A study of the prevalence of anemia and associated sociodemographic factors in pregnant women in Port Blair, Andaman and Nicobar Islands

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Abstract

Background: Anemia in pregnant women, a significant cause of maternal and infant mortality and morbidity, has not been adequately studied in the population of Andaman and Nicobar Islands. In this regard, the study was conducted to document the prevalence and severity of anemia and its associated sociodemographic factors in pregnant women in Andaman and Nicobar Islands. **Methods:** The cross-sectional study was carried out at the Department of Obstetrics and Gynecology at G. B. Pant hospital over a period of 6 months. WHO guidelines were used to define and classify anemia as mild, moderate, or severe. A total of 786 pregnant women of age 12–40 years were included in the study. Data were collected by means of interviewer-administered questionnaire and complete blood count of venous blood. IBM SPSS version 21 was used for statistical analysis. Frequency tables and cross-tables were constructed. Corr elations were determined using Kendall's Tau-b, Pearson's r, and Spearman's rho coefficients. **Results:** Hemoglobin levels of the participants ranged from 4.4 to 15.0 g/dl. Anemia was observed in 50.9% of the sample. Prevalence and severity of anemia decreased with increasing educational levels of both husband and wife and increasing gestational age, and increased with increasing gravidity and parity. **Conclusions:** Awareness and education helped reduce the prevalence of anemia. Education of husband was seen to have a greater effect than education of wife. Wide coverage, systematic intervention, and disbursement of folic acid and iron supplements to pregnant women by subcenters and primary health centers prior to their visit to G. B. Pant Hospital were also effective.

Keywords: Andaman and Nicobar Islands, anemia, pregnancy, sociodemographic, women

Introduction

Anemia (from the ancient Greek $\alpha\nu\alpha\mu\iota\alpha$, *anaimia*, meaning "lack of blood") is defined by a decrease in the total amount of hemoglobin or the number of red blood cells[1] leading to an insufficient oxygen supply to meet the body's physiologic needs[2] and may be caused by multiple factors including nutritional deficiencies. Iron deficiency is thought to be the most common cause of anemia globally, although other conditions, such as folate, vitamin B12 and vitamin A deficiencies, chronic inflammation, parasitic infections, and inherited disorders, can all cause anemia.[2] There is an increased demand of dietary nutrients during pregnancy, and in the absence of nutritional supplementation, the severity of anemia increases with increasing gestational age. Iron deficiency anemia (IDA) accounts for about 50% cases of anemia.[3] Other factors responsible for anemia during pregnancy are gestational age, parity, consecutive birth interval, history of excess bleeding during menstruation, intestinal parasitic infection, malaria, chronic illness, and blood loss during pregnancy.[4] Low dietary intake and poor biological availability of iron in phytate and fiber-rich Indian diet are other contributing factors.[5]

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IDA during pregnancy is a known risk factor for preterm birth, low birthweight, and small-for-gestational-age babies[6] and increases the risk of postpartum hemorrhage.[7] It is a direct or indirect cause of about 20% of all maternal deaths. About half of these occur in South Asian countries, out of which India contributes to approximately 80%.[5] Anemia in pregnant women causes impaired physical and cognitive development in children and reduced work capacity in adults.[8] At a national level, it distorts human resource development and economic prosperity of the country.[9,10]

WHO identifies anemia as the most common nutritional deficiency disorder in the world and a serious health concern among pregnant women. The 2011 estimates suggest that anemia affects around 800 million children and women all over the world, including 273 million children, 496 million nonpregnant women, and 32 million pregnant women.[3]

Bhimrao[7] reports that anemia affects approximately 50% of the Indian population. Women are affected the most with it when compared to men. He also estimates that about 20–40% of maternal deaths in India are due to anemia. Several government schemes have been initiated across India to combat IDA. In 1970, India became the first developing country to commence a National Nutritional Anemia Prophylaxis program, a nationwide initiative, to prevent IDA among pregnant women. Other national initiatives include the 2012 Weekly Iron and Folic Acid Supplementation program and the 2013 National Iron+ Initiative.[11]

The National Family Health Survey conducted by International Institute for Population Sciences, Mumbai, in 2015–2016 reported that 50.3% pregnant women in India were anemic (urban: 45.7%, rural: 52.1%).[12] The survey also reported 61.4% pregnant women (age 15–49 years) in Andaman and Nicobar Islands to be anemic.[13] No other data are available for the population of Andaman and Nicobar Islands. In this regard, the present study was conducted at G. B. Pant Hospital in Port Blair to estimate the prevalence of anemia among pregnant women and explore associated sociodemographic factors. Knowledge of these factors can be used to formulate a multidimensional strategy for prevention and management of anemia.

