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# Prevalence and correlates of anemia among women in the reproductive age (15–49 years) in a rural area of Tamil Nadu: An exploratory study

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## Abstract:

**BACKGROUND:** Anemia is a major public health problem among reproductive-aged women in India. Despite many programs implemented for decades to fight anemia, still the prevalence of anemia is high because its associated factors vary among different regions. This exploratory study was carried out to find the prevalence of anemia and factors influencing it among nonpregnant reproductive-aged women (15–49 years) in a rural area of Coimbatore.

**MATERIALS AND METHODS:** The study was conducted in the field practice area of Rural Health Training Centre, PSG IMSR, Coimbatore, during March 2016 to August 2016. Participants were recruited by two-staged random sampling method and 426 participants were enrolled. A predesigned semi-structured questionnaire was used to collect the data pertaining to the factors influencing the prevalence of anemia, and their hemoglobin level was measured using a hemoglobin photometer. The data were analyzed using SPSS-24. (IBM Corporation, SPSS Inc., Chicago, IL, USA) Univariate analysis was done using Chi-square test and the strength of association was estimated by odds ratio. Those factors which were found to be significant by univariate analysis were further subjected to multivariate logistic regression analysis.  $P < 0.05$  was considered statistically significant.

**RESULTS:** The prevalence of anemia was estimated as 64.8% (95% confidence interval: 60%–69%). Significant predictors for anemia among the study participants were less frequent intake of green leafy vegetables (adjusted odds ratio [AOR] = 3.65, confidence interval [CI]: 2.17–6.12), low socioeconomic status (AOR = 3.36, CI: 1.93–5.84), illiteracy (AOR = 3.09, CI: 1.09–5.24), birth spacing <2 years (AOR = 2.49, CI: 1.19–5.25), excessive menstrual bleeding (AOR = 2.27, CI: 1.09–4.76), and inadequate knowledge regarding anemia (AOR = 2.03, CI: 1.19–3.44).

**CONCLUSION:** Anemia is still prevalent in high magnitude in reproductive-aged women, and measures to prevent and control it are not optimum. Hence, its multifactorial determinants have to be addressed to alleviate its burden.

## Keywords:

Anemia, nonpregnant reproductive-aged women, risk factors for anemia

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## Introduction

Anemia is a major public health problem, affecting 24.8% of the global population. The prevalence of anemia is disproportionately high in developing countries compared to developed countries due to poverty, illiteracy, inadequate

dietary intake, certain infectious diseases, frequent pregnancy, and poor access to health services. The most vulnerable groups affected by anemia are children, adolescent girls, and women in the reproductive age, especially pregnant women.<sup>[1]</sup> Anemia can reduce the quality of life, leading to a substantial economic

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burden on the affected individuals and their families, communities, and societies.<sup>[2]</sup> According to the Fourth National Family Health Survey (NFHS-4), 54.4% and 56.9% of women of reproductive age are found to be anemic in rural areas of India and in Tamil Nadu, respectively.<sup>[3]</sup> Anemia is found to be more prevalent among reproductive-aged women in India, and it poses a significant morbidity risk, particularly among reproductive-aged women. Despite the fact that anemia is largely preventable and easily treatable if detected in time, it still continues to be a common cause of morbidity and mortality and is considered a silent killer.<sup>[4]</sup> This nutritional disability in the life of women will have adverse consequences on the developmental stages of the next generation and can have long-term impact and thus leave a perpetual effect.<sup>[5]</sup> The WHO recommends local studies for each region to provide baseline information for designing prophylactic and therapeutic strategies to control this problem.<sup>[4]</sup> Most of the studies carried out in different parts of the country are either hospital-based studies done among pregnant and lactating mothers or college/school-based studies done among adolescent girls, there is a scarcity of community-based studies among nonpregnant reproductive-aged women. Social, cultural, economic, and dietary features vary widely across India and hence the factors influencing anemia also vary based on the geographical location. Though the accurate data on the prevalence of anemia is essential to determine public health measures, in reality, accurate data are scarce in the study area, which impedes anemia preventive strategies. Identifying the local determinants and risk factors of anemia will help to plan for appropriate package of services to reduce the risks of morbidity and mortality associated with anemia and is one of the priorities for safe motherhood initiative.

