Original Article

Prevalence of anaemia and associated factors among antenatal women in rural Kozhikode, Kerala

Meera S. Nair[1], Lucy Raphael[2], Priya Chandran[3]

[1]Department of Community Medicine, KMCT Medical College, Manassery, Calicut, Kerala, [2]Department of Community Medicine, Jubilee Mission Medical College, Thrissur, Kerala, [3]Department of Community Medicine, Government Medical College, Calicut, Kerala, India

ABSTRACT

Context: Anemia in pregnancy is a significant public health concern with detrimental aftereffects on maternal and fetal well-being universally, especially in developing countries like India. **Aims:** To estimate the prevalence of anemia in pregnant women in rural areas of Kozhikode by hemoglobin estimation and to study the selected factors associated with anemia. **Settings and Design:** A cross-sectional study was conducted among 295 antenatal women in all three trimesters residing in six selected panchayats of Kozhikode district from July 2016 to March 2017. **Materials and Methods:** The cluster sampling method was followed. Data were obtained from antenatal women, applying a pretested semi-structured questionnaire. Hemoglobin estimation was done using the Humacount 30TS automated hematology analyzer. **Statistical Analysis Used:** Data were analyzed using SPSS 18 software. **Results:** The prevalence of anemia was 40%. Of this, 30.5% had mild anemia and 9.5% had moderate anemia. There were no cases of severe anemia. The prevalence was more in the second trimester. Factors such as excess menstrual blood loss prior to present pregnancy, early age at first delivery, trimester, and parity were found to be significantly associated with anemia. **Conclusion:** Anemia continues to be a serious public health problem. Health system should pay more attention on different factors that contribute to anemia, and planners should formulate an apt policy and implement necessary changes in existing programs.

Keywords: Anemia, pregnancy, prevalence, trimester

Introduction

Anemia is a worldwide public health challenge, especially in developing nations, including India, wherein umpteen surveys have been carried out and the results vary widely. According to the District Level Household Survey 4 (DLHS 4) data, the prevalence of anemia in rural Kozhikode is high at 40.6%,[1] but there is a sparsity of studies addressing the risk factors of anemia in pregnancy and its prevalence in Kozhikode. Despite iron supplementation programs, anemia remains to be an important reason of morbidity for both the mother and fetus. The present study aims to find out the prevalence of anemia and explore its risk factors among pregnant women of rural Kozhikode.

Materials and Methods

A community-based cross-sectional study was conducted from July 2016 to March 2017 over a period of 1 year in six selected panchayats in Kozhikode district, located in the northern part of Kerala, India. The study included registered pregnant women of all three trimesters residing in the selected primary health center (PHC) area. Those with coagulation disorders were excluded.

The sample size was estimated using the formula $n = 4pq/d^2$, where P is the prevalence, $q = 1 - p$, d is the allowable error. P

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was taken as 40.6% (40.6% pregnant women in rural Kozhikode were anemic (DLHS-4 data) (2012–2013) [1]), d = 17% of p. The calculated sample size was 197.

A design effect of 1.5 was applied to make allowance for heterogeneity, yielding the revised sample size of 295. Taking into consideration a non-response rate of 10%, the final sample size was 330.

Six panchayats out of the total 75 in the Kozhikode district were selected by simple random sampling. By taking each panchayat as a cluster, a list of all eligible pregnant women was obtained from the antenatal register maintained by the junior public health nurse (JPHN) at the PHC/subcenter. Out of each cluster, 55 participants were chosen from the register using simple random sampling.

Data were gathered by applying a pretested semi-structured questionnaire by visiting each house. Effort was made to visit the study subjects a second time, failing which they were excluded from the study.

Details of sociodemographic variables, obstetric history, morbidities, and medication were collected. Anthropometric measurements such as height and weight were taken. The study participants were asked to attend the PHC/subcenter for hemoglobin estimation on a fixed day. After explaining the procedure to the participant, 1 mL of blood was drawn under aseptic safeguards through venipuncture from the antecubital vein, in an ethylene diamine tetraacetic acid (EDTA) tube. Hemoglobin estimation was done by the photometric method using the Humacount 30 TS automated hematology analyzer in an ISO-certified laboratory on the same day. The following day, the subjects were informed regarding the results of the hematological studies and the anemic persons were given suitable guidance.

