

The effects of socio-economic factors on the prevalence of anemia with reference to different trimester of pregnancy and level of ferritin in pregnant women of District Lahore, Pakistan

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Abstract—Anemia is problem in which level of hemoglobin decreases or numbers of red blood cells reduce. There are many factors which are involve in causing anemia in women like nutritional deficiency, gastrointestinal bleeding (diarrhea). Multiple pregnancies or pregnancies having less than two years' time period between them also result in causing anemia or reducing iron stores in blood. The current research was planned to find out the prevalence of anemia in pregnant women of District Lahore and to know how it is related to iron rich food and socioeconomic status of chosen patients. Method of data collection for the socioeconomic factors on the prevalence of anemia was done by taking interviews as well as questionnaire filled by pregnant women while for other analysis blood samples of 70 pregnant women of age group (25-40) years were collected and stored in EDTA tubes from four different hospitals of District Lahore, during different trimesters of pregnancy. The collected blood samples were taken and stored in already filled with EDTA tubes. All samples were then analyzed by using CBC hematology auto-analyzer. It is concluded from the current study that anemia was highly prevalent in District Lahore. It also indicated that the age of selected PW showed significant effect on severity of anemia because of nutritional deficiency with an increase in age. Income plays a central role in anemic women. Mostly anemic women were belonging to middle class which affected the nutritional status of PW and they didn't take iron and other nutrients containing diets. Trimester of pregnancy had impact on anemia because due to growth of fetus body needs Iron folate, vitamins, and other nutrients. Majority of anemic women were in their 2nd trimester because they did not get proper diet. No of pregnancies were also significant factors in PW. It can be due to the reason that with short birth spacing and increase no of pregnancies and abortions the Hb and serum ferritin level decreases and leads to anemia. This study helped to estimate the prevalence and causes of anemia in expecting females.

Keywords—Anemia; Pregnancy; Trimesters; Hematology

I. INTRODUCTION

In medical term, an individual who has low levels of red blood cells (RBCs) in blood is suffering from anemia, during this adverse state the quantity of RBCs become less and this sort of patients is named by specific name "anemic" (Sulaiman *et al.* 2017; Asrie, 2017). The problem of anemia is more common in pregnant women and different reproductive ages. A survey of World Health Organization (WHO) showed that up to 41.8% of all women living in developing countries are anaemic (Bright *et al.*, 2014; Bansal *et al.*, 2013). There are different types of anemia based on the level of hemoglobin. Among different types of iron deficiency anemia is major cause in 75% cases (Sharma, 2010; Asrie, 2017).

There are many medical conditions that cause the anemia. The active blood loss through the injuries, iron deficiency and chronic anemia (Salhan *et al.*, 2012; Arnold *et al.*, 2009). The iron deficiency anemia is most prevalent in pregnant women (PW). In Iron deficiency anemia major causes include less intake of iron containing foods to meet the proper needs of Iron during pregnancy (Balarajan *et al.*, 2011). These causes may vary in different cases but mainly include nutrition deficiencies like insufficient intake of iron and other micronutrients like folate, vitamin B12 and Vitamin A (Haidar *et al.*, 2010; Ali *et al.*, 2011).

During pregnancy anemia cause damage for both mother and the health status of baby. It can result in premature delivery, low birth weight and improper development of baby's brain (Cusick *et al.*, 2018; Traci, 2018). Anemia is also

related with the pre-term labor, pre-eclampsia (complication in pregnancy which causes coma or convulsions and maternal sepsis (inflammation) (Sharma, 2010). Due to anemic mother during pregnancy babies also develops anemia in the first year after birth (Esmaat, 2011; Galal Salah, 2015).

The levels of serum ferritin used as “gold standard” for measuring the iron stores in body under normal conditions (Dignass *et al.*, 2018). Variance was observed in Ferritin level with gender and age. The concentration of ferritin in females remain low until menopause and then rise (Masukume *et al.*, 2015). The concentration of ferritin <15g/L in adults reflects iron deficiency, however, ferritin is an acute phase protein, so may also be increased in case of infection and inflammation (Lebso, 2017). That’s why ferritin concentration alone does not necessarily showed iron deficiency (Peng Uprichard, 2017). Similarly, increased risk of iron deficiency was reported in more advanced pregnancy, in the final trimester than in the first trimester (Goswami *et al.*, 2014).

