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Incidence of Anemia and its Socio-demographic determinants among pregnant women attending for antenatal care: A cross sectional study

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Abstract
Introduction: Anemia in pregnancy is a global public health problem affecting both developed and developing countries with major consequences for women. It is associated with adverse result for both the mother and the fetus. This is a concerned health issue that requires urgent attention in Nepal as the prevalence of low hemoglobin level is alarming among certain pregnant women having low socio-economic condition. Therefore, the present study was designed to find out the incidence of anemia and its associated socio-demographic profile among pregnant women attending for antenatal care which has a great implication in pregnancy outcome.
Methods: A cross-sectional study was conducted on 200 pregnant women, data was collected using an interview questionnaire to collect data about socio-demographic, medical and obstetric characteristics. Aseptically, venous blood sample was collected in EDTA anticoagulation tubes for determination of anemia by Sahli's method which was compared with Beckman coulter A^C.T differential method.
Results: The incidence of anemia in pregnant women was 16.5%, of which moderate anemia was followed by mild anemia. There was no significant relationship between the incidence of anemia and the women's age, educational level of the women and smoking status of husband followed by others.
Conclusion: The present study concluded that anemia in pregnancy is still prevalent even in selected population of pregnant women identifying low socio-economic, low educational status and lack of employments as risk factors. Health professionals must pay more attention to teach pregnant women good long-term dietary habits as a part of an overall approach to health promotion.

Keywords: Anemia, Hemoglobin, Socio-demographic, Pregnancy, Antenatal care (ANC).

1. Introduction

Anemia is a global public health problem affecting both developed and developing countries with major consequences for human health as well as social and economic development which occurs at all stages of the life cycle [1]. Maternal anemia is a burning municipal health crisis and most commonly encountered medical disorder in pregnancy [2, 3]. Pregnancy in women is a dynamic state consequent of the fact that normal fetal development needs the availability of essential nutrients such as glucose, free fatty acids, long-chain polyunsaturated fatty acids, amino acids, minerals, vitamins, to be continuously supplied to the growing fetus despite intermittent maternal food intake [4, 5]. Advancement of pregnancy is accompanied by the extra demand of energy and biochemical parameters reflect well integrated metabolic adaptive changes in most organ system and are clearly distinct from the non-pregnant state [6]. Antenatal care, which is given to pregnant women, is widely used for prevention, early diagnosis and treatment of general medical and pregnancy related complications. Early ANC and regular follow up during pregnancy usually provide a range of opportunities for delivering health information and interventions that can significantly enhance the health of the mother and the fetus [7, 8].

During pregnancy, there is an increase in both red cell mass and plasma volume to accommodate the needs of the growing uterus and fetus. The circulating plasma volume increases linearly to reach a plateau in the 8th or 9th month of pregnancy. The increment is about 1000 ml, which corresponds to 45% of the circulating plasma volume in non-pregnancy. The plasma volume decreases rapidly after delivery and is then restored to the non-pregnancy level at about 3 puerperal weeks. However, plasma volume increases more than the red cell mass leading to a fall in the concentration of hemoglobin in the blood, despite the increase in the total number of red cells. This drop in hemoglobin concentration decreases the blood viscosity and this enhances the placental perfusion providing a better maternal-fetal gas and nutrient exchange [9]. An adult woman has about 2,000 mg iron in the body, 60–70% of which is present in erythrocytes, with the rest stored in the liver, spleen, and bone marrow. When a woman becomes pregnant, the demand for iron increases. Specifically, about 1,000 mg more is required, comprising 300 mg for the fetus and placenta, 500 mg for increased maternal hemoglobin, and 200 mg that compensates for excretion [10].

