A STUDY ON IRON DEFICIENCY ANEMIA AND HEMATOLOGICAL DIFFERENCES AROUND DELIVERY IN WOMEN OF DIFFERENT SOCIO-ECONOMIC AND AGE GROUPS

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SUMMARY: This study was conducted on pregnant women admitted to various hospitals of Faisalabad for delivery. They were randomly divided into 3 socio-economic groups (low, middle and high) and each group was further subdivided into 3 age groups of < 25, 26–32 and >33 years of patients. The study revealed an overall higher ($p<0.05$) birth weight of newborn of those born to women of middle socio-economic groups than low and high. Overall mean RBC ($10^6/\mu L$), PCV (Packed Cell Volume) (%), Hb (g/dL), TLC (Thin Layer Chromatography) ($10^3/\mu L$), iron ($\mu g/dL$), MCV (fL), MCH (pg) and MCHC (g/dL) were 4.00, 34.49, 9.69, 8.9, 212.02, 90.23, 25.63 and 28.80 before delivery, while 4.10, 34.45, 8.73, 10.36, 173.36, 89.77, 22.96 and 25.93, after delivery, respectively. Overall RBC count and PCV showed non-significant difference pre-and post delivery among socio-economic groups and age groups. After delivery overall TLC was significantly higher ($p<0.05$) but before delivery it was significantly higher ($p<0.05$) in women of middle than high socio-economic group. Before delivery, overall, Hb, MCH and MCHC were significantly higher ($p<0.05$) in women of each socio-economic group. Overall, serum iron was higher and RBC showed positive correlation with birth weight ($r=0.28$, $p<0.005$) before delivery.

Key Words: Birth weight, hematology, iron.

INTRODUCTION

Lacking appropriate nutritional elements in the pregnant women's diet, a number of maternal deficiencies can often occur including calcium, phosphates, vitamins and iron. It has been estimated that about 375 mg of iron is needed by the fetus to form its blood and an additional 600 mg is required by the mother to form her own extra blood. Whereas total iron stores in the body is about 4–5 g, of which about 72% in the form of hemoglobin (26). The normal stores of non-hemoglobin iron in women at the outset of pregnancy has often been 50 to 100 mg, but never more than 700 mg. However, the anemic condition in pregnancy develops when Hb concentration is below 10 g/dL (1, 16, 25). Therefore, without sufficient iron in her blood, a pregnant woman usually develops anemia. It has been reported that iron deficiency in pregnant women remains the most common nutrient deficiency, in both developing and developed countries. Iron deficiency in pregnant women usually results from the combination of

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low iron stores induced by menstrual losses, inadequate iron intakes and the high demands of the fetus. It is observed that fetus extracts iron in amounts proportional to the levels in mothers resulting in iron deficiency anemia during pregnancy which can adversely affect the iron endowment of the infant at birth (24). Women in lower socio-economic group, teenagers and multiparous are at high risk of iron deficiency (2).

Anemia is common in pregnant women in Pakistan (10) and other parts of the world (18). It is also prevalent in American Negroes (22), Wales (12), Maori rural communities (19), Alaskan Eskimos (23), Jerusalem (11, 15). In Pakistan, about 36% of the rural and 56% of the urban population and pregnant women 76% of rural and 100% of urban lactating mothers, have low or deficient level of Hb. In a study, lower Hb and PCV (Packed Cell Volume) values in women after delivery have been reported (26). She reported significantly higher ($p<0.05$) Hb and PCV in women of low socio-economic groups than middle and high.

The information on iron status of pregnant women before and after delivery along with other hematological parameters including Hb, PCV, RBC and TLC (Thin Layer Chromatography) with reference to socio-economic status, nutrient intake, energy intake and birth weight of newborn is scant. Therefore, the present study aimed to find out variation in hematological parameters and iron in women of different socio-economic groups. Further to determine the status of hematological parameters and iron before and after delivery and also to study the effect of birth weight of newborn on mother's blood with regard to hematological parameters.