## Materials and Methods

### Study design and setting

A community-based cross-sectional study was done in the rural field practice area of PSG Institute of Medical Science and Research, Coimbatore, during March 2016 to August 2016. The conceptual framework adopted in this study explains the possible causes of anemia and the interconnectedness of these factors in predisposing a woman to become anemic [Figure 1].<sup>[6]</sup>

### Study participants and sampling

With an estimated prevalence of 55.4% from NFHS-4<sup>[3]</sup> study and 5% allowable error, and 20% nonresponse rate, the sample size was estimated as 480. The study participants were selected by two-staged random sampling method [Figure 2]. In the first stage, three

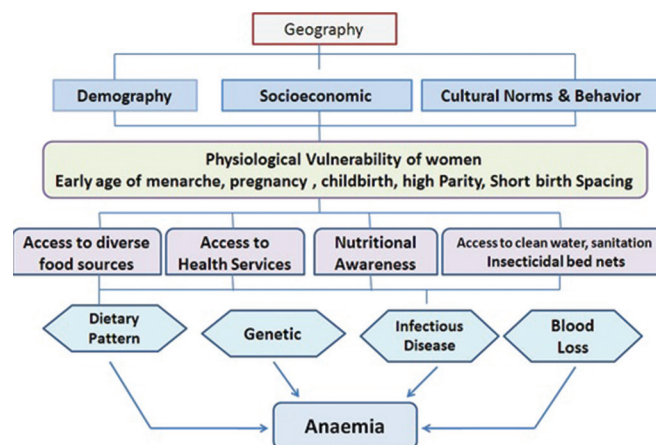


Figure 1: Conceptual framework for anemia among reproductive age women

villages were selected randomly from 14 villages. In the second stage, the required sample numbers were selected from three villages by probability proportional to the size of the villages. Individual participants from each village were chosen by SPSS-generated random numbers. Women in reproductive age group (15–49 years) who are permanent residents for at least 1 year were included, whereas pregnant women, those not willing to participate in the study, and absence at home on three visits were excluded from the study.

### Data collection tool and technique

After obtaining informed consent, a predesigned semi-structured questionnaire was used to collect the data pertaining to the factors influencing the prevalence of anemia namely demographic factors, socioeconomic, environmental factors, reproductive, and menstrual factors. Socio-economic status was assessed using Modified Prasad Classification. Knowledge was assessed by a series of twelve questions on causes, symptoms, complication, and prevention methods, and a scoring system was given and those who scored more than 50% were considered having adequate knowledge on anemia. Sixteen iron-rich food items were considered in our study based on the iron content given by the National Institute of Nutrition.<sup>[7]</sup> Height and weight were measured according to the WHO standard procedure,<sup>[8]</sup> and confidentiality of the study participants was ensured. Hemoglobin level was measured from capillary blood obtained by finger prick using a hemoglobin photometer, which is a reliable method in field surveys.<sup>[9]</sup> The sensitivity and specificity for the hemoglobin estimation by this photometer is 94.1% and 95.2%, respectively.<sup>[10]</sup> The Haemoglobin photometer was checked each day morning prior to data collection with the control microcuvette given along with the instrument by the manufacturer for the purpose of internal validation of the instrument. After every seventy samples examined by the photometer, the instrument was tested for reliability using same blood samples,

and it was also externally validated in the Pathology Laboratory of PSGIMSR using the Beckman Coulter LH 450 method. Difference in the value of hemoglobin was found to be in the range of 0.3–0.6 g/dL.

### Ethical consideration

The study was carried out in accordance with the ethical standards of PSGIMSR Institutional Human Ethics Committee (IHEC – Proposal Code – 14/075), and the Ethical Principles for Medical Research was followed.