Subjects and Methods

A cross-sectional study was conducted in the Department of Obstetrics and Gynecology with the assistance of the Department of Pathology at G. B. Pant Hospital, Andaman and Nicobar Islands and Institute of Medical Sciences (ANIIMS) at Port Blair (Andaman and Nicobar Islands). The institute is a new and the only Medical Council of India-permitted medical college and the only referral tertiary-care center of the region. The islands lie about 1200 km away from the Indian mainland, between 6–14°N latitudes and 92–94°E longitudes.

The study was carried out over a period of 6 months from February to July 2017. The study population comprised all pregnant women who came to Department of Obstetrics and Gynecology, G. B. Pant Hospital on their first visit for antenatal check-up and consented to be a part of the study. A total of 802 pregnant women participated in the study, of which 16 were ignored due to nonavailability of hemoglobin values. Patients with preexisting diagnoses of medical disorders such as diabetes, hepatobiliary disease, cardiac disease, idiopathic thrombocytopenic purpura, and other autoimmune disorders were excluded from the study.

Data were collected via interviewer-administered questionnaire after obtaining consent from the participants. Questions regarding patients age, physical parameters of height and weight, sociodemographic characteristics like occupation, food habits, etc., and obstetrical and gynecological history were put forth. A volume of 3 ml venous blood from each participant was collected by venous puncture using disposable syringes and aseptic techniques. The blood was added to ethylenediamine tetra-acetic acid vials and mixed gently. Complete blood count was measured on the hematology analyzer. Hemoglobin levels were estimated using the calorimetric method. WHO guidelines were used to define the prevalence and severity of anemia [mild anemia (Hb = 10.0–10.9 g/dl), moderate anemia (Hb = 7.0–9.9 g/dl), and severe anemia (Hb < 7.0 g/dl)]. For anemic blood samples, a peripheral smear was prepared to determine the presence of hemoparasites and assessment of the type of anemia.

Participant responses and medical reports were coded and entered into a database using IBM SPSS version 21 for analysis. Frequency tables and cross-tables were constructed. Kendall's Tau-*b*, Pearson's *r*, and Spearman's rho coefficients were used to determine the association between anemia and sociodemographic factors. Statistical significance was set at a *P* value of less than or equal to 0.05.

The study was approved by the ethical committee of ANIIMS.

Results

Hemoglobin levels of the study population ranged from 4.4 to 15.0 g/dl with a mean of 10.79 g/dl, 95% CI [10.69, 10.89]. A percentage of 50.9 of the sample were diagnosed with anemia [Table 1]. Most anemic participants (*n* = 312, 86.7%) had microcytic hypochromic red cell morphology [Table 1].

Table 1: Prevalence, severity and type of anemia		
Variables	**Values**	**n (%)**
Prevalence of anemia	No anemia	386 (49.1)
	Mild anemia	195 (24.8)
	Moderate anemia	195 (24.8)
	Severe anemia	10 (1.3)
Type of anemia	Dimorphic anemia	3 (0.8)
	Macrocytic anemia	3 (0.8)
	Microcytic hypochromic anemia	312 (86.7)
	Normocytic hypochromic anemia	2 (0.6)
	Normocytic normochromic anemia	40 (11.1)

Sociodemographic factors

The age of the participants ranged from 12 to 40 years with a mean of 25.3 years, 95% CI [24.9, 25.6] [Table 2], and did not have a significant effect on the prevalence or severity of anemia [Figure 1 and Table 4]. Body mass index (BMI) was determined for participants who were in their first 20 weeks of pregnancy (*n* = 222). Values ranged from 14.67 to 39.33 with a mean of 23.12, 95% CI [22.53, 23.70]. BMI of the participants did not have a significant effect on the prevalence or severity of anemia.