Therefore, in view of all above facts and severances of this medical condition during pregnancy more research is need of time in developing countries like Pakistan. The current study was carried out to find the effects of socio-economic factors on the prevalence of anemia with reference to different trimester of pregnancy and level of ferritin in PW of district Lahore, Pakistan.

II. MATERIAL AND METHOD

The study was conducted in Department of Biology in Virtual University of Pakistan. During the study period a total of 70 blood samples of pregnant women from four different hospitals (Jinnah Hospital, Lahore General Hospital, Services Hospital, Mayo Hospital) of District Lahore were collected (Table 1). These were representative samples of District Lahore.

These PW were of different age groups (25-40 years) and having different trimester of pregnancy. A questionnaire-based interview was conducted with each participant. The questionnaire was based on data regarding their socio-demographic information (e.g., age, family income/month), medical history (e.g. previous pregnancy and complications).

A. Blood Sampling and Analysis

Blood samples were collected from each PW into EDTA tubes under sterile conditions and transported to lab immediately in ice for the complete blood count (CBC) analysis by using auto-analyzer (Medonic M16/M20 M-Series Analyzer). The blood serum level of ferritin was estimated by utilizing Beckman mechanical apparatus for all studied PW.

Ethical clearance was taken from the administration health office of Virtual University of Pakistan. Pregnant women were informed about the purpose of study as well as about their rights that they can interrupt at any time during the

interview. This study was confidential and every one privacy was maintained.

1) *Statistical Analysis:* All data was subjected to SPSS 17.0 software and was presented in terms of mean \pm SD. The main differences were measured by using test multivariate ANOVA. $p < 0.05$ was considered statistically significant.

III. RESULTS AND DISCUSSION

It is a common observation that anemia is linked with socio economic status and nutritional habits of PW like education, income level, trimesters, low intake of iron rich food etc. which results in growth retardation, infections, increased labor time, premature birth, muscle dysfunction, maternal and prenatal mortality and less physical capacity for more pregnancies (Srouf, 2018; Tiongco *et al.*, 2019).

In the current study total 70 PW were selected from different hospitals of Lahore (Table 1), among these PW about 80% were anemic (Table 2) based on their blood haemoglobin level. The percentage of anaemic PW (80%) is very high and these finding were in line with the study conducted by Shams *et al.* (2017) in Mardan, Pakistan, which reported 76.7% anemia prevalence among PW. The same findings were reported by Anam *et al.* (2015) and Shahid *et al.* (2011) in Faisalabad and Kohat, Pakistan, respectively.

TABLE I
THE NUMBER OF PREGNANT WOMEN FROM DIFFERENT HOSPITAL OF DISTRICT LAHORE

Sr.	Hospitals	No of patients
1	Mayo Hospital	15
2	Services Hospital	17
3	Jinnah Hospital	22
4	General Hospital	16
Total		70

The anemic women further divided in to three categories based on severity of anemia (Table 2). The results determine that out of 56 anemic PW 33.9% patients had mild anemia as their hemoglobin level was ranging between 10 to 10.9 g/dl while 55.3% PW had moderate anemia and their level of hemoglobin was ranging between 8-10 g/dl. Only 10.7% PW had severe anemia with Hb level below 8 g/dl (Table 2). This was in accordance with study done in Telangana, India and Kenya which reported high number of PWs had mild anemia by Shridevi (2018) and Siteti *et al.*, (2014), respectively.