### Operational definition

The WHO criteria for diagnosis of anemia in nonpregnant women with hemoglobin level <12 g/dL were used in this study. Grading of anemia was done on the basis of cutoff values: mild anemic (hemoglobin [Hb]: 11–11.9 g/dL), moderate anemic (Hb: 8–10.9 g/dL), and severe anemic (Hb: <8 g/dL).

### Statistical analysis

Data were analyzed using SPSS-24. The prevalence of anemia was estimated with 95% confidence interval (CI). The associations between independent variables and hemoglobin level were tested using Chi-square test and the strength of associations was obtained using odds ratio. The variables which were found to be statistically significant in univariate analysis were further subjected to multivariate logistic regression analysis.  $P < 0.05$  was considered statistically significant.

## Results

Of the selected 480 women of reproductive age, 37 of them did not participate due to fear of finger prick, 7 of them were pregnant, and 12 of them were not present in their house during three visits and hence excluded from the study. A total of 426 nonpregnant women in the reproductive age group were enrolled in the study.

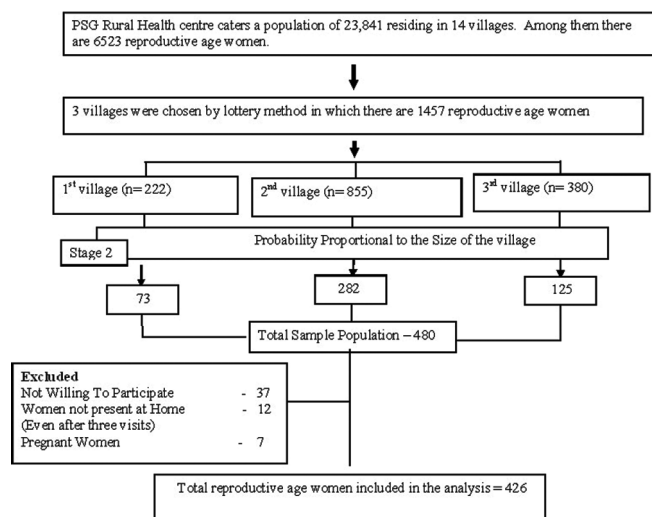


Figure 2: Flow diagram showing the sampling procedure

The demographic profile of the study participants is shown in Table 1. 18.8% of the study participants were in the age group of 25-29 years, 26.7% had education up to high School, higher proportion (63.8%) of the study participants were not working and majority of them (92.7%) belonged to Hindu religion. 71.6% of the participants were residing in a nuclear family and 37% of them belonged to low-socio-economic class (Class IV and V).

Table 2 shows the reproductive characteristics of the study participants. Nearly 75.6% of them have attained menarche before the age of 14 years, and 79.6% of the participants were married. Among those who were married, 25.7% of them got married before the age of 18 years, 9.6% of them have more than 2 children, 28.6% have a history of abortion, and 8.3% of the individuals are currently using IUD. Among 218 people having two children and more, 45.4% had birth spacing <2 years. 10 participants had hysterectomy done, and 19 of them have attained menopause. Of the remaining 397 participants,

Table 1: Demographic profile of the study participants (n=426)

Variable	Frequency, n (%)
Age (years)	
15-19	51 (12.0)
20-24	75 (17.6)
25-29	80 (18.8)
30-34	66 (15.5)
35-39	59 (13.8)
40-44	48 (11.3)
45-49	47 (11.0)
Education	
Illiterate	64 (16.2)
Primary	29 (6.8)
Middle	63 (14.8)
High school	114 (26.7)
Higher secondary	68 (16.0)
Graduate	83 (19.5)
Occupation	
Working	154 (36.2)
Not working	272 (63.8)
Religion	
Hinduism	395 (92.7)
Christianity	27 (6.3)
Islam	4 (1.0)
Type of family	
Nuclear	305 (71.6)
Extended	121 (28.4)
Socioeconomic status	
Class I	22 (5.2)
Class II	102 (23.9)
Class III	144 (33.8)
Class IV	111 (26.1)
Class V	47 (11.0)