Anemia was classified as per WHO criteria. Antenatal women with hemoglobin levels of <11 g/dL were classified as anemic. Furthermore, anemia was categorized as mild (10–10.9 g/dL), moderate (7–9.9 g/dL), and severe (<7 g/dL).[2] Modified Kuppuswamy's socioeconomic scale[3] was used to assess the socioeconomic status. Socioeconomic class was computed by scoring the highest education and highest occupation of the head of the family and total monthly family income.

Ethical concerns

The study protocol was sanctioned by the Institutional Research Committee and The Institutional Ethics Committee of Government Medical College Kozhikode (Reference letter number: GMCKKD/RP 2014/IEC/47/12 dated 29/12/2014). Permission was obtained from the District Medical Officer (DMO). Written informed consent was taken from the participants in their local language. Care was taken to maintain the confidentiality of study participants.

Statistical analyses

Data were entered in Excel and analyzed using SPSS 18 software. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were computed under the univariate analysis. Under the bivariate analysis, cross tables were constructed and Chi-square test was done and the associations with the status of anemia were tested. The results were considered statistically significant at $P < 0.05$.

Results

Among a total of 295 antenatal women who were studied, 118 were found to be anemic. Thus, the prevalence of anemia in this study was 40%. Out of this, 90 (30.5%) had mild anemia (10–10.9 g/dL) and 28 (9.5%) had moderate anemia (7–9.9 g/dL). No one suffered from severe anemia. The hemoglobin levels of the study participants ranged between 7.8 and 14.4 g/dL, with the mean hemoglobin as 11.24 ± 1.07 g/dL. Mean hemoglobin ± SD was 11.24 ± 1.09 g/dL the in 15–25 age group, 11.29 (1.06) g/dL in the 26–35 age group, and 10.67 (0.85) g/dL in the 36–45 age group. Pallor was found in 81 women (68.6% of the anemic women).

Socio demographic details [Table 1]

The mean age of the study population was 25.27 ± 4.88 years (range: 18–39 years). All the antenatal women were literate and educated. Further, 49.5% of females were educated up to higher secondary/diploma. Employed women constituted a minority (3.7%).

Menstrual and obstetric details [Table 2]

The mean age at menarche of the study population was 13.46 (1.121) years (range: 9–17 years). The majority of the study participants (102 (34.6%)) had attained menarche at the age of 13 years.

The mean age at marriage was 19.9 ± 3.16 years, the minimum age at marriage was 15 years, and the maximum age at marriage was 36 years. About 13.2% of women got married before the legal minimum age of 18. The mean age at first delivery was 20.627 ± 3.168 years. The age at first delivery ranged from 16 to 37 years. Among the 295 antenatal women, 216 (73.2%) had their first delivery at 21 years of age or less and only five women (1.7%) delivered for the first time after 30 years of age.

The majority of the study participants (106 (35.9%)) were in their first trimester, 97 (32.9%) in the second trimester, and 92 (31.2%) were in the third trimester. The mean gestational age was 24 weeks.

The mean parity was 1.02 ± 0.956, and the maximum parity was six.

In our study, the majority (108 (36.6%)) were primipara, 88 (29.8%) were primigravida, and 94 (31.9%) were second gravida.

Table 1: Sociodemographic characteristics of the participants

Characteristics	Antenatal women (*n*=295) frequency	Percentage
Age group in years		
<25	166	56.3
26-35	119	40.3
36-45	10	3.4
Religion		
Hindu	118	40
Muslim	174	59
Christian	3	1
Educational status		
Middle school	2	0.7
High school	104	35.3
Higher secondary/diploma	146	49.5
education	43	14.6
Graduate/Postgraduate		
Occupation		
Housewife	284	96.3
Unskilled worker	1	0.3
Elementary school teacher	6	2
Semi-professional	4	1.4
Socioeconomic status and class		
Upper middle (I)	128	43.4
Lower middle (II)	133	45.1
Upper lower (III)	34	11.5
Type of family		
Three generation	116	39
Nuclear	96	33
Joint	83	28
Family members		
1-5	201	68.1
6-10	89	30.2
>11	5	1.7

Table 2: Menstrual and obstetric details of the study population

Characteristics	Antenatal women (*n*=295) Frequency	Percentage
Age at marriage (in years)		
≤19	174	59
20-24	97	32.9
≥25	24	8.1
Age at first delivery (in years)		
≤21	216	73.2
22-30	74	25.1
>30	5	1.7
Trimester		
First	106	35.9
Second	97	32.9
Third	92	31.2
Number of abortions		
0	233	79
1	52	17.6
2	10	3.4
Birth spacing between previous and current pregnancy		
≤4 years	138	66.7
5-8 years	57	27.5
9-14 years	12	5.8

*Primigravida were not included

The mean number of abortions was 1.78 ± 0.408 (range: 1–2).

