Original Article

Prevalence and risk factors of anemia among pregnant women attending a public-sector hospital in Bangalore, South India

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Abstract

Background: Anemia affects almost two-thirds of pregnant women in developing countries and contributes to maternal mortality and low birthweight. According to the National Family Health Survey-4 reports, maternal anemia continues to be a public health problem. **Objective:** To study the prevalence of anemia and its risk factors among pregnant women attending a public-sector hospital. **Materials and Methods:** This study was nested within an ongoing cohort study "ÇASCADE" which is exploring the effect of prenatal exposure to maternal cortisol and psychological distress on infant development in Bangalore. The respondents were enrolled from the antenatal clinic at Jayanagar General Hospital, which is a sub-district hospital. A total of 280 women who fulfilled the eligibility criteria were enrolled. **Results:** The prevalence of anemia was observed to be 33.9%; proportion of mild and moderate anemia was almost similar (48.4 and 49.5%). The mean hemoglobin level of all the participants was 11.33 ± 1.460 g/dl. The mean hemoglobin level concentration was high during early gestation with a slight decrease by 21–24 weeks. Prenatal depression but not anxiety appeared to be a strong predictor of anemia on bivariate as well as multivariate analysis. No association was observed with socio-demographic and obstetric variables. **Conclusion:** The burden of maternal anemia was considerably high in the study population. Although iron-folic acid supplementation is available under the national health program to address this issue, it is important to consider and address other risk factors when designing and implementing target interventions for anemia control in selected populations.

Keywords: Anemia, maternal, prenatal, prevalence

Introduction

Anemia affects almost two-thirds of pregnant women in developing countries and contributes to maternal mortality and low birthweight.[1,2] The World Health Organization (WHO) defines anemia as a condition in which the hemoglobin concentration of a woman during pregnancy is <11 g/dl.[3] Nutritional anemia as iron deficiency anemia (IDA) is the most common cause of anemia during pregnancy, globally affecting about 32 million women[3,4] and at least half of all the pregnant women in middle and low-income countries.[5] In these countries, the risk of anemia is higher due to a wide range of factors such as inadequate diet, hemoglobinopathies, and infections such as HIV, malaria, and parasitic infestation.[5,6] The prevalence of anemia is estimated to be higher in India when compared to all other developing countries.[7] Also, it is the second leading cause of maternal deaths in the country.[8]

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Numerous national health programs related to the prevention and control of anemia have been in existence. Initially launched as the National Nutritional Anemia Prophylaxis Programme (NNAPP) in the year 1973, iron–folic acid supplementation was later on integrated into the Reproductive and Child Health Programme as a part of which pregnant women are administered 100 mg of elemental iron along with 0.5 mg of folic acid.[9] According to the recent data of National Family Health Survey (NFHS-4), the prevalence of anemia is estimated to be 50.3%, with an overall burden of 45.4% in Karnataka.[10] Although there has been a reduction in the prevalence of anemia from 58.3 (NFHS-3) to 50.3% (NFHS-4), there is not much difference in the prevalence of anemia reported in NFHS-2 (49.7%) and NFHS-4 (50.3%).[10]

The primary care physician who is the backbone of the health care system and also the first contact point for a patient plays a crucial role in the identification and management of anemia. Even in the public sector, majority of the antenatal cases are handled at the level of primary health care. Although biological risk factors such as dietary deficiency, parasitic infestations, and chronic diseases are well-known risk factors, it is important for the physician to understand the ecological or structural risk factors that could be of regional interest. These include socio-demographic characteristics, obstetric variables, mental health, and nutritional status reflected by the body mass index (BMI). These factors are not amenable to clinical management with iron supplementation but can be comprehensively addressed at the level of primary care. Hence, this study was carried out with the objective to measure the prevalence of anemia and its association with the above-mentioned risk factors, among pregnant women attending a public-sector hospital in Bangalore city in Karnataka.