**Table 2: Reproductive and menstrual characteristics of the study participants**

Variable	Frequency, n (%)
Age at the time of menarche (years) (n=426)	
<14	322 (75.6)
≥ 14	104 (24.4)
Marital status (n=426)	
Unmarried	70 (16.4)
Married	339 (79.6)
Widowed	15 (3.5)
Divorced	2 (0.5)
Age at the time of marriage (years) (n=339)	
<18	87 (25.7)
>18	252 (74.3)
Number of children (n=339)	
0	22 (6.4)
1	99 (29.2)
2	185 (54.6)
3	24 (7.1)
>3	9 (2.7)
Age at the time of first child birth (years) (n=317)	
<19	35 (11)
≥ 19	282 (89)
Birth spacing (n=218)	
<2	99 (45.4)
≥ 2	119 (54.6)
History of abortion (n=339)	
Yes	97 (28.6)
No	242 (71.4)
Current IUD usage (n=339)	
Yes	28 (8.3)
No	311 (91.7)
Menstrual cycle (n=397)	
Regular	313 (78.8)
Irregular	84 (21.2)
Excessive menstrual bleeding (n=397)	
Yes	83 (20.9)
No	314 (79.1)

IUD=Intrauterine device

21.2% of them had irregular menstrual cycle and 19.5% of the individuals had excessive menstrual bleeding.

Regarding the environmental factors, only 64.3% of them were having toilet facility in their homes, 20.4% of them were having the practice of open-air defecation, and the rest were using community toilets. Almost 5.9% of the participants had the habit of barefoot walking, 8.2% of them had a history of passing worms in the stool, and 20% of them did not have the habit of washing hands with soap after defecation.

Regarding knowledge, 49.1% of them had adequate knowledge regarding anemia – its cause, symptoms, methods to prevent anemia – and knowledge regarding iron-rich foods. Almost 87.3% of the participants were on mixed diet and 40.1 of them have the habit of taking

coffee along with food. Nearly half (48.6%) of them were having normal body mass index (BMI), while 19% of them were undernourished and 32.4% were overweight/obese. The mean BMI of the study participants was  $23.03 \pm 4.71$  kg/m<sup>2</sup>.

### Prevalence of anemia

The prevalence of anemia among the study population was 64.8% (95% CI: 60–69). The mean hemoglobin of the study participants was  $11.34 \pm 1.63$  g/dL. Out of the 276 anemic women, 55.07% of them were mildly anemic, 35.15% were moderately anemic, and 9.78% of them were severely anemic.

### Factors influencing prevalence of anemia

The contributing factors associated with anemia in descending order as revealed by multivariate logistic regression [Table 3] were intake of green leafy vegetables (GLVs) (<2 times weekly), socioeconomic status (class IV and V), illiteracy, birth spacing <2 years between last two pregnancies, excessive menstrual bleeding, and inadequate knowledge regarding anemia. Factors such as open air defecation habit, history of passing worms in stool, not washing hands with soap after defecation, attained menarche <14 years of age, irregular menstrual cycle, following vegetarian diet, those having the habit of drinking coffee along with food, those having low BMI, intake of whole grains and mutton less frequently, which were found to have a significant association on univariate analysis did not show a significant association with anemia in the multivariate logistic regression analysis. There was no significant association between anemia and type of family, habit of barefoot walking, marital status, age at marriage <18 years, age at first child birth <19 years, having more than two children, current IUD usage, and other iron-rich foods.

## Discussion

Anemia is largely preventable and easily treatable if the local determinants are identified. The WHO and UNICEF therefore reemphasize the urgent need to combat anemia and stress the importance of recognizing its multifactorial etiology for developing effective control programs.<sup>[11]</sup> Our study showed the prevalence of anemia to be 65% (95% CI: 60%–69%), which is 10% higher compared to NFHS-4<sup>[3]</sup> survey. According to the WHO, if the prevalence of anemia at community levels is more than 40%,<sup>[1]</sup> it is considered a problem of high magnitude.

