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Effect of Socio-Demographic and Gestational Status on the Development of Iron Deficiency Anemia in Pregnant Women

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Abstract: To study the effect of age, gravidity, interval since last pregnancy and socioeconomic status (education and per capita income) on the development of iron deficiency anaemia in pregnant women. This descriptive study was conducted at the antenatal clinic of tertiary care hospital in Lahore. 150 pregnant women (50 in each trimester), attending antenatal clinic of tertiary care hospital was selected randomly. Information about socioeconomic and gestational status was collected with the help of semi structured questionnaire while 5cc venous blood was also collected for the estimation of Hemoglobin (Hb), Packed Cell Volume (PCV) and Mean Corpuscular Hemoglobin Concentration (MCHC). Diagnosis of iron deficiency anemia was based on history, percent hemoglobin and packed cell volume. In 150 selected patients, 80% had Hb within the range of 9-12 g/dl. Occurrence of anemia was most common in the age group of 20-30 years and it has statistically significant adverse effects on Hb level. It was also found that the Hb concentration was related to educational status of the pregnant women and Hb level improved significantly ($p<0.05$) with the increase in per capita family income. A directly proportional relationship of PCV and MCHC was found with Hb concentration. Fewer children, greater intervals between pregnancies and better socioeconomic status lead to lower probability of iron deficiency anemia during pregnancy.

Key words: Iron deficiency anemia, pregnant women, age, gravidity, socioeconomic status, hemoglobin

INTRODUCTION

Anemia associated with pregnancy is a public health problem all over the world. Iron deficiency is the most common form of nutritional deficiency worldwide (Abalkhail and Shawky, 2002; Sabah *et al*., 2010) The WHO report (WHO, 1992) gives the anemic prevalence picture at global level particularly in expectant mothers. Prevalence of anemia in Pakistani expectant mothers was estimated to be 43-47% and no improvement has been noted since the last two decades (WHO, 1994). Anemia during pregnancy increases the risk of maternal mortality, fatality, short gestational length, low birth weight and pre mature labor (Rasmussen, 2001). Anaemia can also reduce physical activity (reducing work productivity) and circulation of blood throughout the body to meet tissue oxygen requirement (Neumann, 1985). Anaemia may occur as a result of either low production or higher rate of destruction of red blood cells or a combination of both (Nathan, 1996).

According to WHO, 1994 anaemia is a condition in which the concentration of hemoglobin in the blood falls below the normal level for particular age and sex of the individual. The normal values of hemoglobin concentration in adult female (non pregnant) is 12 g/dl and adult female (pregnant) is 11 g/dl. In addition to this, the three arbitrary degrees of anemia on the basis of the level of Hb concentration may be recognized as mild (10-11 g/dl), moderate (7-10 g/dl) and severe (below 7 g/dl). Establishment of a relationship between age, gravidity, interval since last pregnancy and socioeconomic status with iron deficiency anemia indicates possible causes, which may be reduced by increased awareness by diagnosing and treating anemia to ensure optimal health of the expectant mothers. The current study was under taken to see how socio demographic and gestational status affects the occurrence of iron deficiency anemia during pregnancy.

MATERIALS AND METHODS

Study design: This was descriptive cross-sectional hospital based study.

Place of study: Study was conducted in antenatal clinic of Jinnah Hospital (tertiary care hospital of city Lahore, Pakistan with bed strength of 1500).

Study population: Study population comprised all pregnant women who attended antenatal clinic in three months time. Approximately 20 pregnant women attended the antenatal clinic daily, which worked thrice a week. Every 5th women was selected for detailed interview and for collection of blood sample. In order to interview 150 women, twelve women were interviewed in a week.