Materials and Methods

Study population

This study was nested within an ongoing cohort study "ÇASCADE" which is exploring the effect of prenatal exposure to maternal cortisol and psychological distress on infant development in Bangalore, the protocol of which has already been published.[11,12] The study was conducted at Jayanagar General Hospital in Bangalore, which is a sub-district hospital. Data were analyzed for a study period of 9 months from August 1, 2017 to April 30, 2018, for those women who had completed their baseline visit; the number of participants amounting to 280.

Inclusion criteria

The study participants included women above the age of 18 years, having a gestational age of <24 weeks and without any major obstetrical complication.

Exclusion criteria

The participants with any major obstetrical complication and women with a history of intake of steroidal medication over the past 1 year were excluded from the study.

Methodology

A detailed data pertaining to socio-demographic factors and obstetric history was obtained. Edinburg Postnatal Depression Scale (EPDS) was used to screen the study participants for the presence of depression.[13] The EPDS scores range from 0 to 30 points. Pregnancy anxiety was measured by means of using the 10-item pregnancy-related anxiety (PRA) scale.[14] Socio-economic status was calculated based on Kuppuswamy scale.[15] Weight and height were recorded using standard calibrated weighing scale and stadiometer, followed by calculation of BMI. Data on hemoglobin level were obtained from hospital laboratory reports. Anemia was classified based on the WHO criteria, according to which a hemoglobin (Hb) concentration of <11 g/dl during pregnancy was considered as anemia. Hb concentration in the range of 10–10.9, 7–9.9, and <7 g/dl is considered as mild, moderate, and severe anemia, respectively.[3]

Statistical tool used

Statistical analysis was done using SPSS version 22. Descriptive statistics in terms of percentage was used to present the prevalence and severity of anemia. Bivariate analysis was used to determine the association between independent variables, which included socio-demographic variables, obstetric factors, EPDS scores, PRAQ scores, and BMI with the outcome variable anemia in terms of crude odds ratio (COR) with 95% confidence interval (CI). Those variables that were found to be associated with a *P* value <0.2 in the bivariate analysis were entered into a multivariate logistic regression model to calculate the adjusted odds ratio (AOR) and to eliminate the effects of confounding factors. The variables with *P* value <0.05 in the multivariate analysis were considered to be significant.

Ethical considerations

The study was approved by the Ethical Committee of Indian Institute of Public Health, Bangalore campus (IIPHHB/TRCIEC/118/2017), Karnataka, India. Written informed consent was obtained from the pregnant mothers and they were assured of confidentiality and privacy of records.

Results

Socio-demographic characteristics of the respondents

Table 1 demonstrates the frequency distribution of socio-demographic characteristics of the study participants. Among the 280 pregnant women, the mean age of the respondents was 23.02 ± 3.40 years and majority (72.9%) of them belonged to age group of more than 20 years. Majority (72.2%) of the study respondents were Muslims, and 40.4% had completed their secondary education. Nearly 91.8% were housewife and 57.5% belonged to upper-lower class. The mean gestational was 18.050 ± 3.541 weeks.

Prevalence of anemia among the pregnant women

Figure 1 shows that the overall prevalence of anemia in pregnancy was 33.9%. 2.1% were severely anemic, whereas the proportion

Table 1: Socio-demographic characteristics of the pregnant women (*n*=280)

Variables	Frequency (*n*)	Percentage (%)
Age groups		
>20 years	204	72.9
≤20 years	76	27.1
Religion		
Hinduism	73	26.1
Christian	5	1.8
Islam	202	72.1
Education		
≥High school	76	27.1
<High school	204	72.9
Occupation		
Housewife	257	91.8
Working	23	8.2
Socio-economic status		
Upper-middle	36	12.9
Lower-middle	83	29.6
Upper-lower	161	57.5

of mild and moderate anemia was almost similar (48.4 and 49.5%), as shown in Figure 2.