Educational status of the respondents and their spouses was categorized as follows:
1. Received no education or attended primary school;
2. Attended middle school or high school;
3. Attended senior secondary school, received technical education or diploma; and
4. Received graduate or postgraduate degree.

Both husband and wife's education had weak and inverse statistically significant effect on the prevalence and severity of anemia (Tau-*b* = −0.107, *P* = 0.001 and Tau-*b* = −0.066, *P* = 0.036, respectively) [Table 4].

Most participants were followers of the Hindu religion (*n* = 644, 81.9%) [Table 2]. The mean hemoglobin level of Muslim participants was 11.34 g/dl while that of Hindu and Christian participants were 10.77 g/dl and 10.38 g/dl, respectively. Prevalence of anemia was observed to be the least in Muslim participants [Figures 2 and 3].

Almost all participants (*n* = 772, 98.2%) consumed omnivorous diets [Table 2]. Mean hemoglobin level of participants consuming omnivorous diets (*n* = 772, 98.2%) was 10.80 g/dl while that of participants consuming vegetarian diets (*n* = 13, 1.7%) was 10.08 g/dl.
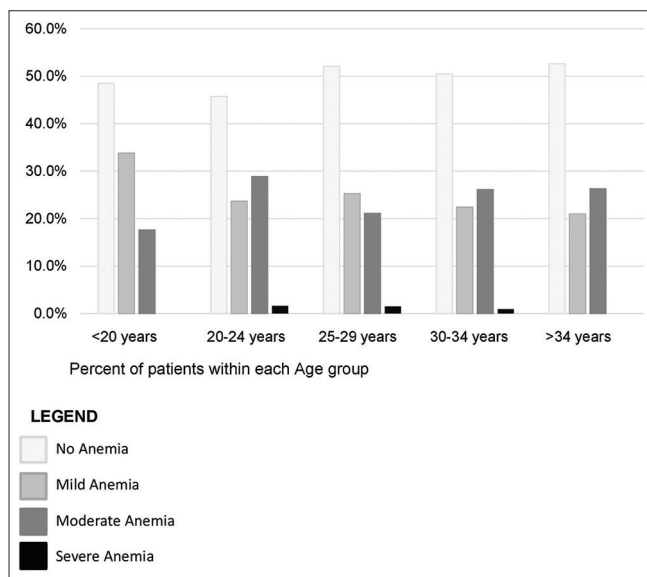
Gynecological factors

Duration of gestation in the study population varied from 6 to 41 weeks, with a mean of 25.61 weeks, 95% CI [25.85, 27.16] [Table 3]. Increase in gestational age was

Table 2: Sociodemographic characteristics of study population

Variables	Values	n (%)
Age group (years)	<20	68 (8.7)
	20-24	308 (39.2)
	25-29	265 (33.7)
	30-34	107 (13.6)
	>34	38 (4.8)
Education - husband	No education or attended primary school	77 (9.8)
	Attended middle school or high school	366 (46.6)
	Attended senior secondary school, or obtained technical education or diploma	218 (27.7)
	Obtained graduate or postgraduate degree	122 (15.5)
Education - wife	No education or attended primary school	65 (8.3)
	Attended middle school or high school	304 (38.7)
	Attended senior secondary school, or obtained technical education or diploma	252 (32.1)
	Obtained graduate or postgraduate degree	161 (20.5)
Religion	Christian	61 (7.8)
	Hindu	644 (81.9)
	Muslim	78 (9.9)
	Other	3 (0.4)
Diet	Vegetarian	13 (1.7)
	Omnivorous/nonvegetarian	772 (98.2)

Table 3: Sociodemographic characteristics of study population - obstetric history

Variables	Values	n (%)
Duration of gestation (weeks)	<13	79 (10.1)
	13-20	143 (18.2)
	21-28	175 (22.3)
	29-36	253 (32.2)
	>36	136 (17.3)
Gravidity	1	371 (47.2)
	2	268 (34.1)
	3	111 (14.1)
	4	27 (3.4)
	5	8 (1.0)
	6	1 (0.1)
Parity	0	420 (53.4)
	1	296 (37.7)
	2	58 (7.4)
	3	10 (1.3)
	4	1 (0.1)
	5	1 (0.1)