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Sample size: Sampling size was calculated by the formula:

$$(n) = Z^2 \times p\ q/d^2$$

Where value of Z at 95% level of confidence i.e 1.96 x 1.96 = 3.84 and P (prevalence of iron deficiency anaemia in Pakistan) was 25% (Umeta *et al*., 2008), q = 1-p = 75% and d, the margin of error was 7.5%.
Sample size was calculated to be 128 but for convenience 150 pregnant women were enrolled for the study. In order to get complete picture of iron deficiency anaemia, this figure of 150 pregnant women were divided into three categories, i.e first, second and third trimester with equal number of pregnant females (50) in each trimester.

Sampling technique: Convenient simple random technique was used to collect data from 50 pregnant women in each trimester of pregnancy.

Sampling unit: Pregnant women, who can understand the questions and ready to respond were included.

Exclusion criteria: Cases where abnormalities (such as abnormal antenatal, intra-natal and post natal bleeding, history of piles, worms and other problems which could result in or aggravate expectant mothers iron depletion) were not included in the study. This was done to avoid any discrepancy in the results, which could lead to different Hb concentration due to anemia resulting from reason other than pregnancy.

Data collection: Data about socioeconomic status (education and per capita of family income), age, gravidity and interval since last pregnancy was recorded with the help of open and close ended questionnaire. The questionnaire used was pre tested on non-study population and necessary changes were made. Blood samples of the pregnant women were drawn for conducting the laboratory investigations of Hb, PCV and MCHC. Hemoglobin (Hb) level estimation was conducted by Cynomethaemoglobin method, PCV which is also called Haematocrit value was estimated by Microhaematrocrit while MCHC was estimated from the values of Hb (g/dl) and PCV (%) by the following formula:

$$MCHC = \frac{\text{Hb in g/dl of blood}}{PCV} \times 100$$

Data analysis: Data was described in terms of frequencies and percentages. A confidential level of 95% was used in estimating the outcome variables. ANOVA and Duncan multiple range tests were used to find the association between independent and dependent variables and significant testing $p \leq 0.05$.

Ethical consideration: The study was approved by the Research and Ethical Clearance Committee of Allama Iqbal Open University, Islamabad. Written informed consent was obtained from each subject for their participation after the nature of the study was fully explained to them in their local languages. They were ensured that information collected will not be shared for any other purpose except academics.

RESULTS

Frequency distribution of women according to Hb levels was shown in Table 1. The results revealed that statistically significant p = 0.05 percentage of pregnant women in all the three trimesters fell in the range of 9-12 g/dl of Hb.

Table 1: Frequency distribution of pregnant women according to Hb level

Hb Conc. (g/dl)	Frequency	Mean Hb % g/dl	Standard error
1st Trimester			
8.1-9.0	4d	8.90c	±0.67
9.1-10.0	9b	9.60c	±0.58
10.1-11.0	11b	10.90b	±0.58
11.1-12.0	20a	11.80a	±0.67
12.1-13.0	6c	12.40a	±0.58
2nd Trimester			
8.1-9.0	5c	8.40%c	±0.33
9.1-10.0	13b	9.70%d	±0.33
10.1-11.0	8c	10.90%c	±0.67
11.1-12.0	18a	11.66%b	±0.58
12.1-13.0	6c	12.50%a	±1.01
3rd Trimester			
8.1-9.0	6c	8.60%c	±0.58
9.1-10.0	16a	9.50%d	±0.33
10.1-11.0	10b	10.80%c	±0.33
11.1-12.0	15a	11.80%b	±0.00
12.1-13.0	3d	12.33%a	±0.58

Treatment means with different letter in the same column are significantly different at p = 0.05 according to Duncan's Multiple Range Test as given in Costat ver. 3.03. Conc. = Concentration

