DOI: https://doi.org/10.53350/pjmhs2023174584

ORIGINAL ARTICLE

Frequency of Serum Ferritin Level in Non-Anemic Pregnant Women Presenting at Hospital

NAHIL SHAMS[1], AMNA ASLAM[2], HINA AMANULLAH[3], KIRAN MEMON[4], SAMRAZ[5], AFNAN RIZWAN[6], KIRAN AAMIR[7], AAMIR RAMZAN[8]
[1]*Senior registrar Gynaecology & obstetrics Department, Indus hospital Tando Muhammad khan*
[2]*Senior Registrar, Gynae unit 01, isra university hospital, Hyderabad*
[3]*Senior registrar Gynae unit 01, Isra university hospital , Hyderabad*
[4]*Assiatant professor Pathology Department Indus medical college Tando Muhammad khan*
[5]*Resident pathologist, pathology Department Liaquat university of Medical and health sciences jamshoro Hyderabad*
[6]*Assistant professor gynaecology & obstetrics Department, Islamabad medical and dental college.*
[7]*Associate professor, Pathology Department, Liaquat university of Medical and health sciences jamshoro Hyderabad*
[8]*Lecturer pathology Department, Liaquat university of Medical and health sciences jamshoro Hyderabad*
Corresponding author: Nahil Shams, Email: Dr.nahilshams@gmail.com, Cell: 03336877660

ABSTRACT

Objective: To determine mean serum ferritin level in non-anemic pregnant women presenting at Isra University Hospital during their antenatal visit.

Study Design: Cross sectional study.

Place and Duration: Department of Obstetrics and Gynecology at Isra University Hospital Hyderabad. January 2019-Jun 2019

Methods: A total of 78 non-anemic pregnant women with hemoglobin level>11gm/dl during 1st and 3rd trimester and>10.5gm/dl during 2nd trimester (as defined by CDC Criteria for anemia) were included in this study. A detailed history was obtained. All variable information was recorded in predesigned Performa.

Results: The average age of women was 30.15±3.36 years. Mean serum ferritin level in non-anemic pregnant women was 13.05±5.088 nm/dl. Out of 78 cases 43(55.1%) of non-anemic female were found to have Iron deficiency state on the basis of serum ferritin estimates ≤12 ng/ml.

Conclusion: In pregnancy, plasma volume, erythropoesis, and fetoplacental unit demand rise, causing iron defficiency. All pregnant women should be tested for iron status. Proper ID surveillance among pregnant women ensures accurate recording, assessment, and introduction of serum ferritin test early in the first trimester with the first ANC visit to catch afflicted pregnant.

Keywords: serum ferritin, Non-anemic pregnant women, Iron deficiency anemia

INTRODUCTION

Pregnancy is associated with physiological changes that results in increased plasma volume and red blood cells and decreased concentration of micronutrients like (iron, folic acid and vitamin B12) [1] . Physiological alterations in plasma volume and red cell mass diminish the reliability of Hb estimation or determination of hematocrit, due to increase demand of iron as a result of fetal and placental growth as well as expansion of blood volume [2]. It is well known fact that hemoglobin concentration falls during pregnancy principally as a result of hemodilution. If iron is not supplemented women are exhausted of their iron stores and develop iron deficiency anemia [3].

Determination of hemoglobin (or hematocrit) is not the optimal mean to identify pregnant women at risk from effects of iron deficiency as it fails to identify women who are iron-deficient but are not anemic [4,5]. Several studies have proven that serum ferritin is the single best noninvasive test and is very useful and reliable index of iron stores especially during pregnancy with low levels indicating iron deficiency [6,7].

Anemia in pregnancy has been defined by criteria from the centers for disease control and prevention (CDC) as a hemoglobin level of < 11g/dl during first and third trimester and<10.5g/dl during second trimester. Ferritin level of <12ng/ml is considered as the gold standard for the diagnosis of iron deficiency anemia in pregnancy [8].

Iron deficiency is the most widespread nutritional deficiency in the world [9]. It is the most common cause of anemia during pregnancy worldwide. It has been reported that 56% of pregnant women in low income countries are affected in contrast to 18% in high income countries [4] .Iron deficiency without anemia is associated with reduced exercise capacity, impaired temperature regulation and impaired cognitive function and may therefore implicate risk for both mother and baby [10].

Maternal iron deficiency anemia is associated with number of maternal and fetal problems including the risk of preterm births, low birth weight babies, perinatal mortality and intrauterine growth retardation [11].

By reviewing literature, there was similar study conducted at Rawalpindi which showed mean ± SD of 19.96 ±22.37 serum ferritin levels [4].

In our population poor diet factors, low socioeconomic conditions, large family size and repeated pregnancies are contributory factors for iron deficiency and on the basis of results of my study if ferritin levels is low in our population measures will be taken to improve their iron status and its outcome in pregnancy.