Fifty-two antenatal women (17.6%) had one abortion, and 10 women (3.4%) had two abortions in their reproductive life.

The mean number of years of spacing between previous and current pregnancy was 3.9 ± 2.39 years (range: 3 months–14 years). The minimum spacing was as low as 3 months because some of the antenatal women had a history of abortions.

The majority of the antenatal women (138 (66.7%)) had birth spacing of 4 years or less [Table 2].

In our study, 56 antenatal women (19%) had symptoms suggestive of anemia. Of these, 41 were anemic.

Factors associated with anemia [Table 3]

Anemia was seen more in pregnant women who had a history of menorrhagia (58.4%), which is statistically significant.

Increased blood loss, whether due to early menarche or due to menorrhagia earlier in life, contributes to anemia during pregnancy. In our study, women aged 25 years or less in the first pregnancy were more anemic, which is statistically significant.

The prevalence of anemia was found to be more in the second trimester of pregnancy (47.4%) as compared to the first (30.2%) and third trimesters (43.5%) ($P < 0.05$), indicating that anemia is further accentuated by hemodilution.

Pregnant women with increased parity (two or more) had an increased risk of anemia (50%), and it was statistically significant ($P = 0.025$).

Further, 73.2% of anemic women reported symptoms suggestive of anemia, which is statistically significant. Symptoms such as easy fatiguability or getting tired easily and giddiness were found to be associated with anemia [Table 4].

Factors such as excess menstrual blood loss prior to present pregnancy, young age at first delivery (≤25 years), trimester, parity, and symptoms suggestive of anemia were found to be significantly associated with anemia.

Discussion

The prevalence of anemia among pregnant women was found to be 40%, which is at par with the global prevalence (41.8%)[4] and lower than the national data (50.4%- National Family Health Survey-4 data (NFHS-4)) but higher than the NHFS 4 data for rural Kerala (22.5%) and Kozhikode (32%).[5-7] According to DLHS 4 data, studies done in Kozhikode indicated that the prevalence of anemia in pregnant women in the Kozhikode district was 46.8%.[1] This was higher than the state average of 34.6%, whereas in rural Kozhikode, it was 40.6%.[1,8] Tiwari *et al*.[9] in Karnataka and Abiselvi *et al*.[10] found

Table 3: Factors influencing anemia

Variable	Categories	Total n=295 (%)	Anemia n (%)	Normal n (%)	Odds ratio	95% confidence Interval	P
Menstrual bleeding	Menorrhagia (>5 days)	77	45 (58.4%)	32 (41.6%)	2.793	1.639-4.762	0.000
	Normal (≤5 days)	218	73 (33.5%)	145 (66.5%)			
Age at first delivery	≤25	274	115 (42%)	159 (58%)	4.340	1.249-15.080	0.013
	>25	21	3 (14.3%)	18 (85.7%)			
Trimester	First	106	32 (30.2%)	74 (69.8%)			0.031
	Second	97	46 (47.4%)	51 (52.6%)			
	Third	92	40 (43.5%)	52 (56.5%)			
Parity	≥2	86	43 (50%)	43 (50%)	1.787	1.075-2.971	0.025
	<2	209	75 (35.9%)	134 (64.1%)			
Gravida	≥3	113	53 (46.9%)	60 (53.1%)	1.590	0.986-2.564	0.057
	≤2	182	65 (35.7%)	117 (64.3%)			
Number of abortions (*n*=62)	1	52	21 (40.4%)	31 (59.6%)	0.677	0.174-2.633	0.573
	2	10	5 (50%)	5 (50%)			
Spacing between previous pregnancy and current pregnancy*	<3 years	72	35 (48.6%)	37 (51.4%)	1.359	0.764-2.418	0.296
	≥3 years	135	55 (41.0%)	80 (59.0%)			
Symptoms suggestive of anemia	Present	56	41 (73.2%)	15 (26.8%)	5.751	3.000-11.023	0.000
	Absent	239	77 (32.2%)	162 (67.8%)			