Trends in hemoglobin level concentration

The mean hemoglobin level of all the participants was 11.33 ± 1.460 g/dl. The mean hemoglobin level concentration showed a steady increase during 15–20 gestational weeks and slightly decreased during 21–24 weeks. The hemoglobin concentration across three time periods of gestational weeks is shown in Figure 3.

Association of anemia with socio-demographic factors

The association of socio-demographic factors such as age, education, occupation, and socio-economic status with anemia was nonsignificant on bivariate analysis (*P*-value >0.05) [Table 2].

Association of anemia with obstetric history

On bivariate analysis, history of abortion, gravidity, parity, and unplanned pregnancy showed no significant association with anemia [Table 3].

Association of anemia with prenatal depression, anxiety, and BMI

On bivariate and multivariate logistic regression analysis, prenatal depression was found to be significantly associated with anemia (COR = 1.621; 95% CI: 0.973–2.701, *P* value = 0.06; AOR = 1.821; 95% CI 0.993–2.781, *P* value = 0.04). No association was observed for prenatal anxiety and BMI with anemia [Table 4].

Discussion and Conclusion

In this study we estimated the prevalence of anemia among pregnant women and its association with certain risk factors such

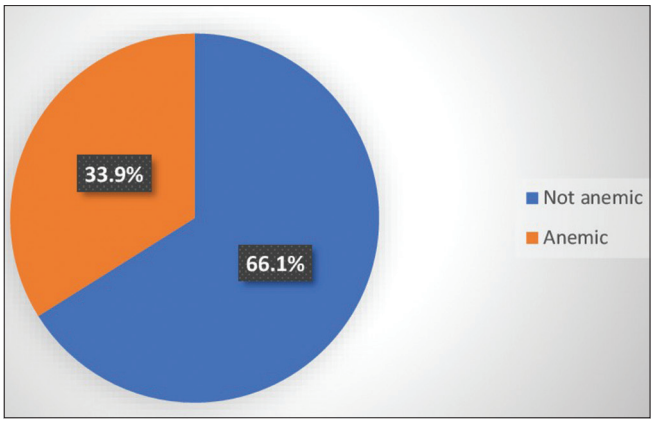

Figure 1: Prevalence of anemia (*n* = 280)

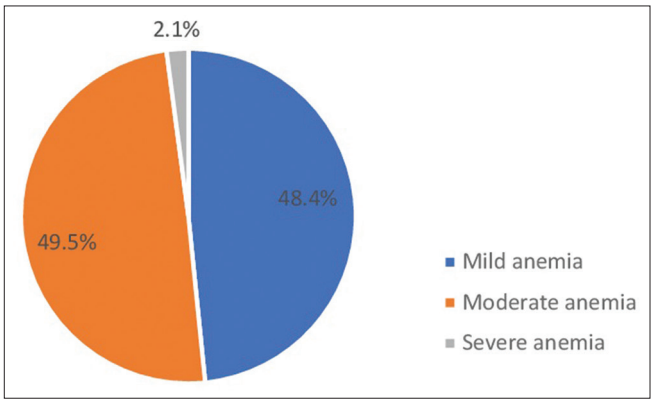

Figure 2: Grades of anemia (*n* = 95)

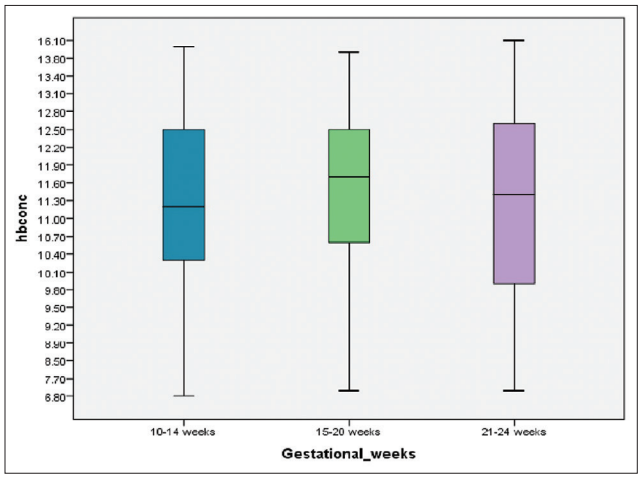

Figure 3: Trends in Hb concentration across the gestational weeks

as socio-demographic factors, obstetrical risk factors, prenatal depression, anxiety, and BMI.