TABLE II
THE STATUS OF ANEMIA IN PREGNANT WOMAN FROM DIFFERENT HOSPITALS OF DISTRICT LAHORE

Status	Hb (g/dl)	No. of Women	Percentage	
Non-anemic	<11	14	20	
Anemic	>11	56	80	
Severity of Anemia	Mild	10-10.9	19	33.9
	Moderate	8-10	31	55.3
	Severe	below 8	06	10.7

Table 3 presents the general and socio-economic factors of selected PW. The data showed that highest percentages

(52.8%) of selected PW were belong to age group of 31-35 years and 12.8% PW were from the age group of 25 – 30 years while 34.2% PW were 36-40 years age group. This reflects that age is important factor. These finding were in line with Noreen *et al.* (2014) who reported in their study that anemia was more prevalent (46%) among women aged 25-30. (Most of the PW (58.5%) in present study belonged to lower class with monthly income 20000-40000 Rs. /Month. Therefore, the anemia relates with the economic status of PW. It was evident from the study that low-income status is related to poor nutrition, and it can lead to anemia. A study done in Ethiopia showed those women who were belonging to lower class were having high prevalence of anemia as compared to the women of upper class (Alemayehu, 2016; Tadesse *et al.*, 2019). In present study the anemia association with economic status showed that middle class has more probability of anemia during pregnancy. About 58.5% women were belonging to middle class, 27% women were from upper class and 8% women were belonging to lower class. This study was similar to other studies carried out in district Mardan and District karak that revealed high rate of anemia in middle class i.e., 47% and 48%, respectively (Irfan *et al.*, 2013; Suleiman *et al.*, 2017).

The pregnancy status and parity (number of times someone has pregnant) is shown in Table 3. The data showed that out of total 70 PW, 41.4% of the PW were in their 2nd trimester of pregnancy; 22.8% in 3rd trimester and 35.7% were in their 1st trimester (Table 3). It reveals that advancement in pregnancy relate with the chance to get anemia. The developing baby needs more nutrients. According to a report high prevalence of anemia was observed between 20-24 weeks of pregnancy because of level of Hb varies in different trimesters (Shehata 2012; Kumar *et al.*, 2013). Table 3 determined that the prevalence of anemia was high in the 2nd trimester (41.4%) and the rest of females were either in their 1st trimester (35.7%) or 3rd trimester (22.8%). These findings were comparable to the study done in Abbottabad that reported decrease in Hb level during 2nd trimester. (Dilshad *et al.*, 2010; Lin *et al.*, 2018).

Among all selected PW only 17.1% PW having their first pregnancy while 58.5% having their second pregnancy and 24.2% having more than 2 pregnancies (Table 3). These results were in line with the other studies that reported that multigravida and short birth spacing as the causes of anemia in pregnant women (Shams *et al.*, 2017; Shwetha *et al.*, 2018; Shridevi, 2018). Thus, the current study was in contrast with a study done in Ethiopia. It did not show any significant relation between anemia and multiparity. It can be due to experience gained from first pregnancy, intake of balanced food and increased awareness in antenatal care center (Fikir, 2017).

The current study also focused to know the prevalence of iron deficiency in the anemic pregnant women. To find out the serum ferritin level in anemic pregnant women their blood samples were further examined. To interpret the levels of

TABLE III
SOCIO-ECONOMIC FACTORS AND PREGNANCY STATUS OF SELECTED PREGNANT WOMEN AMONG DIFFERENT HOSPITALS OF DISTRICT LAHORE

Characteristics	Group/Range	Number	Percentage
Age Group	25-30	09	12.8
	31-35	37	52.8
	36-40	24	34.2
Monthly Income	Lower class	12	17.1
	Middle class	41	58.5
	Upper Class	17	24.2
Pregnancy status	1st Trimester	25	35.7
	2nd Trimester	29	41.4
	3rd Trimester	16	22.8
Parity Status	First Pregnancy	12	17.1
	2nd Pregnancy	41	58.5
	Multiple Pregnancy	17	24.2

(Lower class monthly income less than 20,000, middle = 20,000- 40,000, Upper = greater than 40,000)

TABLE IV
THE STATUS OF ANEMIA IN PREGNANT WOMAN FROM DIFFERENT HOSPITALS OF DISTRICT LAHORE

Category	Plasma ferritin (ng/mL)	No. of Patients	Percentage
1	<12 ng/mL	06	10.7
2	12-30	26	46.4
3	31-100	17	30.3
4	100<	7	12.5