MATERIALS AND METHODS

Blood samples (5 mL) for the study were collected from women admitted in various hospitals of Faisalabad, Pakistan. Samples of about 5 mL were collected from the vein with the help of a disposable syringe from randomly selected volunteer

Table 1: Birth weight of newborn of women with different socio-economic statuses and ages.

Parameters	Socio-economic groups			
	Low	Middle	High	Overall
Birth weight (Ibs)				
< 25 years	7.68±1.56	8.10±0.75	7.18±1.88	7.64±1.49
26–32 years	7.44±0.73	7.77±0.94	6.99±1.53	7.40±1.14
> 33 years	6.96±1.74b	9.20±3.00a	6.74±1.43b	7.63±2.38
Overall	6.97±1.58b	8.37±1.93a	7.36±1.42b	7.56±1.74

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

Table 2a: Overall hemoglobin, PCV and RBC count before and after delivery in women of different age groups.

Age groups	Before delivery	After delivery
Hemoglobin (g/dL)		
< 25 years	9.56±1.12a	8.84±1.16b
26–32 years	9.90±1.42a	8.60±1.26b
> 33 years	9.62±1.18a	8.77±1.08b
Overall	9.69±1.24a	8.73±1.16b
PCV (%)		
< 25 years	35.17±4.48	34.38±5.09
26–32 years	34.90±5.82	34.90±5.72
> 33 years	33.43±5.55	34.10±5.33
Overall	34.49±5.31	34.45±1.15
RBC ($10^6/\mu L$)		
< 25 years	4.14±0.97	3.96±0.75
26–32 years	3.95±0.99	4.16±1.44
> 33 years	3.92±0.90	4.18±1.19
Overall	4.00±0.95	4.10±1.15

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

Table 2b: Hemoglobin, packed cell volume and RBC count in women of different socio-economic statuses and ages before and after delivery.

Parameters	Socio-economic groups					
	Low		Middle		High	
	Pre-del.	Post-del.	Pre-del.	Post-del.	Pre-del.	Post-del.
Hb (g/dL)						
< 25 years	9.17±1.02	8.65±1.69	10.09±0.98a	8.94±0.49b	9.47±1.24	8.91±1.10
26–32 years	10.13±0.98a	8.64±1.36b	9.09±1.66	8.21±1.36	10.56±1.24a	8.98±1.00b
> 33 years	9.35±1.04	8.70±1.14	9.13±0.79	8.48±0.88	10.37±1.33a	9.13±1.20b
Overall	9.55±1.07a	8.66±1.37b	9.41±1.25a	8.53±1.00b	10.12±1.32a	9.01±1.07b
PCV (%)						
< 25 years	32.60±3.53B	31.80±4.59	38.67±3.61A	38.22±4.82A	34.60±4.30	33.67±4.18
26–32 years	37.40±4.17A	36.00±5.95	31.40±6.62B	34.00±6.86AB	36.00±5.00	34.67±4.36
> 33 years	34.20±5.92AB	35.50±6.28	32.50±3.92B	32.20±3.94B	33.60±6.87	34.60±5.48
Overall	34.73±4.93	34.43±5.78	34.04±5.74	34.69±5.76	34.69±5.41	34.32±4.59
RBC ($10^6/\mu L$)						
< 25 years	3.93±1.22	3.99±0.82	4.24±0.86	4.07±0.82	4.25±0.85	3.88±0.69B
26–32 years	4.06±1.30	4.48±1.88	3.68±0.73	4.20±1.26	4.13±0.90	3.77±1.08B
> 33 years	3.61±0.82	4.27±1.01	3.95±0.74	3.41±0.61	4.20±1.11	4.87±1.40A
Overall	3.87±1.11	4.25±1.29	3.95±0.78	3.91±0.98	4.20±0.93	4.20±1.19

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

women before (within 24 hrs) and after delivery (within 12 hrs). Of the 5 mL, 2 mL with anticoagulant was used for hematological studies and 3 mL for separation of serum for iron studies. A total of 90 women were randomly selected and divided into 3 socio-economic groups, each comprising 30 women, on the basis of the monthly income as below:

Low socio-economic group, maximum earning of Rs. 4.000/ month or below.