Figure 1: Age of the participants (years) versus prevalence and severity of anemia (%)

associated with an increase in hemoglobin levels with a weak and statistically significant correlation (Pearson's $r = 0.086$, $P = 0.016$) [Table 4]. It was observed that the higher the gravidity and parity in participants, the lower their hemoglobin values. Correlations were seen to be weak but statistically significant (gravidity: Pearson's $r = -0.074$, $P = 0.039$; parity: Pearson's $r = -0.101$, $P = 0.005$) [Table 4].

Table 4: Association between sociodemographic factors and anemia in pregnancy

Independent variable	Dependent variable	Correlation type	Correlation value	Significance (P)
Age	Hemoglobin level	Pearson's r	(+) 0.039	0.279
BMI	Hemoglobin level	Pearson's r	(+) 0.114	0.090
Education of husband	Prevalence and severity of anemia	Kendall's Tau-b	(-) 0.107	0.001
Education of wife	Prevalence and severity of anemia	Kendall's Tau-b	(−) 0.066	0.036
Religion	Prevalence and severity of anemia	Spearman's rho	0.108	0.002
Diet	Prevalence and severity of anemia	Spearman's rho	0.077	0.027
Duration of gestation	Hemoglobin level	Pearson's r	(+) 0.086	0.016
Gravidity	Hemoglobin level	Pearson's r	(−) 0.074	0.039
Parity	Hemoglobin level	Pearson's r	(−) 0.101	0.005

BMI: Body mass index

Discussion

The study attempted to assess the prevalence and severity of anemia, and associated sociodemographic factors, among pregnant women in Andaman and Nicobar Islands. The overall prevalence of anemia in the studied population was observed to be 50.9%, very close to the Indian average of 50.3%[12] and significantly lower than the average of 61.4% reported in the region.[13] Microcytic hypochromic anemia was seen to be the most common red blood cell morphology. During their study, Babu *et al.*[14] observed microcytic hypochromic anemia to be commonest pattern of anemia in their study population, followed by dimorphic and macrocytic anemia, respectively. In a study conducted in a different part of India, Hunshikatti and Viveki[15] had documented normocytic normochromic anemia as the most common type of anemia in pregnant women, followed by macrocytic hypochromic anemia.

As in other studies carried out across the world, the age or BMI of the participants did not have a significant bearing on the prevalence or severity of anemia. Bisoi *et al.*[8] had observed that age was independent of the prevalence of anemia in pregnant women. Gebre and Mulugeta[16] reported no significant correlation of BMI with anemia in pregnant women.

As the education levels of the husband and the wife improved, the prevalence and severity of anemia in the studied population of pregnant women decreased. Of the two factors, husband's education had a greater bearing. Correlations were best seen in the overall incidence of anemia and that of moderate anemia [Figure 2]. Similar findings were also observed by Morsy and Alhady[17] where they found that women with a higher education were less frequently anemic than illiterate women or women with a primary or secondary education. Husband's
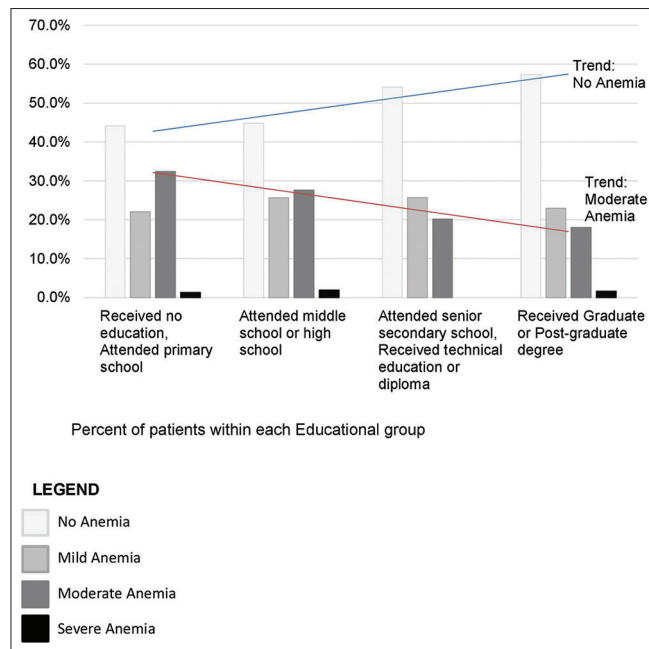