serum ferritin all the cases were divided into four categories. Table 4 specifically represents frequency of iron deficiency anemia in PW. Moreover, the confirmation of anemia in PWs (whose hemoglobin level was below 11 g/dl) under study was done by assessment of their ferritin level and were categories on the bases of ferritin levels which represent the iron stores, category 1 (<12 ng/ml) shows very low iron stores while category 2, 3 and 4 presented 12-30, 31-100, >300 ng/ml level of ferritin, respectively. It revealed from present research that out of 56 anemic PWs, 11.4% anemic females had serum ferritin lower than 12 ng/ml which was the alarming level of iron deficiency anemia 34.2% women had serum ferritin in the range of 12-30 ng/ml which still signifies low iron stores in blood. About 42.8% anemic women had value of serum ferritin ranging between 31-300 ng/ml and only 11.4% pregnant women had normal level of serum ferritin i.e., 100< ng/ml. Moreover, PW having any acute or chronic disease were excluded from the study for getting a clear report related to levels of iron stores and during study it was also observed that the rate of low-birth-weight babies was high in pregnant women who were anemic in their third trimester. Along this the pre-mature deliveries also occurred in mothers who were anemic in their second and third trimesters (Kumar *et al.*, 2016). The same findings were presented by Judistiani *et al.* (2018) who relate the ferritin level with trimester of pregnancy and found it significant. These finding are in line with Galal and Salah (2015) and Raza *et al.* (2011) they reported the relationship of pregnancy with iron deficiency anemia with respect to the levels of blood ferritin.

The multiple comparisons between socioeconomic factors associated with selected PW from different hospital of district Lahore with respect to severity of anemia are shown in table 5. The age of selected PW shows significant (>0.05) impact on severity of anemia as it increases with increase in age. The trimester of pregnancy in selected women indicated significant (>0.05) impact in term of moderate anemia.

The prevalence of anemia was high in present study. In Pakistan high prevalence was observed in several parts of country. This high prevalence was due to short spacing between pregnancies, and less availability of the services by government. This study showed significant association between different socioeconomic factors and anemia and several studies have also shown significant association between the same.

IV. CONCLUSION

It is concluded from the current study that anemia was highly prevalent in District Lahore. It also indicated that the age, income, and pregnancy stage were significant factors in term of prevalence of anemia in PWs. The no of pregnancies were also significant factors in PW. It can be due to the reason that with short birth spacing and increase no of pregnancies and abortions the Hb and serum ferritin level decreases and leads to anemia.

Characteristics	Group/Range	Severity of anemia			Sig	
		Mild	Moderate	Severe		
Age Group	25-30	No of PW	No of PW	No of PW	Single P value (use chi square test if you are using both variable as categories)	
	31-35					
	36-40					
Monthly Income	Lower class					
	Middle class					
	Upper Class					
Pregnancy status	Milk					
	1 st Trimester					
	2 nd Trimester					
Parity Status	3 rd Trimester					
	First Pregnancy					
	2 nd Pregnancy					
Socioeconomic factors	Severity of anemia	Mean Difference (I-J)	Sig.	95% Confidence Interval		
				Lower Bound	Upper Bound	
Age	Mild	Moderate	-0.8	0.301	-2.8	1.1
		Sever	-2.2	0.102	-5.4	0.9
		Non anemic	1.1	0.304	-1.2	3.5
	Moderate	Mild	0.8	0.302	-1.1	2.8
		Sever	-1.3	0.301	-4.3	1.6
		Non anemic	2.02	0.060	-0.1	4.1
	Sever	Mild	2.2	0.100	-0.9	5.4
		Moderate	1.3	0.300	-1.6	4.3
		Non anemic	3.3	0.040*	0.09	6.6
	Non anemic	Mild	-1.1	0.301	-3.5	1.2
		Moderate	-2.02	0.060	-4.1	0.1
		Sever	-3.3	0.040*	-6.6	-0.9