Iron deficiency is the most prevalent cause of anemia which is usually due to chronic blood loss caused by excessive menstruation increased demand for iron, such as fetal growth in

pregnancy [11]. The predisposing factors include grand multiparity, low socioeconomic status, maternal infection, late prenatal care, HIV infection and inadequate spacing of children [12]. Medical problems during pregnancy such as anemia, gestational diabetes mellitus, hypertension, heart problems and other illnesses, are widely recognized to cause many complications to maternal and fetal well-being. Pregnancy induced hypertension is five times more common in severe anemia and significant proportion of patients had postpartum haemorrhage with severe maternal anemia [13]. Severe maternal anemia has poor outcome of neonates in the form of low birth weight, prematurity, intrauterine growth retardation, intrauterine death and birth asphyxia [14, 15].

Anemia is the commonest medical disorder in pregnancy and has a varied prevalence, etiology and degree of severity in different populations being more common in non-industrial countries [15]. The World Health Organization (WHO) estimates that two billion people over 30% of the World's populations are anemic, although prevalence rates are variable because of differences in Socio-economic conditions, lifestyles, food habits, and rates of communicable and non-communicable diseases [16]. Globally, anemia contributes to more than 1, 15, 000 maternal deaths and 5, 91,000 perinatal deaths every year [17]. Prevalence of anemia during pregnancy in developing countries is relatively high (33%-75%) [18], while 15% of pregnant women are anemic in developed countries [19, 20]. Women in developing countries are always in a state of precarious iron balance during their reproductive years. Anemia is regarded as a major risk factor for unfavorable outcomes of pregnancy [21] both for the mother and the fetus.

Data analysis on global prevalence shows that anemia in pregnancy is disproportionately rigorous in low socio economic groups [22]. Until recently, they were beyond the light of modern education and culture trends. Socio-demographic factors like literacy, religion, caste, type of family, occupation are the major obstacles for the prevention of anemia during pregnancy [23]. Hemorrhage, eclampsia and infections are the three major causes of maternal deaths in Nepal [24]. There is the crucial need to control iron deficiency and to have a sound knowledge regarding the antenatal care, and socio demographic factors for safe motherhood. Therefore, the aim of the present study was to find the prevalence of anemia among pregnant women and associated socio-demographic factor with anemia attending for antenatal care at Janaki Medical College Teaching Hospital which is located in rural region of Terai of Nepal. The present study is intended to ascertain the various factors associated with anemia among pregnant women during pregancy which has a great implication in pregnancy outcome and safe motherhood.

2. Materials and Methods

2.1 Study design

A cross-sectional study was carried out on pregnant women attending antenatal care in Obstetrics and gynecology department at Janaki Medical College Teaching Hospital (JMCTH), Janakpur which is located in Dhanusha district of Nepal. The study was conducted from Jan 2013 to March 2014.

2.2 Study population

This study comprises 200 eligible pregnant women who attended the antenatal checkup at OPDs and IPDs of hospital were approached at the waiting area by the nurse in-charge and they were requested for their voluntarily participation for the study. Informed consent was obtained from them after explaining the purpose of the study. After giving voluntary and informed consent, women were administered a face to face structured questionnaire that were returned the same day after completion.

2.3 Inclusion and exclusion criteria

Selection criteria for this study were pregnant women who attended for ANC check-up and who filled three parameters related socio-demographic, obstetrical and medical characteristics during study period were included. Any participant who didn't fill one of these three parameters was excluded from the study.

2.4 Data and Sample Collection

The data and sample collection was conducted in three phases; 1st phase -participants gave a written consent to be a part of the study; 2nd phase- participants filled questionnaires designed particularly to answer socio-demographic, obstetrical and medical characteristics and 3rd phase -venous blood sample collection using EDTA anticoagulation tubes for determination of anemia.

A detailed demographic profile of the women like age, education level of women & her husband, and socioeconomic status was collected. To assure the quality of the data, training was given to the data collectors to minimize technical and observer bias. Weight and height of the pregnant women were also measured for computing Body Mass Index (BMI). A pre-test questionnaire was conducted to check for clarity prior to the main data collection period.