The overall prevalence of anemia was found to be 33.9% in the present study, which reflects upon the burden of anemia in an urban setting among a group of pregnant women availing of antenatal care at a public-sector hospital. Samuel *et al.* in a similar study which was done at an urban public health facility in Bangalore observed an almost similar prevalence rate

Table 2: Bivariate analysis of association of socio-demographic factors with anemia

Variables	Anemic (<10.9 g/dl) (*n*=95)	Not anemic (10.9 g/dl) (*n*=185)	COR	*P*	CI Lower-upper
Age groups					
>20 years	70 (73.7%)	134 (72.4%)	1	-	
≤20 years	25 (26.3%)	41 (27.6%)	0.703	0.279	0.371-1.331
Education status					
≥High school	29 (30.5%)	47 (25.4%)	1	-	
<High school	66 (69.5%)	138 (74.6%)	0.837	0.553	0.464-1.507
Occupation					
Housewife	85 (89.5%)	172 (93.0%)	1	-	
Working	10 (10.5%)	13 (7.0%)	1.29	0.792	0.445-2.893
Socio-economic status					
Upper-middle	11 (11.6%)	25 (13.5%)	1	-	-
Lower-middle	26 (27.4%)	57 (30.8%)	1.012	0.979	0.415-2.467
Upper-lower	58 (61.1%)	103 (55.7%)	1.306	0.527	0.571-2.988

Table 3: Bivariate analysis of association of obstetric variables with anemia

Variables	Anemic (<10.9 g/dl) (*n*=95)	Not anemic (>10.9 g/dl) (*n*=185)	COR	*P*	CI Lower-upper
H/o of abortion					
Zero	73 (76.8%)	145 (78.4%)	1		
>One	22 (23.2%)	40 (21.6%)	1.037	0.927	0.482-2.22
Gravida					
Primipara	44 (46.3%)	74 (40%)	1		
Multipara	51 (53.7%)	111 (60%)	1.010	0.985	0.358-2.84
Parity					
Nulliparous	49 (51.6%)	80 (43.2%)	1		
Parous	46 (48.4%)	105 (56.8%)	0.714	0.474	0.2841.79
Unplanned pregnancy					
No	54 (56.8%)	100 (54.1%)	1		
Yes	41 (43.2%)	85 (45.9%)	0.801	0.422	0.467-1.37

Table 4: Bivariate analysis of association of mental health (depression and anxiety) and BMI with anemia

Variables	Anemic (<10.9 g/dl) (*n*=95)	Not anemic (>10.9 g/dl) (*n*=185)	COR	*P*	CI Lower-upper
Depression*					
Not depressed	54 (56.8%)	126 (68.1%)	1	-	-
Depressed	41 (43.2%)	59 (38.9%)	1.621	0.06	0.973-2.701
Anxiety					
Not anxious	57 (60.0%)	99 (53.5%)			
Anxious	38 (40.0%)	86 (46.5%)	0.767	0.301	0.465–1.268
BMI					
Normal	59 (62.1%)	93 (50.3%)	1	-	-
Underweight	14 (14.7%)	19 (10.3%)	1.278	0.540	0.583-2.80
Obese	22 (23.2%)	73 (39.5%)	0.480	0.480	0.264-0.87

