepalese women 39.7%.³³ In one study the prevalence of anaemia among female cotton mill workers was 34%.²¹ Some of these differences may partly be due to various methodologies³⁴ and that the cut-off values for haematological variables for diagnosing ID and IDA are arbitrary and may not be appropriate for all given geographic areas and populations because the varying cultural backgrounds and social systems in different countries can be the reason for such differences⁹ In great contrast to above very less proportion of females (17%) had anaemia in Kenya.³⁵

The gender was associated with anaemia in one study²⁵ we didn't attempt to know the association, as the females in our study were less and there is difference in the haemoglobin levels to diagnose anaemia which might lead to a skewed result, the association was not attempted. In

our study however more, females were affected by anaemia than males in proportion (52.3 vs.18.5%).

Age: Younger males have a lesser predilection for anaemia.²⁵ This agrees with our study as well. There is a significant association of age in our study. On the other hand, this is in contrast with the findings of a study wherein it revealed that anaemia was found to be common in young women in Cambodia.¹⁸ People of ≤ 35 years have shown lesser tendency of being anaemic in our study when compared to ≥ 36 years with an odds ratio of 0.45 and p – value of 0.049. This is consistent with a study by Rajesh et.al.³⁶

Education level: Lower education levels were found to have lesser rates of anaemia in our study with an odds ratio of 0.49 and p – value of 0.08, which says that the association is not statistically significant. The reason for the unusual picture in our study can be attributed to the fact the workers with lesser levels of education were employed in stations which required high manual labour which makes them take adequate nutrition while the workers with higher educational levels were employed in not so physically taxing stations during their work. The findings by Tantut et al.²⁵ showed a reverse picture of 41 % of participants who had only elementary education were anaemic. Similarly, those who had primary level of education, 17.3% of them were found to be anaemic whereas 4.1% had anaemia who had secondary level of education.³⁷

Findings obtained by Taslima Khatun et.al² shows that 69% of workers who had primary education exhibited anaemia, however, the association was not significant which is like the scenario in our study. In another study poor educational status was associated with anaemia (51.4%).³⁷

Duration of work experience: It was observed in the current study that workers having < 10 years of experience are less prone for anaemia than those who had > 10 years of experience with an odds ratio of 0.38 and p – value of 0.01. In another study, those workers with more than 10 years of experience, 16.8% of them had anaemia.³⁸

Conclusions and recommendations: Although, the prevalence of anaemia is almost like the state of Tamil Nadu, (general population), it is expected to be much lesser, among the workers, as they are actively engaged in physically demanding and more productive work, than the general population. Our study points out that, the lower socioeconomic classes have increased tendency of being anaemic, hence the employers may be exhorted to be more generous to them, and incentives may be brought in place. Some management techniques may be taught to workers as well as their employers to effectively manage their limited resources. Government. may also take some steps to improve their holistic well-being including their nutritional status. A lone lady is found to have severe anaemia, which is not acceptable, as it may be potentially life-threatening, and further studies are required in other factory settings to

rule out or rule in, that this is or not a common occurrence (‘ice-berg’ phenomenon) among the working population.

There is a great handy remedy which may be made readily available to workers and that which is within the reach of employers: some studies have shown that Sugar cane molasses and evaporated sugarcane juice was a potential dietary supplement to prevent anaemia.

Our study revealed number of underweight subjects are anaemic, the dietary intervention are required to restore normalcy, for instance, gooseberry juice or cereal fermented foods can be used which not only replenish the iron but also could help in improving their underweight.

Limitations:

1. The females are less in number in our study, hence generalizability is guarded.
2. Sugarcane factory workers may not be homogenous with other factory workers.
3. In some places, we have given facts and figures, disregarding the gender differences, but not deviated too far away from actual truth, because in such instances, gender supposed to be playing a minor role, e.g., relationship of obesity with anaemia.
4. Exact cause of anaemia could not be ascertained.

Acknowledgement:

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