Interval between pregnancies and iron deficiency anemia: The result of this research clearly showed that decreased interval between pregnancies led to statistically significant (p = 0.05) incidence of anemia and vice versa (Table 2). The findings revealed that among women having pregnancy interval of less than 2 years 20, 15 and 15 cases in the first, second and third trimester respectively were found while 34% of the total selected women had Hb concentration 11 g/dl. Whereas in women having pregnancy interval $\geq$2 years 8, 9 and 12 cases in the first, second and third trimester respectively were found while 19.33% had Hb concentration less than 11 g/dl, showing that anemia is more frequent when the interval between pregnancies is shorter.
It was also found that with decreasing levels of Hb concentration, MCHC also significantly decreased. Thus

Table 2: Relationship of interval since last pregnancy with level of Hb concentration

Interval since last pregnancy	Hb levels <11 g/dl NOC	%	≥11 g/dl NOC	%	Total
1st Trimester					
<2 years	20a±0.88	40	12a±0.58	24	32
≥2 years	8b±0.88	16	10a±0.33	20	18
Total	28	56	22	44	50
2nd Trimester					
<2 years	15a±0.58	30	16a±0.45	32	31
≥2 years	9b±0.58	18	10b±0.33	20	19
Total	24	48	26	52	50
3rd Trimester					
<2 years	16a±0.33	32	14a±0.33	28	30
≥2 years	12b±0.33	24	8b±0.67	16	20
Total	28	56	22	44	50

Treatment means with different letter in the same column are significantly different at p = 0.05 according to Duncan's Multiple Range Test as given in Costat ver. 3.03. NOC = No. of Cases

Table 3: Relationship between Hb and MCHC

Hb Conc (g/dl)	Mean MCH	No. of cases	Standard error
1st Trimester			
7.1-8	23.98b	1c	-
8.1-9	26.90a	7b	±0.33
9.1-10	27.20a	17a	±0.33
10.1-11	28.15a	19a	±0.88
11.1-12	29.25a	6b	±0.58
2nd Trimester			
7.1-8	27.00b	3d	±0.00
8.1-9	26.60b	6c	±0.58
9.1-10	26.90b	25a	±0.88
10.1-11	28.30a	10b	±0.67
11.1-12	28.60a	6c	±0.00
3rd Trimester			
7.1-8	26.02c	1c	-
8.1-9	26.50c	7b	±0.33
9.1-10	27.06b	17a	±0.88
10.1-11	28.05a	19a	±0.33
11.1-12	28.80a	6b	±0.58

Treatment means with different letters in the same column are significantly different at p = 0.05 according to Duncan's Multiple Range Test as given in Costat ver. 3.03

MCHC and age of pregnant women were found to be directly related to Hb concentration (Table 3 and 4).

With the exception of first trimester, increased gravidity had statistically significant adverse effect on Hb. concentration. In gravida 5 and above (in 2nd and 3rd trimester) very few cases had Hb concentration more than 11 g/dl, showing that the incidence of anaemia increased with the number of pregnancies (Table 5).

The effect of educational status on Hb concentration (Table 6) seemed to have generalized trend, as increase in the level of education did influence a statistically significant ($p \leq 0.05$) increase in Hb concentration.

The socioeconomic status also affected the occurrence of anemia. In all trimesters, greater percentage of cases

Table 4: Relationship of age of pregnant women with level of Hb concentration

Age group (years)	Hb level <11 g/dl NOC	%	≥11 g/dl NOC	%	Total
1st Trimester					
<20	3b±0.25	60	2b±0.01	40	5
20-30	30a±0.5	75	10a±0.45	25	40
>30	2b±0.02	40	3b±0.62	60	5
Total	35	70	15	30	50
2nd Trimester					
<20	5b±0.33	10	3b±1.01	6	8
20-30	12a±0.58	24	25a±0.67	50	37
>30	3b±0.58	6	2b±0.33	4	5
Total	20	40	30	60	50
3rd Trimester					
<20	6b±0.58	12	5b±0.33	10	11
20-30	14a±0.33	28	20a±0.88	40	34
>30	3c±0	6	2c±0.33	4	5
Total	23	46	27	54	50