*Primigravida were not included

Table 4: Anemia in relation with different symptoms suggestive of anemia

Symptoms suggestive of anemia	Total n=73	Anemia		OR	95% confidence Interval	P
		Anemic	Normal			
Easy fatiguability	39	29 (74.4%)	10 (25.6%)	5.442	2.536-11.675	0.000
Giddiness	19	12 (63.2%)	7 (36.8%)	2.749	1.049-7.203	0.033
Leg cramps	6 (66.7%)	3 (33.3%)	9	3.107	0.762-12.677	0.097
Breathlessness	4 (80%)	1 (20%)	5	6.175	0.682-55.953	0.066
Palpitation	2 (66.7%)	1 (33.3%)	3	3.034	0.272-33.849	0.343
Reduced concentrating power	1 (50%)	1 (50%)	2	1.504	0.093-24.287	0.772
Pica	2 (100%)	0	2			0.159

*The above tables are original, and not from any other source. *Please note- Multimedia files/tables have been uploaded separately also, as per your instruction video

a similar prevalence (41.5%) to our study. Sreejith *et al.*'s[11] study in Thiruvananthapuram district, Kerala noted a higher prevalence (64%) than our study. Higher prevalence was also noted in many other studies, such as Rai *et al.*[12] (74.7%), Cheema *et al.*[13] (65.6%), and Gopinath *et al.*[14] (51%). This may be due to the dissimilarity in the sociodemographic pattern, literacy, access to health facilities, etc., in various parts of India. Compared to most states of India, Kerala has a higher literacy rate and better access to health care. Two studies performed by Saxena *et al.*[15] and Samuel *et al.*[16] reported a lower prevalence than our study, which were 38% and 30.3%, respectively.

Globally, higher prevalence has been seen in studies done in Pakistan (90.5%),[17] Nigeria (76.5%),[18] Nepal (66.9%),[19] and eastern Ethiopia (56.8%).[20] Low prevalence has been reported from Northwest Ethiopia (21.6%)[21] and Uganda (14.1%).[22] Studies done in West Algeria (40.08%)[23] and in Turkey (41.6%)[24] showed similar prevalence as that noted in our study.

Although the prevalence of anemia was 40% in our study, the majority had mild anemia and there were none with severe anemia. The majority of the anemic women had mild anemia.

This could be due to the beneficial rewards of antenatal care services. Similar findings were observed by Gopinath *et al.*[14] in Karnataka and Bisoi *et al.*[25] in West Bengal. Our findings were also supported by studies done in Uganda, Jordan, and Nigeria.[22,26,27] However, contrary to our finding, the prevalence of moderate anemia was found to be high in a study done by Khan *et al.*[28] in West Bengal.

Anemia was seen more in housewives when compared to employed women, which, however, was not found to be statistically significant. In a study done by Alem *et al.*[21] among 384 pregnant women in Northwest Ethiopia, the risk of anemia was 2.42 times higher among housewives as compared to governmental employees.

In this study, the prevalence of anemia is more in the lower socioeconomic class, although not statistically significant. Noronha *et al.*[29] in their study also portrayed a similar fact.

Anemia was detected more in pregnant women who had a history of menorrhagia (58.4%), which is statistically significant (OR: 2.793, 95% CI: 1.639–4.762). Our finding was consistent with another

study by Kefiyalew *et al.*[30] conducted in Southeast Ethiopia, in which it was found that the prevalence of anemia was higher (AOR = 2.7, 95% CI: 1.3–1.7) in pregnant women who reported a history of heavy bleeding during the menstrual cycle (>5 days). Increased blood loss, whether due to early menarche or due to menorrhagia earlier in life, contributes to anemia during pregnancy.

In our study, the prevalence of anemia is 4.34 times more common in women with age at first delivery 25 years or less, which is statistically significant.

Noronha *et al.*[29] in Udupi district, Karnataka, reported a higher prevalence of anemia in women with age at first childbirth <21 years.