2.4.1 Blood collection

Aseptically, about 1-2 ml of blood was withdrawn from patients. The blood was kept in test tube labeled with the name and number of the patient and the date and time of collection. The tube was allowed to stand. Precautionary measures were taken to see hemolysis and if occurs, hemolysed samples were discarded.

2.4.2 Sample processing

Anemia in pregnancy was determined by Sahli's method and was compared with Beckman coulter A^C T diffential method.

2.5 BMI calculation

Obesity and BMI overweight was measured by calculating BMI as:

$$\frac{\text{BMI} = \text{Weight (Kg)}}{(\text{Height})^2 \text{ cm}}$$

2.6 Quality Control

Reagents were regularly monitored for their manufacture, expiry date and proper storage. Reagents were run to check the accuracy and precision of the data generated by the hematology analyzer. Fresh blood was collected in EDTA vial daily. Blood sample was immediately processed or stored in a fridge at 2-8 °C.

2.7 Ethical Considerations

The study was approved by the Institutional Ethics Committee. Participation in this study was on voluntary basis; every respondent was given a copy of the consent form. An assurance

of privacy and confidentiality of the information was also given to the participants.

2.8 Data Analysis

Data from completed survey questionnaires were entered into the Statistical Package for Social Sciences (SPSS) version 18 for descriptive and statistical analysis. Chi-square tests were used to determine the association between Hb level and participant's socio-economic characteristics. A significance level for the study was set at 0.05.

3. Results and Discussion

3.1 Incidence of anemia among study population

In the present study, 200 pregnant women of age between 16 to 42 years old attending OPDs and IPDs of JMCTH visited for antenatal checkup. Among them, only 33 (16.5%) pregnant women were found to be anemic. Incidence of anemia in pregnancy varies from one country to another and from one region to another. In the study conducted by Kefiyalew F *et al* (2014), prevalence of anemia in pregnant women was found to be 27.9% [25]. Similarly, Abdelhafez AM and El-Soadaa SS (2012) also reported prevalence of anemia in pregnant women was 39% which is almost similar to the present study [26]. This may be due to the physiological anemia that occurs in pregnant women.

The present study showed the highest numbers of anemic pregnant women were found in between 25-30 years age group followed by greater than 30. The results are shown in table 1. Similar findings were also obtained in the study done by Lelissa D *et al* (2012) [27]. This may be due to pregnant women residing in rural areas, having Inter-pregnancy intervals (IPIs) and history of heavy cycle.

Table 1: Incidence of anemia among study population

Age group (yrs)	Anemia		Total pregnant women
	Positive	Negative	
	No. (%)	No. (%)	
Smaller than25	7 (10)	63 (90)	70
25-30	14 (18.91)	60 (81.08)	74
Greater than 30	12(21.42)	44 (78.57)	56
Total	33 (16.5)	167 (83.5)	200

3.2 Hemoglobin estimation

There were two methods applied for hemoglobin estimation among study population i.e. Sahli's method and Beckman coulter A^C.T differential method. In Sahli's method, 138 (69%) pregnant women were found to be anemic, of this 1%, 12% and 56% were severe, mild and moderate anemia respectively. When this result was compared with the more precise and accurate instrument Beckman coulter A^C.T diff. method, anemia was found to be 33 (16.5%). Of them, 1.5%, 3.5% and 11.5% were severe, mild and moderate anemia as shown in table 2. Similar study conducted by Jufar AH and Zewde T (2014), out of 84 anemic pregnant mothers, 80.95% was mildly anemic, 17.86% were moderately anemic and 1.19% were severely anemic [28]. More, type of study conducted in Cape Verde where 38.8% pregnant women were anemic and the majority 71% constituted mild anemic cases whereas 29% were moderate anemic and no severe anemic cases recorded. The above all studies reveal the incidence of mild and moderate anemia in pregnant women was found to be more or less high which is in accordance with this study.