Treatment means with different letters in the same column are significantly different at $p \leq 0.05$ according to Duncan's Multiple Range Test as given in Costat ver. 3.03. NOC = No. of Cases

Table 5: Relationship of gravidity with level of Hb concentration

Gravidity	Hb level <11 g/dl NOC	%	≥11 g/dl NOC	%	Total
1st Trimester					
G1	2b±0.33	4	11b±0.67	22	13
G2-G4	12a±0.58	24	18a±0.58	36	30
≥G5	4b±0.88	8	3c±0.58	6	7
Total	18	36	32	64	50
2nd Trimester					
G1	3c±0.00	6	14a±0.67	28	17
G2-G4	10a±0.33	20	5b±0.33	30	25
≥G5	6b±0.58	12	2c±0.67	4	8
Total	19	38	31	62	50
3rd Trimester					
G1	5b±0.67	10	16a±0.88	32	21
G2-G4	8a±0.33	16	12b±1.01	24	20
≥G5	7a±0.33	14	2c±0.33	4	9
Total	20	40	30	60	50

Treatment means with different letters in the same column are significantly different at $p \leq 0.05$ according to Duncan's Multiple Range Test as given in Costat ver. 3.03. NOC = No. of Cases

with income less than Rs. 1000 per capita had low Hb concentration, whereas in cases where per capita income was above Rs. 1500, greater number of cases had more than 11 g/dl Hb (Table 7). Haemoglobin level was found to be proportional to Packed Cell Volume (PCV) (Table 8).

DISCUSSION

The finding of this study, that most of the pregnant women who had anaemia, fell in the age group of 20-30 years, could be attributed to the fact that most of the subjects belonged to lower or lower-middle class and in

Table 6: Relationship of educational status of pregnant female with the level of Hb concentration

	Hb level				
	<11 g/dl		≥11 g/dl		
Educational status	No. of cases	%	No. of cases	%	Total
1st Trimester					
Illiterate	3b±0.33	6	3b±0.58	6	6
Upto matric	11a±0.33	22	13a±0.33	26	24
Post matric	5b±0.51	10	15a±0.58	30	20
Total	19	38	31	72	50
2nd Trimester					
Illiterate	5b±0.19	10	2b±0.33	4	7
Upto matric	9a±0.51	18	14a±0.33	28	23
Post matric	4b±0.38	8	16a±0.88	32	20
Total	18	36	32	64	50
3rd Trimester					
Illiterate	6b±0.33	12	4c±0.67	2	8
Upto matric	9a±0.00	18	26b±1.33	13	22
Post matric	2c±0.19	4	36a±1.01	18	20
Total	17	34	66	33	50

Treatment means with different letters in the same column are significantly different at $p \leq 0.05$ according to Duncan's Multiple Range Test as given in Costat ver. 3.03

Table 7: Relationship of family income (Per capita of their families) with level of Hb concentration

	Hb level				
	<11 g/dl		≥11 g/dl		
Family income per capita	No. of cases	%	No. of cases	%	Total
1st Trimester					
<1000	8a±0.33	16	2c±0.33	4	10
1000-1499	6a±0.58	12	9b±0.58	18	15
≥1500	6a±0.00	12	19a±0.33	38	25
Total	20	40	30	60	50
2nd Trimester					
<1000	10a±0.33	20	7b±0.33	14	17
1000-1499	4b±0.33	8	8b±0.33	16	12
≥1500	5b±0.33	10	16a±0.89	32	21
Total	19	38	31	52	50
3rd Trimester					
<1000	15a±0.00	30	9a±0.58	18	24
1000-1499	4b±0.33	8	5b±0.58	10	9
≥1500	6b±0.58	12	11a±0.67	22	17
Total	25	50	25	50	50