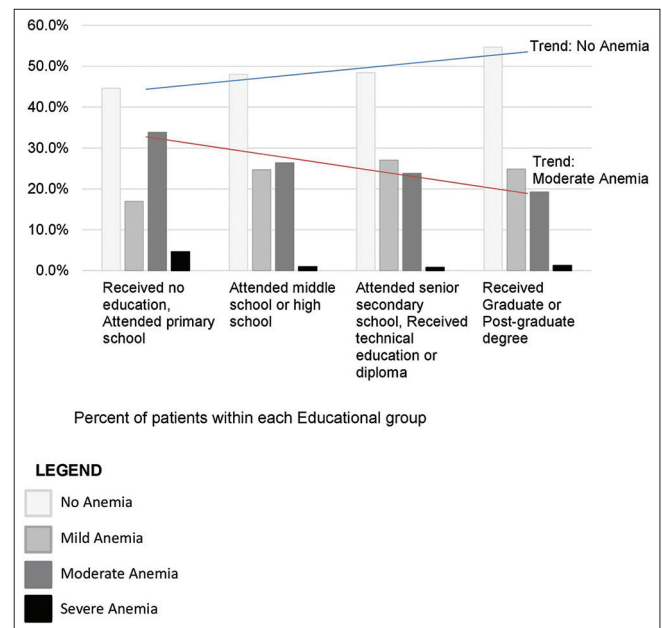**Figure 2:** Education of husband (%) versus prevalence and severity of anemia

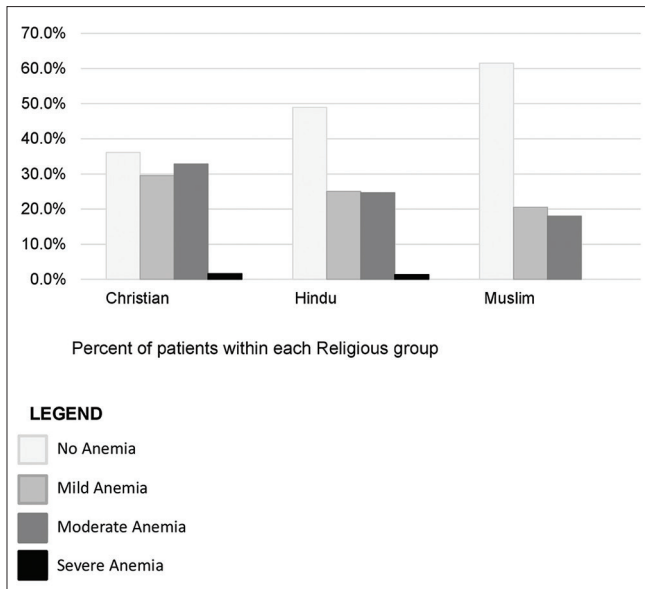**Figure 3:** Education of wife (%) versus prevalence and severity of anemia

Figure 4: Religion of the participants (%) versus prevalence and severity of anemia

Figure 5: Gestational age (*n*%) versus prevalence and severity of anemia

education was found to have a significant effect on anemia in women, greater than that of wife's education. They also reported mild-to-severe anemia in the wives of about 91% of husbands who had not received any education.

Though the number of vegetarians was too small to draw reliable conclusions, it was observed that the prevalence and severity of anemia in patients consuming omnivorous/nonvegetarian diets was less than those consuming only vegetarian diets. A weak but significant correlation was observed between participant's diet and the prevalence and severity of anemia (Spearman's $\rho = 0.077$, $P = 0.027$) [Table 4]. Similar findings were observed by Rammohan *et al.*[18] where they concluded that vegetarian women in India were significantly more likely to be iron deficient compared to their omnivorous counterparts.