Table 2: Percentage distribution of anemic pregnant women by Beckman coulter A^C.T diff versus Sahli's method

	Methods	Anemia			Total
		Severe	Mild	Moderate	
		%	%	%	
Hemoglobin estimation	Sahli's method	1	12	56	69
	Beckman coulter A^C.T diff	1.5	3.5	11.5	16.5

3.3 Socio-demographic characteristics of the pregnant women

The age distribution of the pregnant women was found to be highest among the age between 25-30 years of age 74 (37%), followed by pregnant women with the age less than 25 years of age 70 (35%). Most of the respondent had high school level education and 165 (82.5%) of our study population were unemployed. None of the present study population had the habit of smoking. The results are shown in table 3. A similar finding was also obtained in the study conducted by Jufar AH and Zewde T (2014) [28].

Table 3: Frequency distribution of the pregnant women on socio-demographic characteristics

Socio-demographic characteristics	Percentage (%)
Age (year)	
<25	70 (35)
25-30	74 (37)
>30	56 (28)
Educational level	
≤ High school	170 (85)
> High school	30 (15)
Employment	
Yes	35 (17.5)
No	165 (82.5)
Smoking	0 (0)

3.4 Obstetrical characteristics of pregnant women

Among all respondents, majority of the pregnant women were having normal BMI with 66% followed by underweight (23%), overweight (5%) and obese (6%). Out of the total study population, 16.5% had taken iron tablet. Only 1% pregnant women had taken multivitamin and folic acid during pregnancy. The results are shown in table 4. A similar finding was also obtained in study conducted by Sharma *et al* (2015) [29].

Table 4: Frequency distribution of the pregnant women by obstetrical characteristics

Obstetrical characteristics	No. (%)
Body mass index	
Underweight (<19.8)	46 (23)
Normal (19.8–26)	132 (66)
Overweight (26.1–29)	10 (5)
Obese (>29)	12 (6)
Iron intake	33 (16.5)
Multivitamins intake	2 (1)
Folic acid intake	2 (1)

3.5 Medical characteristics of the pregnant women

About 6% pregnant women had chronic diseases. Pregnant women who had undergone previous surgery were 1.5%, 9.5% pregnant women had hemorrhoids and 35% women had peptic ulcer as shown in table 5. A similar finding was also obtained in study conducted by Sharma *et al* (2014) [29]. Chronic illness such as liver diseases, malaria and HIV which may be shown in pregnancy. A study conducted in Kisumu, Kenya by Timothy Thomas *et al* showed antiretroviral drug, Zidovudine (ZDV), is known to cause anemia [30]. Plasmodium species dwelling in host red blood cells are known to cause anemia followed by hepatomegalic complications. The history of previous surgeries and hemorrhoids in pregnant women might be due to recurrent bleeding. The incidence of peptic ulcer during pregnancy may be due to gastritics which is caused by Helicobacter pylori.

Table 5: Frequency distribution of the pregnant women by medical characteristics

Medical characteristics	No. (%)
Presence of chronic diseases	12 (6)
History of previous surgeries	3 (1.5)
Hemorrhoids	19 (9.5)
Peptic ulcer	70 (35)

3.6 Socio-demographic characteristics on anemia

There was no significant relationship between the incidence of anemia and the women's age, educational level of the women and smoking status of husband followed by others. There was no statistically significant difference between pregnant women's employment and anemia incidence (p>0.05). The incidence of anemia was found to be highest among those who were unemployed with 82.5%. The results are shown in table 6. There was no statistical significance between numbers of family members with anemia, but there was high incidence of anemia in pregnant women with more than two family members. In this study, the incidences of anemia were not affected by age. This is contrary to the findings of Koblinsky MA (1995) who found that the prevalence of anemia in Saudi women was highest among those who were less than 20 years old [31]. In addition, no significant association was found between anemia and employment. Although it was not statistical significant, this study found out that there was high incidence of anemia among women with low educational level. This is may be due to less knowledge of the study subject towards nutrition.