Middle socio-economic group, minimum earning of Rs. 4.000 and maximum earning of Rs. 10.000/month.

High socio-economic group, minimum earning of Rs. 15.000/ month and above.

Each socio-economic group was further divided into 3 age groups, having 10 women in each age group, as given below:

Group I below 25 years of age.

Group II between 26–32 years of age.

Group III 33 years of age and above.

Birth weight of newborn was recorded by using weighing scale for babies. The Hb was estimated by acid haematin method and PCV by microhematocrit method (6). RBC counting was done with the help of an improved Neubaur counting chamber (6). Erythrocytic indices were also worked out by using formulae (6). The TLC was made by hemocytometer method using improved Neubaur hemocytometer. Serum iron was determined spectrophotometrically (6).

Data thus obtained on various parameters were analyzed by

Table 2c: Hemoglobin, packed cell volume and RBC count before and after delivery in women of different socio-economic statuses and ages.

Parameters	Pre-delivery			Post-delivery		
	Low	Middle	High	Low	Middle	High
Hb (g/dL)						
< 25 years	9.17±1.02	10.09±0.98	9.47±1.24	8.65±1.69	8.94±0.49	8.91±1.09
26–32 years	10.13±0.98ab	9.09±1.66b	10.56±1.24a	8.64±1.36	8.21±1.36	8.98±1.00
> 33 years	9.35±1.04b	9.13±0.79b	10.37±1.33a	8.70±1.14	8.48±0.88	9.13±1.20
Overall	9.55±1.07ab	9.41±1.25b	10.12±1.32a	8.66±1.37	8.53±1.00	9.01±1.07
PCV (%)						
< 25 years	32.60±3.53b	38.67±3.61a	34.60±4.30b	31.80±4.59b	38.22±4.82a	33.67±4.18b
26–32 years	37.40±4.17a	31.40±6.62b	36.00±5.00ab	36.00±5.96	34.00±6.86	34.67±4.36
> 33 years	34.20±5.92	32.50±3.92	33.60±6.87	35.50±6.28	32.20±3.94	34.60±5.84
Overall	34.73±4.93	34.04±5.74	34.69±5.41	34.43±5.78	34.69±5.76	34.32±4.59
RBC ($10^6/\mu L$)						
< 25 years	3.93±1.22	4.24±0.86	4.25±0.85	3.99±0.82	4.07±0.82	3.88±0.69
26–32 years	4.06±1.30	3.68±0.73	4.13±0.90	4.48±1.88	4.20±1.26	3.77±1.08
> 33 years	3.61±0.82	3.95±0.74	4.20±1.11	4.27±1.01ab	3.41±0.61b	4.87±1.40a
Overall	3.87±1.11	3.95±0.78	4.20±0.93	4.25±1.29	3.91±0.98	4.20±1.19

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

using SAS (6.12) computer software package (3). Analysis of Variance technique was used for analyzing the data and means were compared by DMR test at $p<0.05$ (95% level). The Pearson correlation coefficients among different parameters were also worked out.

RESULTS AND DISCUSSION

Birth weight of newborns was significantly higher ($p<0.05$) of those born to women of middle socio-economic status while no difference was observed between women of different age groups (Table 1). Mean birth weight was 3.43 kg (7.56 Ibs) and was within range of 3–4 kg in USA (21). Higher birth weight in women of middle socio-economic group observed was due to higher birth weight in women of > 33 years of age in this socio-economic group. Women of middle socio-economic group in this area participate actively in the household affairs and involve themselves physically in home maintenance and cleanliness and also take good nutrition which probably contributed to better birth weight of newborns in these women. While women of high socio-economic status do not involve themselves physically in household affairs and depends on servants. However, in all these socio-economic and age groups, an overall birth weight was within normal range of 6–8 Ibs (8).