Income	Mild	Moderate	0.3	0.070	-0.03	0.6
		Sever	0.1	0.500	-0.4	0.7
		Non anemic	-0.3	0.101	-0.7	0.09
	Moderate	Mild	-0.3	0.070	-0.6	0.03
		Sever	-0.1	0.500	-0.6	0.3
		Non anemic	-0.6	0.001*	-1.04	-0.2
	Sever	Mild	-0.1	0.501	-0.7	0.4
		Moderate	0.1	0.501	-0.3	0.6
		Non anemic	-0.5	0.090	-1.0	.09
	Non anemic	Mild	0.3	0.100	-0.0	0.7
		Moderate	0.6	0.001*	0.2	1.04
		Sever	0.5	0.090	-0.0	1.0
Trimesters	Mild	Moderate	0.1	0.503	-0.3	0.6
		Sever	0.1	0.704	-0.6	0.8
		Non anemic	0.08	0.704	-0.4	0.6
	Moderate	Mild	-0.1	0.502	-0.6	0.3
		Sever	-0.02	0.904	-0.7	0.6
		Non anemic	-0.04	0.802	-0.5	0.4
	Sever	Mild	-0.1	0.701	-0.8	0.6
		Moderate	0.02	0.911	-0.6	0.7
		Non anemic	-0.02	0.901	-0.8	0.7
	Non anemic	Mild	-0.08	0.700	-0.6	0.4
		Moderate	0.04	0.811	-0.4	0.5
		Sever	0.02	0.922	-0.7	0.8
No of abortions	Mild	Moderate	-0.2	0.081	-0.5	0.03
		Sever	0.0	0.011*	-0.4	0.4
		Non anemic	0.09	0.612	-0.2	0.4
	Moderate	Mild	0.2	0.081	-0.03	0.5
		Sever	0.2	0.211	-0.1	0.7
		Non anemic	0.3	0.030*	0.03	0.7
	Sever	Mild	0.0	0.101	-0.4	0.4
		Moderate	-0.2	0.202	-0.7	0.1
		Non anemic	0.09	0.701	-0.4	0.6
	Non anemic	Mild	-0.09	0.602	-0.4	0.2
		Moderate	-0.3	0.030*	-0.7	-0.03
		Sever	-0.09	0.711	-0.6	0.4
No of pregnancies	Mild	Moderate	-0.9	0.000*	-1.6	-0.3
		Sever	-2.6	0.000*	-3.7	-1.5
		Non anemic	0.1	0.700	-0.6	0.9
	Moderate	Mild	0.9	0.005*	0.3	1.6
		Sever	-1.6	0.001*	-2.6	-0.6
		Non anemic	1.09	0.004*	0.3	1.8
	Sever	Mild	2.6	0.000*	1.5	3.7
		Moderate	1.6	0.001*	0.6	2.6
		Non anemic	2.7	0.000*	1.6	3.8
	Non anemic	Mild	-0.11	0.701	-0.9	0.6
		Moderate	-1.09	0.004*	-1.8	-0.3
		Sever	-2.7	0.000*	-3.8	-1.6
Hb	Mild	Moderate	1.1	0.000*	0.8	1.4
		Sever	3.1	0.000*	2.6	3.6
		Non anemic	-1.5	0.000*	-1.8	-1.1
	Moderate	Mild	-1.1	0.000*	-1.4	-0.8
		Sever	1.9	0.000*	1.5	2.4
		Non anemic	-2.6	0.000*	-2.9	-2.3
	Sever	Mild	-3.1	0.000*	-3.6	-2.6
		Moderate	-1.9	0.000*	-2.4	-1.5
		Non anemic	-4.6	0.000*	-5.1	-4.1
	Non anemic	Mild	1.5	0.000*	1.1	1.8
		Moderate	2.6	0.000*	2.3	2.9
		Sever	4.6	0.000*	4.1	5.1
Ferritin	Mild	Moderate	3.1	0.701	-14.3	20.7
		Sever	27.9	0.051	-0.7	55.9
		Non anemic	14.5	0.101	-6.6	35.7
	Moderate	Mild	-3.1	0.704	-20.7	14.3
		Sever	24.7	0.060	-1.6	51.2
		Non anemic	11.3	0.211	-7.7	30.3
	Sever	Mild	-27.9	0.051	-55.9	0.07
		Moderate	-24.7	0.064	-51.2	1.6
		Non anemic	-13.4	0.331	-42.4	15.5
	Non anemic	Mild	-14.5	0.112	-35.7	6.6
		Moderate	-11.3	0.234	-30.3	7.7
		Sever	13.4	0.311	-15.5	42.4

*. The mean difference is significant at the 0.05 level.

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