Out of the 276 anemic women, majority of them were mild to moderately anemic and only few of them were severely anemic, which was consistent with that of other studies.<sup>[12,13]</sup> Hence, its prevention is essential for child



**Table 3: Multivariate logistic regression analysis of factors influencing anemia**

Variable	AOR	CI	P
Education			
Illiterate	3.09	1.09-8.81	<0.05
Literate	1		
Socioeconomic status			
Classes IV, V	1.38	1.93-5.84	<0.001
Classes I, II, III	1		
Practice open-air defecation			
Present	1.84	0.97-5.57	0.09
Absent	1		
History of passing worms in stools			
Present	2.83	0.88-9.04	0.08
Absent	1		
Washing hands with soap after defecation			
Present	0.89	0.44-1.21	0.75
Absent	1		
Menarche attained (years)			
<14	2.35	0.78-4.22	0.09
≥ 14	1		
Birth spacing (<2 years)			
Present	2.49	1.19-5.25	<0.05
Absent	1		
Regularity of menstrual cycle			
Regular	0.78	0.42-1.47	0.44
Irregular	1		
Excessive menstrual bleeding			
Present	2.27	1.09-4.76	<0.05
Absent	1		
Knowledge regarding anemia			
Inadequate	2.03	1.19-3.44	<0.05
adequate	1		
Nature of diet			
Vegetarian	2.57	0.89-6.29	0.10
Mixed	1		
Taking coffee along with food			
Yes	1.60	0.92-2.78	0.09
No	1		
BMI (Kg/m <sup>2</sup> )			
<25	2.46	0.94-5.01	0.57
≥25	1		
Intake of whole grains (times/week)			
<2	2.36	0.89-8.44	0.102
≥2	1		
Intake of GLVs (times/week)			
<2	3.65	2.17-6.12	<0.001
≥2	1		
Intake of heme iron (time/week) (meat, poultry, and fish)			
<1	2.79	0.88-8.91	0.08
≥1	1		

AOR=Adjusted odds ratio, CI=Confidence interval, BMI=Body mass index, GLVs=Green leafy vegetables

survival and safe motherhood.<sup>[14]</sup> The identified anemic women were referred to the Rural Health Training Centre for further management. Data from the National Nutritional Monitoring Bureau Surveys<sup>[5]</sup> show that Indian women have a sustained low intake of iron, which

may be due to various reasons such as economic, social, and lack of empowerment.

In our study, we identified six factors which had a significant association with anemia. The mean

hemoglobin level of significant predictors for anemia in the current study is shown in Figure 3. The first risk factor which was found to have statistical significant association with higher risk of anaemia was the intake of GLV. The study participants who took GLV less than twice a week had three times higher risk of becoming anaemic and this finding was also observed in other studies.<sup>[15,16]</sup> GLV is a good source of iron, and inadequate intake of GLV is one of the important causes of anemia. It is followed by socioeconomic status which had an inverse relationship with anemia. This finding is consistent with that of other studies.<sup>[17-19]</sup> Poor socioeconomic status is known to be associated with a number of factors such as high parity; short birth interval; poor diet, both in quantity and quality; lack of awareness regarding health and nutrition; a high rate of infectious diseases and parasitic infestations; as well as limited access to medical attention.<sup>[12]</sup>

The current study reveals the fact that illiterates have about three times higher risk of becoming anemic. Similar findings have been observed in other studies.<sup>[20,21]</sup> Better educated women enjoy the privilege of higher paying jobs and live in better environment, which will have a positive influence on their nutritional status. In our study, another factor associated with anemia is birth spacing, which is a similar observation in other studies also.<sup>[22,23]</sup> Repeated pregnancies at short interval deplete the iron stores, thereby leading to anemia, which depict the need for contraception education.<sup>[24]</sup>