Overall Hb concentration before and after delivery was 9.69 and 8.74 g/dL, respectively (Table 2a), and was higher ($p<0.05$) before delivery both in women of different

Table 3a: Overall mean corpuscular volume, mean corpuscular Hb and mean corpuscular Hb concentration before and after delivery in women of different age groups.

Age groups	Before delivery	After delivery
MCV (fL)		
< 25 years	89.53±24.01	89.28±18.46
26–32 years	93.62±33.56	93.64±36.35
> 33 years	87.62±15.50	86.51±24.54
Overall	90.23±25.19	89.77±27.28
MCH (pg)		
< 25 years	24.47±6.86	23.35±6.15
26–32 years	36.65±7.93	23.32±10.47
> 33 years	25.77±6.97a	22.23±5.57b
Overall	25.63±7.24a	22.96±7.62b
MCHC (g/dL)		
< 25 years	27.42±3.37	26.22±5.24
26–32 years	29.32±7.69a	25.22±5.85b
> 33 years	29.63±7.00a	26.33±5.36b
Overall	28.80±6.32a	25.93±5.45b

Values in each column with different capital letters and in each row with different small letters are statistically significant at p<0.05 (Values are means±SD).

socio-economic (Table 2b) and age groups (Table 2a). This suggests that decrease in Hb occurs after delivery. Present values of Hb concentration after delivery were in complete agreement with that reported previously of Hb=8.70 g/dL, within 24 hours after delivery (26). However, higher Hb concentration after delivery observed has been correlated with hemodilution effect during pregnancy, but it has been further reported that this concept of hemodilution effect was misleading as in many of the parameters no such effect was observed (7). It has been reported that in well-nourished subjects, less hemodilution effect occurs. However, before and after delivery, values were less than 11 g/dL (WHO definition of anemia for pregnant women) thus suggesting a state of anemia. Therefore, present findings and those previously observed (26) suggest that some measures should be taken to increase the levels of Hb during pregnancy. During present study the difference in Hb before delivery, between women of different socio-economic statuses was significant, but was non-significant after delivery (Table 2c). These findings were contrary to the earlier findings of significant difference between women of different socio-economic statuses after delivery (26). Higher value before delivery in women of high socio-economic group was also contrary to the earlier findings of higher ($p<0.05$) Hb in women of low socio-economic status after delivery (26). This may be due to the higher iron and nutrient intakes by the women of high socio-economic groups. Further research is needed involving much higher number of subjects in each group to clarify the difference in two studies observed. However, the difference of genetics and environmental factors along with season of study might be important contributors.

The mean PCV before and after delivery was almost same (Table 2a), but was higher than 29.20% (26). Variation in the two studies could be due to the difference of subjects selected in two studies having different genetic constitution, eating habits or due to some other reasons. Present values were, however, slightly lower as reported for normal healthy women of 37–47% (9). Almost similar PCV both before and after delivery observed during present study was contrary to the higher PCV post than prepartum (7) and was similar to findings of Hb. This further confirms the difference in two studies, which may be due geonetic (genetic and geographic) differences and other environmental differences. PCV showed non-significant difference between women of different age (Table 2a) and socio-economic groups (Table 2b). However, PCV was significantly higher before delivery in women of 26-32 years of age in low, while in women of < 25 years of age in high socio-economic status (Table 2c). Non-significant difference in women of different age groups has already been reported (26). However, significant difference between women of different socio-economic status with higher values in women of low socio-economic status

Table 3b: Mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration before and after delivery in women of different socio-economic statuses and ages.