Incidence of anemia was observed to be the highest in Christians (63.9%), followed by Hindus (51.1%). Anemia was least prevalent in Muslims (38.5%) [Figure 4]. A low prevalence of anemia in Muslims when compared to Hindus was also observed by Lokare *et al.*[19] in a study based in Karnataka. They attributed this phenomenon to a probable difference in the dietary patterns of the two religious populations.

Many studies, including that by Suryanarayana *et al.*,[20] document an increase in anemia in pregnant women with increasing gestational age. However, contrary to the above, the prevalence of anemia in the studied population was seen to decrease with an increase in the duration of gestation [Figure 5]. A similar observation was also made by Vemulapalli and Rao[21] in a study based in Andhra Pradesh where they documented the least incidence of anemia in the third trimester. The rising trend in hemoglobin levels with increasing gestational age was analyzed in conjunction with the registration of all participants at their respective subcenters and
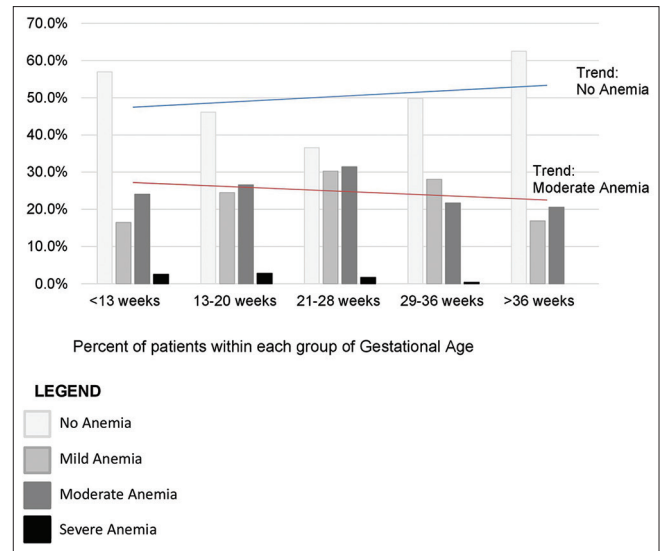
primary health centers prior to their visit to G. B. Pant Hospital. This suggested that the intervention of local-area health facilities and disbursement of folic acid and iron supplements therein were effective in reducing the prevalence and severity of anemia even before these participants visited G. B. Pant Hospital.

Increasing gravidity and parity in pregnant women was seen to be associated with an increase in the prevalence and severity of anemia in the studied population. A similar observation was made by Hunshikatti and Viveki[15] in a study where they noted that the prevalence of anemia in pregnant women increased with increasing parity.

Limitations of the study

The samples were collected at the first visit to the facility, and hence, there was no way to know the hemoglobin levels at the start of the pregnancy. Facility for spectrophotometric analysis of hemoglobin and serum iron studies was not available; so, hemoglobinopathies could not be ruled out, and the confirmation of iron deficiency was not done.

Conclusion

Anemia in pregnancy is a major public health concern in India and worldwide and takes a heavy toll on the well-being of the mother and child. Even after decades of implementing anemia control programs, there is limited improvement in prevalence and severity of anemia in pregnant women. The study highlights the importance of education of both the husband and wife in reducing the prevalence of anemia. It is evident that pregnant women who are well educated or whose spouses are well educated are at lesser risk of anemia as compared to those who are not.

Primary-care physicians and family-medicine practitioners providing medical services in the region may refer to the findings

of this study to estimate the incidence of anemia and to plan efficient diagnostic schema. Results of the study may also assist medical practitioners to provide proper counseling and treatment to patients and their families.

Local health centers must provide preconception counseling to women and help to increase the awareness of maternal and child-care practices in the population. All pregnant women must be fully assessed at the beginning of their pregnancy. Early registration of pregnant women at local health centers and disbursement of folic acid in the first trimester and iron supplementation in the second trimester of pregnancy are helpful. Subcenters and primary health centers must, thus, make efforts toward universal antenatal registration of pregnant women and timely referral to higher center if required.[22]

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Conflicts of interest

There are no conflicts of interest.

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