Anemia is found to be more prevalent in women in their second trimester, indicating that anemia is further aggravated by hemodilution. Sreejith *et al.*[11] in Thiruvananthapuram, Kerala; Bansal *et al.*[13] in Punjab; and Idowu *et al.*[18] in Nigeria noted similar results that the prevalence of anemia was high in the second trimester, followed by the third trimester and then by the first. Contrary to our finding, a study done in West Bengal by Bisoi *et al.*[25] and Cheema *et al.*[13] showed that the highest prevalence of anemia was found in the third trimester, followed by second and then first.

The present study showed that pregnant women with parity two or more have an increased risk of anemia (50%), and it was statistically significant (*P* = 0.025). Tiwari *et al.*[9] in Mangalore, Karnataka showed that the prevalence of anemia was significantly high in women with high parity (40.6%). Noronha *et al.*[29] in Udupi district, Karnataka reported that women with parity three or more are more likely to be anemic (61.54%). Cheema *et al.*[13] in Punjab and Rai *et al.*[12] in Madhya Pradesh also exposed that anemia is directly proportional to parity.

Our study showed that pregnant women with gravidity three or more have 1.59 times increased risk of anemia, but it is not statistically significant (*P* = 0.057). Studies conducted by Gopinath *et al.*[14] and Bansal *et al.*[31] showed that multigravida were more anemic when compared to primigravida. Suryanarayana *et al.*[32] documented that the prevalence of anemia increased with an increase in gravidity. Gravidity three or more had an increased risk of anemia, which was statistically significant. Contrary to our findings, a study done by Idowu *et al.*[18] in Nigeria found that primigravidae were more anemic than multigravidae.

Antenatal women who have high parity and gravid status tend to be more anemic because they become pregnant frequently and are hence prone to anemia.

In this study, the mean number of abortions was 1.78 with a standard deviation of 0.408. The number of abortions in the study group ranged between one and two. The prevalence of anemia was found to be more common in antenatal women with two abortions. It could be because abortion is one of the causes of acute blood loss, which depletes iron stores in the body. In a study done by Uche-Nwachi *et al.*[33] in Trinidad and Tobago, past spontaneous abortions were directly linked to the prevalence of anemia.

The present study shows that antenatal females who had less than three years' birth interval or spacing between past and current pregnancy had more chance of developing anemia (48.6%), although not statistically significant. This is because birth spacing favors replenishing the iron stores among fertile-age women. In studies done by Tiwari *et al.*[9] in Mangalore, Cheema *et al.*[13] in Punjab, and Suryanarayana *et al.*[32] in Karnataka, the prevalence of anemia was inversely related to the spacing between previous and present pregnancy. In another study conducted by Swarnalatha in Andhra Pradesh, a high prevalence of anemia was found among pregnant women whose birth interval was less than three years (85.2%).[34]

Primary care physicians are to effectively consider the relevant factors observed in this study in dealing with cases of anemia in pregnant women to render comprehensive and positive results. The scope of research activities in other aspects relating to different causes of anemia such as malaria and hookworm infestations are still at large and it remains open to research scholars to pursue surveys on this.

Summary and Conclusion

The prevalence of anemia in rural Kozhikode was found to be 40%, which highlights that it is a serious public health problem. Though it is lower compared to the national average, it is a growing concern as Kerala is a state with a high literacy rate. Factors such as excessive menstrual blood loss prior to present pregnancy, early age at first delivery, trimester, and parity were found to be significantly associated with anemia.

Recommendation

There is a need for health awareness among pregnant women encompassing the components of reproductive health such as delay in age of marriage, delay in first childbirth, and spacing between births. It is the right time for the health department to emphasize different factors which contribute toward anemia and the planners to formulate an apt policy and implement necessary changes in existing programs.

Limitations of the study

1. As per WHO, the cut-off of hemoglobin values is 11 g/dL in the first and third trimesters and 10.5 g/dL in the second trimester. In this study, we have taken the cut-off of hemoglobin values in all three trimesters as 11 g/dL.
2. Only registered pregnant women in the Panchayat were included in the study. However, as most of the pregnant women residing in rural areas get registered in our settings, only a few antenatal women are likely to get missed.

Relevance of study

This study would enhance the efficiency of the planners in formulating preventive measures to combat anemia.

Key Messages

The investigative study conducted in different panchayaths in Kozhikode, Kerala evidenced the seriousness of the public health problem relating to anemia. On top of existing national programs, other vital social factors also need to be explored at length.

Conflicts of interest

There are no conflicts of interest.

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