Parameters	Pre-delivery			Post-delivery		
	Low	Middle	High	Low	Middle	High
MCV (fL)						
< 25 years	91.09±33.77	93.83±17.18	84.11±18.35	81.46±3.00	97.36±22.76	89.16±18.16
26–32 years	105.01±53.34	86.25±15.29	89.15±15.02	97.12±53.27	87.04±28.00	97.11±21.58
> 33 years	96.02±10.63	83.48±9.98	83.35±21.07	85.64±8.50ab	98.87±30.05a	75.03±19.45b
Overall	97.38±36.14	87.65±14.52	85.42±17.94	88.07±32.94	94.32±26.83	86.67±21.22
MCH (pg)						
< 25 years	25.91±9.97	24.42±4.05	23.07±5.29	22.96±7.82	22.90±5.43	23.77±5.59
26–32 years	27.49±9.82	26.12±8.92	26.30±4.55	24.34±16.66	20.65±5.00	25.16±5.37
> 33 years	27.14±7.55	23.76±4.39	26.40±8.56	21.04±4.31	25.53±4.99	20.11±6.15
Overall	26.85±8.88	24.78±6.12	25.22±6.40	22.78±10.62	23.03±5.36	22.91±5.94
MCMC (g/dL)						
< 25 years	28.42±4.24	26.28±3.38	27.44±2.18	27.67±6.70	23.75±3.42	26.81±4.80
26–32 years	27.28±3.02	30.99±12.19	29.73±4.25	24.41±4.61	25.25±8.66	26.08±3.16
> 33 years	28.17±6.75	28.44±4.02	32.28±9.20	25.04±4.73	26.68±4.01	27.28±7.16
Overall	27.96±4.77	28.65±7.75	29.82±6.24	25.70±5.43	25.28±5.84	26.74±5.21

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

has been reported (26). The difference observed between different age groups during present study might be due to age itself along with nutritional factors.

Overall mean of RBC before and after delivery was 4.0 and 4.10 x $10^6/\mu L$, respectively, and no difference was observed in overall values among different socio-economic and age groups (Table 2a). However, after delivery in women > 33 years of age, significantly higher RBC count was observed in high socio-economic group (Table 2c). Present values of slightly higher RBC after delivery were in line with the earlier findings in Iranian women in whom higher PCV (after delivery) observed (7), which might be due to hemoconcentration occurring as a result of leakage of fluid from blood vessels in delivery process. However, the values were close to normal values of 4.7 x $10^6/\mu L$ (8). Present findings of slightly higher RBC count in women of high than low socio-economic status were well compared to those reported for Iranian women (7) and correspond to the higher Hb observed in these women during present study.

Mean MCV before and after delivery was 90.23 and 89.77, respectively (Table 3a) and was within normal range of 75–95 fL in adult females (20). The comparison of overall MCV in different age (Table 3a) and socio-economic groups revealed no difference (Table 3b), which suggests that MCV, is not affected by change in age or nutritional factors.

The mean MCH before and after delivery was 25.60 and 22.96, respectively (Table 3a), and was close to the

Table 3c: Mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration in women of different socio-economic statuses and ages before and after delivery.

Parameters	Socio-economic groups					
	Low		Middle		High	
	Pre-del.	Post-del.	Pre-del.	Post-del.	Pre-del.	Post-del.
MCV (fL)						
< 25 years	91.09±33.77	81.46±13.00	93.83±17.18	97.36±22.76	84.11±18.35	89.16±18.16AB
26–32 years	105.01±53.34	97.12±53.27	86.25±15.29	87.04±28.00	89.15±15.02	97.11±21.58A
> 33 years	96.02±10.63	85.64±18.50	83.48±9.98	98.87±30.05	83.35±21.07	75.03±19.45B
Overall	97.38±36.14	88.07±32.94	87.65±14.52	94.32±26.83	85.42±17.94	86.67±21.22
MCH (pg)						
< 25 years	25.91±9.97	22.96±7.82	24.42±4.05	22.90±5.43	23.07±5.29	23.77±5.59
26–32 years	27.49±9.82	24.34±16.66	26.12±8.92	20.65±5.00	26.30±4.55	25.16±5.37
> 33 years	27.14±7.55a	21.04±4.31b	23.76±4.39	25.53±4.99	26.40±8.56	20.11±6.15
Overall	26.85±8.88	22.78±10.62	24.78±6.12	23.03±5.36	25.22±6.40	22.91±5.94
MCHC (g/dL)						
< 25 years	28.42±4.24	27.67±6.70	26.28±3.38	23.75±3.42	27.44±2.18	26.81±4.80
26–32 years	27.28±3.02	24.41±4.61	30.99±12.19	25.25±8.66	29.73±4.58	26.08±3.16
> 33 years	28.17±6.75	25.04±4.73	28.44±4.02	26.68±4.01	32.28±9.20	27.28±7.16
Overall	27.96±4.77	25.70±5.43	28.65±7.75	25.28±5.84	29.82±6.24a	26.74±5.21b