Treatment means with different letters in the same column are significantly different at $p \leq 0.05$ according to Duncan's Multiple Range Test as given in Costat ver. 3.03

this sector of population, usually early marriages take place. These results are in conformity with the finding of Ilyas *et al*. (1995), who reported that women in the age group 20-24 tended to have higher average haemoglobin levels than women in the age group 16-19 years. Cases with higher gravidity showed adverse effect on haemogloblin level, as repeated pregnancies result in iron depletion. These results are the same as those of Thangaleela and Vijayalakshmi (1994), who reported that mean haemoglobin concentration of fewer pregnancies and supplement iron intake should be advised. Similarly, lesser intervals between pregnancies have the same consequences of iron deficiency anaemia. These findings coincide with the study carried out by Lozovic and Pocekovae in 1996 in Yogosalavia who found that in first trimester, anaemia was detected in 13.3% of pregnant mothers of shorter interval and 7.1% of longer interval between births. Educational status seemed to show a generalized trend of relatively higher hemoglobin levels in subjects having higher educational status. Perhaps, educated women had a broader vision and greater awareness regarding intake of quality food. This signifies the importance of imparting education to illiterate population, for the health of women and children. Likewise families with better per capita income are expected to consume relatively high quality food, resulting in higher hemoglobin concentrations, as shown by the results of this study. These results are supported by the findings of Somboonsook (1995) who found a positive correlation of

Table 8: Relationship between PCV and Hb concentration

Hb Conc (g/dl)	PCV	No. of cases	SE
1st Trimester			
7.1-8	29.6c	1c	-
8.1-9	33.0b	7b	±0.33
9.1-10	36.0b	17a	±0.33
10.1-11	38.0a	19a	±0.67
11.1-12	40.0a	6b	±0.58
2nd Trimester			
7.1-8	29.0d	3d	±0.58
8.1-9	33.5c	6c	±0.58
9.1-10	36.5b	25a	±0.88
10.1-11	37.0b	10b	±0.33
11.1-12	40.3a	6c	±1.00
3rd Trimester			
7.1-8	28.0d	2d	
8.1-9	33.2c	6c	±0.00
9.1-10	35.1b	25a	±1.33
10.1-11	36.0b	14b	±0.33
11.1-12	39.5a	3d	±0.00

Treatment means with different letters in the same column are significantly different at $p \leq 0.05$ according to Duncan's Multiple Range Test as given in Costat ver. 3.03

low income with anemia. Bentleym and Griffiths (2003) found that poor urban women had highest rates of being anemic.

Conclusion: Anemia is a common clinical problem throughout the world and enormous public health problem in developing countries. The present study was conducted to assess anaemia among pregnant mothers in all three trimesters, attending antenatal clinic of Gynecology Unit, Jinnah Hospital Lahore during the period of one month. Each pregnant, woman was enquired about her age, parity, socioeconomic status, education, per capita income, stage of pregnancy, family type (Nuclear or extended) interval since last pregnancy. Age of these pregnant mothers ranged from 15-45 years. Anaemia was assessed by estimating the Hb concentration in g/dl by colorimetric method using Drabkins's reagent. Each women was examined for PCV and MCHC. Among 50 pregnant women in 1st trimester, 30 had Hb concentration less than 11 g/dl, 70 had Hb $\geq$11 g/dl. Among 50 pregnant women in 2nd trimester 40% mothers had Hb less than 11 g/dl and 60% mothers had Hb 11 g and more than 11 g/dl. Out of 50 cases studied in 3rd trimester 46, had Hb <11 g/dl and 54 had Hb $\geq$11 g/dl. It was observed that increasing parity had inverse relationship with Hb Concentration. Socioeconomic status especially education and income strongly influenced the degree of anemia through nutrition. Low income results in poor nutrition of women of child bearing age leads to anemia during pregnancy when nutritional demand also increases. Short interval during pregnancy had adverse effects on Hb concentration. It was observed that women with less Hb concentration had low values of PCV. It was further found that with the decreasing level of Hb concentration, MCHC also decreased. This study was able to explore some important predisposing factors leading to anemia during pregnancy.

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