Table 6: Relationship between anemia and socio-demographic characteristics

Variables	Anemia		Total	p-value
	Yes	No		
Age group (year)				
<25	7	63	70	0.178
25-30	14	60	74	
>30	12	44	56	
Number of family members				
2	9	52	61	0.989
3	9	48	57	
4	6	32	38	
>4	9	35	44	
Education level				
≤ High school	26	144	170	0.274
> High school	7	23	30	
Husband education level				
≤ High school	12	92	104	0.113
> High school	21	75	96	
Employment				
Yes	8	27	35	0.265
No	25	140	165	
Smoking status of women				
Yes	0	0	0	-
No	33	167	200	
Smoking status of husband				
Yes	7	30	37	0.959
No	26	137	163	
Site of husband's smoking				
Inside the house	4	10	14	0.329
Outside the house	3	20	23	

3.7 Relationship between anemia and body mass index

The highest number of pregnant women had normal Body Mass Index which was found to be statistically significant with anemia (p=0.01). The results are shown in table 7. The study conducted by Abdelhafez AM and El-Soadaa SS (2012) also showed anemic pregnant women with normal BMI which was found to be statistically insignificant (p=0.18) [26]. Overweight and obese women had higher odds of anemia compared to women with normal BMI. This finding was inconsistent with the finding of Al-Mehaisen L *et al* (2011) and Mardones F *et al* (2003) where the incidences of anemia are strongly associated with low BMI [32, 33]. This indicates that pregnant women regardless of their BMI need a special attention for prevention and treatment of anemia.

Table 7: Relationship between anemia and body mass index

Body mass index (BMI)	Anemia		Total	p-value
	Yes	No		
Underweight (<19.8)	5	41	46	0.01
Normal (19.8–26)	18	114	132	
Overweight (26.1–29)	5	5	10	
Obese (>29)	5	7	12	

4. Conclusion

The prevalence of anemia among pregnant women was fair, however, sizable proportion of the pregnant women had severe anemia. Anemia in pregnancy is associated with adverse consequences both for the mother and the fetus. This is a health issue that requires urgent attention in Nepal as the prevalence of low Hb level is alarming among certain pregnant women. Studies have shown that the adverse consequences of maternal

anemia may affect not only the neonate and infant but also increase the risk of non-communicable diseases, when the child grows into an adult and the risk of low birth weight in the next generation [34]. Anemia has been associated with premature labour and low birth weight [35] and maternal and prenatal mortality [36]. Fetal mortality has consistently been associated with maternal mortality [37]. Various socio-economical characteristics of pregnant women such as age, education level, occupation, family income etc are associated with low Hb levels which are the major determinants that contribute to the problem of anemia. Educating the women only will not produce any desirable change but increasing the degree of literacy of family will definitely help to solve this problem.

This study has shown that anemia in pregnancy is still prevalent even in selected population of pregnant women identifying low socio-economic, low educational status and lack of employments as risk factors. The findings of this study could provide insights for health care providers to take into account these variables in maintaining Hb at safe levels during pregnancy. Future study is recommended to address the issue of anemia among pregnant mothers in rural and urban areas so as to have a more comprehensive view of the problem. Therefore, health information on public health, monitoring the compliance of women with ante-natal care services, advice on dietary supplementation and consumption of iron and folic acid tablets, are measures to be undertaken to prevent and treat anemia.

5. Recommendation

In the light of this serious problem, it is strongly recommended that:

- Government should design strategies and polices to enhance women education to make them independent in socioeconomic and cultural decision, which directly and indirectly affects women health status.
- Health education should be provided both to pregnant women as well as adolescent girls about proper nutrition and importance of anemia free pregnancy.
- Health care workers should also be motivated for effective distribution of IFA Supplements and to ensure proper compliance by the beneficiaries so as to reduce anaemia in reproductive age in the long term.
- Awareness creation on the consequences of anemia during pregnancy should be given to women in child bearing age in general and pregnant women in particular.

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