*$P<0.1$: Statistically significant

of 30.3%.[16] As compared with other study findings done in an urban setup in South India, our study findings are higher than the prevalence rate of 23.16% observed in Vellore[17] but lower than the prevalence rate of 50.1% that was found in urban Udupi.[18] Studies done in rural Karnataka show a much higher burden of anemia with a prevalence of 64% in Kolar,[19] 72.5% in Belagavi,[20] and 62.3% in Kolar.[21] This geographical rural–urban disparity could be attributed to a plethora of factors such as variation in the socio-demographic characteristics, pattern of obstetric variables, medical morbidities, access and utilization of health care services, dietary factors, and even the method of estimation of hemoglobin. More than 70% of the women in our study were Muslims. Other studies have found a much higher morbidity because of anemia in this subpopulation owing to various reasons such as poor socio-economic status and overcrowding.[22]

The prevalence of mild and moderate anemia was almost similar (48.4 and 49.5%) with a mean Hb level of 11.33 ± 1.460 g/dl, which reflects upon the severity of this problem. Madhu Priya *et al.*[17] also observed an almost identical pattern of distribution wherein the prevalence of moderate anemia was slightly higher (31.2%) than mild anemia (30%) with a mean hemoglobin

level of 11.7 g/dl. Any significant variation in the hemoglobin concentration could be not be observed over the three time periods of gestational weeks, i.e., from 10 to 24 weeks, although there was a slight drop towards 24 weeks. Usually, hemoglobin level tends to follow a U-shaped curve over the course of pregnancy, with higher mean Hb levels in early (12–16 weeks) and late pregnancy (>37 weeks) and a dip in the level during mid-pregnancy (28–33 weeks), which occurs owing to physiological dilution arising from plasma expansion.[23,24]

In our study, socio-demographic factors did not appear to be significantly associated with anemia although younger age and low socio-economic status are known to be associated with anemia as revealed in other research findings.[25,26] Balarajan *et al.*[27] also in their analysis of epidemiology of anemia in low and middle-income countries noted a skew in the distribution of anemia in lower income groups. There was no statistically significant difference in the prevalence among working women versus housewives in contrast to the result findings from a study which was done by Baig-Ansari *et al.* in urban Pakistan, according to which the hemoglobin concentration of working women was much less than that of their nonworking counterparts.[28] Our study could not confirm the existence of association between obstetric variables such as gravidity, parity, and history of abortion with anemia. However, meta-analysis shows that primigravida women are 61% less likely than multigravida women to develop anemia during pregnancy, which could be a consequence of depletion of iron reserves owing to repeated pregnancies.[29] Nevertheless, similar to our study findings, Singh *et al.*[30] did not find any such association with gravidity, whereas Suryanarayana *et al.*[21] could not establish any linkage with parity.

Prenatal depression but not anxiety appeared to be a strong predictor of anemia on bivariate as well as multivariate analysis. Yılmaz *et al.* and Dama *et al.* in their studies also reported high levels of depression among pregnant women with IDA,[31,32] whereas Kang *et al.* documented a relationship between anxiety and anemia.[33] Prospective studies are, however, needed to analyze the mechanism that underlies this relationship. We could not identify any link between BMI and anemia even though pregnant women with a lower BMI were more likely to be anemic according to other study reports.[28,34] This could be related to factors such as food insecurity and poor dietary intake. which in turn is determined by the socio-economic status and per-capita income.

Study limitations

Anemia is a multifactorial disease condition. Although the present study was nested within an ongoing cohort study as described in the study section, we could collect data pertaining to a few selected risk factors relevant to anemia from the baseline study tool. As a part of the study protocol, women with severe obstetric complications and those with a history of recent intake of steroidal medication were excluded from the study, which could have impacted our study findings and limited the generalizability of the study results. In addition, data on hemoglobin level was obtained from hospital records which could have been subjected to measurement bias. Data on consumption of iron–folic acid supplementation was not recorded as the study participants were recruited at different time periods before 24 weeks of gestation and in most of the public-sector hospitals, supplementation is only initiated after 16 weeks of gestation.

Conclusion

Our study findings suggest that anemia continues to be a public health problem. Although iron–folic acid supplementation is available under the national health program to address this issue, it is important for primary care physicians to consider and address other risk factors when designing and implementing target interventions for anemia control in selected populations.

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Conflicts of interest

There are no conflicts of interest.

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