Excessive menstrual bleeding is said to be present when a woman has long duration of menstruation (>5 days) or if there is passage of clots during the menstrual period. In the present study, those with excessive menstrual bleeding had two times higher risk of anemia. Similar findings have been observed in other studies.<sup>[19,23,25]</sup> We also observed that there was a significant association between inadequate knowledge regarding anemia and risk of anemia, which was similar to the findings of other studies.<sup>[26,27]</sup> Due to lack of adequate knowledge on anemic causes, ill effects, and preventive measures, incorrect choice of food can lead to nutritional deficiency,

making them more prone to become anemic. No significant association was found between hemoglobin concentrations and anthropometric measurements, which was similar to that of another study.<sup>[28]</sup> Other demographic, reproductive, and socioenvironmental factors did not show a significant association with anemia.

India was the first developing country to commence a National Anaemia Prophylaxis Programme during the 4<sup>th</sup> five-year plan in 1970, providing iron and folic acid supplementation to all pregnant women and children with an aim to reduce the prevalence of anemia to below 25%.<sup>[29]</sup> The current study highlights that anemia still remains a public health issue of great magnitude among nonpregnant reproductive-aged women, even after nearly 50 years into the program. Women of childbearing age are at risk of anemia not only throughout their reproductive years but also during pregnancy. Measures to prevent and control anemia so far have largely been ineffective, hence strategies to combat anemia, therefore, should address all the causal factors and focusing our thrust on iron supplementation alone may not be able to provide the much-desired effect because the pathogenesis of anemia is multifactorial. First, the system of periodic screening for anemia among women of childbearing age should be developed and it should be considered one of the important primary healthcare activities at the center. Second, an IEC program to change knowledge, attitudes, household dietary practices, and kitchen garden activities is required to effect positive changes in consumption patterns, thereby improving the nutritional status. Economic empowerment of women can be attempted by organizing the women to form a self help group in order to carry out small scale business and thereby paving a way for small income. Optimal birth spacing (Minimum two years) should be enforced and the reproductive aged women should be made assertive to it.

Further studies are needed to determine the specific types of anemia and the quantum of dietary intake of iron, thereby giving a better insight into the situation.

**Limitation**

The study has few limitations. Because it is a cross-sectional study, cause-effect relationship cannot be determined. Dietary history was limited to self-reported food frequency, hence the quantum of dietary intake of iron could not be ascertained and confirmation of worm infestation by stool examination was not possible due to operational difficulty.

**Conclusion**

Anemia has been recognized as a public health problem for many years, but only little progress has been made in its control. The best predictors of anemia in descending order are intake of GLVs (<2 times weekly),

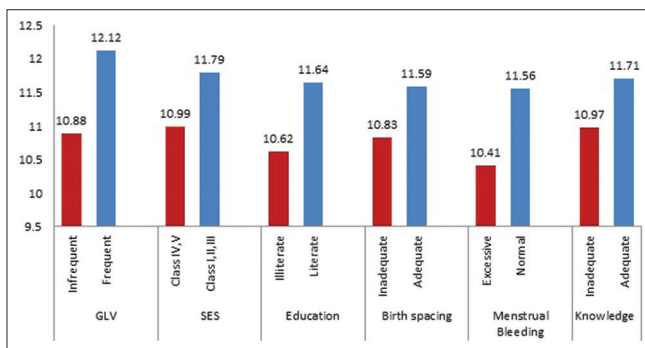


Figure 3: Mean hemoglobin levels of significant predictors for anemia in the current study

socioeconomic status (class IV and V by the Modified Prasad classification), illiteracy, birth spacing <2 years between last two pregnancies, excessive menstrual bleeding, and inadequate knowledge regarding anemia. Hence, to alleviate anemia burden, measures such as economic empowerment, improvement in awareness regarding anemia, dietary practice of taking frequent GLVs and making it easily available, and contraceptive education should be provided by an integrated multifactorial and multi-sectorial approach.

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### Conflicts of interest

There are no conflicts of interest.

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