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

Table 4a: Overall total leukocyte count and serum iron before and after delivery in women of different age groups.

Age groups	Before delivery	After delivery
TLC ($10^3/\mu L$)		
< 25 years	8.92±4.43b	11.44±4.62a
26–32 years	9.30±3.73	10.31±4.49
> 33 years	8.70±3.91	9.38±3.31
Overall	8.97±3.39b	10.36±4.21a
Iron (μg/dL)		
< 25 years	190.13±84.03	185.28±125.70
26–32 years	234.17±120.59a	149.09±85.28b
> 33 years	211.78±108.24	185.28±124.38
Overall	212.02±105.74a	173.36±113.47b

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

range of 27–32 pg in normal adult females (20), however, slightly lower MCH after delivery corresponds to lower Hb after delivery. Similar to MCV, overall MCH was also not affected by difference in age or socio-economic status (Tables 3b, 3c).

Overall mean of MCHC before and after delivery was 28.80 and 25.93 respectively (Table 3a), as compared with 30–36 g/dL in normal adult female (20), which suggest lower MCHC near delivery and corresponds to lower Hb, both before and after delivery. It has been reported that MCH seemed to discriminate the state of iron deficiency better than MCV and MCHC (14). During present study both MCH and MCHC was found associated with iron status both before and after delivery, although the correlation between these was not significant, while association of MCV was not observed. The non-significant correlation with iron was probably due to overall higher iron concentration, but not being effectively utilized for Hb syn-

Table 4b : Total leukocyte count and serum iron before and after delivery in women of different socio-economic statuses and ages.

Parameters	Pre-delivery			Post-delivery		
	Low	Middle	High	Low	Middle	High
TLC ($10^3/\mu L$)						
< 25 years	9.44±6.62	9.82±3.12	7.60±2.34	13.33±5.78	10.55±3.81	11.06±3.16
26–32 years	8.31±3.54	10.52±4.04	9.03±3.61	10.16±5.76	11.63±3.44	9.03±3.97
> 33 years	8.15±1.70ab	10.86±4.51a	7.10±4.21b	8.04±1.63b	11.35±3.45a	8.76±3.74ab
Overall	8.63±4.33ab	10.42±3.84a	7.87±3.45b	10.51±5.14	11.19±3.46	9.59±3.65
Iron (μg/dL)						
< 25 years	207.59±89.47	180.71±99.39	181.15±68.29	193.71±135.03	219.82±167.76	145.78±53.84
26–32 years	252.55±105.31	234.70±169.14	213.17±72.91	134.54±62.10	148.09±95.10	166.38±101.68
> 33 years	254.53±135.82a	228.75±71.63ab	152.06±88.64a	210.73±92.90	131.89±109.83	213.21±156.21
Overall	238.22a	215.89ab	181.06b	179.66	164.77	175.42

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

Table 4c : Total leukocyte count and serum iron in women of different socio-economic statuses and ages before and after delivery

Parameters	Socio-economic groups					
	Low		Middle		High	
	Pre-del.	Post-del.	Pre-del.	Post-del.	Pre-del.	Post-del.
TLC ($10^3/\mu L$)						
< 25 years	9.44±6.62	13.33±5.78A	9.82±3.12	10.55±3.81	7.60±2.34	11.07±3.16
26–32 years	8.31±3.54	10.16±5.76AB	10.52±4.04	11.63±3.44	9.03±3.62	9.03±3.97
> 33 years	8.15±1.70	8.04±1.63B	10.86±4.51	11.35±3.45	7.10±4.21	8.76±3.74
Overall	8.63±4.43	10.51±5.14	10.42±3.84	11.19±3.46	7.87±3.45	9.59±3.65
Iron (μg/dL)						
< 25 years	207.59±89.47	193.71±135.03	180.71±99.39	219.82±167.76	181.15±68.29	145.78±53.84
26–32 years	252.55±105.31	134.54±62.10	234.70±169.14	148.09±95.10	213.17±72.91	166.38±101.68
> 33 years	254.53±135.82	210.73±92.90	228.75±71.63	131.89±109.83	152.06±88.64	213.21±156.21
Overall	238.22±110.17a	179.66±103.14b	215.89±119.37	164.77±127.62	181.06±78.59	175.42±112.16

Values in each column with different capital letters and in each row with different small letters are statistically significant at $p<0.05$ (Values are means±SD).

thesis, which is probably lower, or the demand of it is higher and not yet optimized.

Means of serum iron before and after delivery were 212 and 173 μg/dL (Table 4a) and was higher than the normal level of 90–152 ug/dL (8). This indicates no deficiency of iron in these subjects. However, overall iron dropped significantly ($p<0.05$) after delivery. In women of low socio-economic status and of 26–32 years of age, iron dropped significantly after delivery. Although the value was still higher from the normal range, while no change was observed in women of other socio-economic statuses and age groups. This further indicates that the subjects under study were not iron deficient. The findings are contrary to the significantly lower serum iron in teenage school girls of 3 socio-economic statuses, i.e., low, middle and high (3). Higher serum iron observed during present study was probably due to higher intake of iron in the form of iron containing tablets/capsules/syrups during the last trimester of pregnancy or through vegetables and fruits. During present study, on investigation, about 20% of women were found taking iron supplements in the form of Theragran-M, Fefol-vit while other probably have not felt the need of it. In Kenya anemia due to iron deficiency is the commonest occurrence mainly due to hookworm infestation (13). While iron deficiency anemia to be associated with poor availability of iron in Indian diet has been reported (17). Present findings though suggest a state of anemia, but iron level was in normal range thus suggesting involvement of some other factor(s) causing anemia.

The mean TLC observed during present study after delivery was close to $10.63 \times 10^3/\mu L$ (26), but was lower ($p<0.05$) before delivery. Higher values of TLC after delivery might be due to the need of active defense system as the body gets exposed to various pathogens and/or may be due to the requirement of leukocytes to participate in the uterine repair process. The rise in TLC at parturition in sheep has already been reported (5).

Birth weight was significantly correlated with RBC mass ($r=0.28$, $p<0.005$) of their mothers, which was due to high correlation in mothers of low and high socio-economic status and those of 26–32 years of age. This suggests that birth weight is influenced by the RBC concentration in their mothers. However, protein and energy intakes showed non-significant correlation with hematological parameters except in mothers of middle socio-economic status, where energy intake was inversely correlated with Hb contents ($r=-0.362$, $p<0.05$). Both before and after delivery, the correlation of iron with hematological parameters was non-significant which may be due to the reason of higher iron but was probably no more needed or perhaps the rate of RBC formation slows down near the term or demand is much higher and not optimized.

It can be concluded from the present study that the women in all the groups were anemic as Hb level was less than the required and further decrease occur after delivery. Socio-economic status and age influence the RBC count. Birth weight on newborns has direct correlation with RBC count in their mothers.

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