MATERIALS AND METHODS

This study was carried out in department of obstetrics and gynaecology at Isra University Hospital Hyderabad. Non-anemic pregnant women: pregnant women with hemoglobin level>11gm/dl during 1st and 3rd trimester and>10.5gm/dl during 2nd trimester. Patients with age 15 to 45 years, Primigravida, multigravida, Any trimester (1st trimester, 2nd trimester, 3rd trimester), Inter pregnancy interval > 1year (confirmed on history) were included.

Anemic pregnant women: pregnant women whose hemoglobin level is <11gm/dl during 1st and 3rd trimester and < 10.5gm/dl during 2nd trimester. Grand multiparous (>5), known Diabetic, known hypertensive, known thallesemic, H/O acute or chronic illness: e.g. acute or chronic hepatitis and respiratory infection were excluded.

After taking approval from ethical committee and taking informed consent from women fulfilling the criteria were included in the study. The data was entered in performa attached. A detailed history was obtained. Examination and hematological parameters including HB, RBC count, HCT, MCV, MCH, MCHC and Ferritin levels were obtained. Exclusion criteria was strictly followed to control the confounding variables. Interview was conducted by the doctor conducting the research and all variable information was recorded on predesigned performa by the researcher herself. Results were supervised by consultant gynecologist having experience of 25 years post fellowship.

Data was entered and analyzed by using SPSS version 19.Mean and standard deviation was calculated for quantitative variables like age, parity, gravid, gestational age, inter pregnancy interval, HB, RCT, HCT, MCV, MCHC and Ferritin. Frequency and percentages werecalculated for qualitative variables like residence,

h/o blood transfusion and socioeconomic status. Effect modifier like age, parity, gravida, socioeconomic status, residence, inter-pregnancy interval, HB, RCT, HCT, MCV, MCHC and gestational agewas controlled by stratification. Post stratification t-test/ANOVA was applied by taking p<0.05 as significant.

RESULTS

A total of 78 non-anemic pregnant women with hemoglobin level >11gm/dl during 1st and 3rd trimester and>10.5gm/dl during 2nd trimester were included in this study. The average age of women was 30.15±3.36 years (as shown in figure 5).Gravidity, parity, gestational age and inter pregnancy interval is shown in table 3. Out of 78 women, 25(32.05%) were primigravida and 53(67.95%) were multigravida as shown in figure 6. Residential status i:e 50(64.10%) women were from urban areas and 28(35.90%) were from rural area as shown in figure 7. Socio economic status of 8(10.26%) women was below 10,000 26(33.33%) women was between 10,000 to 15000 and of 44(56.41%) women was above 15,000 as shown in figure 8. History of blood transfusion was observed in only 1 case as shown in figure 9. Hematological parameter of 78 pregnant females is shown in table 4.

Mean serum ferritin level in non-anemic pregnant women was 13.05±5.088 nm/dl as shown in figure 10. Out of 78 cases 43(55.1%) of non-anemic female were found to have Iron deficiency state on the basis of serum ferritin estimates ≤12 ng/ml as shown in table 4.

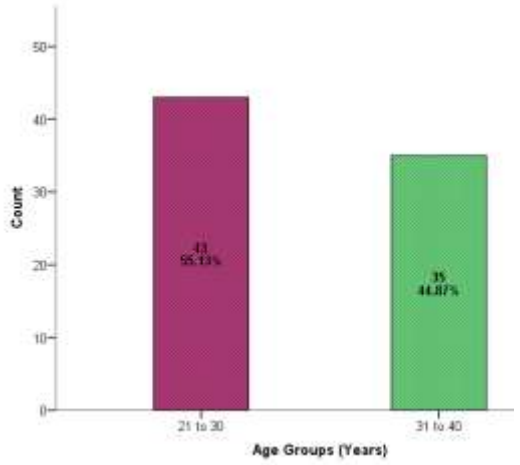

Figure 1: Age Distribution of Pregnant Women n=78

Table 1: Descriptive Statistics of Characteristics of Pregnant Women n=78

Variables	Mean	SD	95% Confidence Interval for Mean	
			Lower Bound	Upper Bound
Age (Years)	30.15	3.36	29.40	30.91
Parity	1.01	1.29	.72	1.30
Gravidity	2.33	1.51	1.99	2.68
Gestational Age (Weeks)	26.13	9.38	24.01	28.24
Inter pregnancy Interval	1.17	0.41	1.06	1.27

Stratification analysis was performed and observed that mean serum ferritin level was low in women above 30 years of age as compare to women below and equal 30 years of age (table 5). Mean serum ferritin level was not significant among parity groups as shown in table 6. Similarly mean serum ferritin level was also not significant in multigravida and primigravida women (table 7). Mean serum ferritin level was significantly low in those women whose socio economic status was low (<10,000 Rs.) as shown in table 8. Mean serum ferritin level was significantly low in women with ≥36 gestational weeks (p=0.017) as shown in table 9. Similarly mean serum ferritin level was also observed with respect to hematological parameter and Inter pregnancy interval as shown in table 10 to 16.

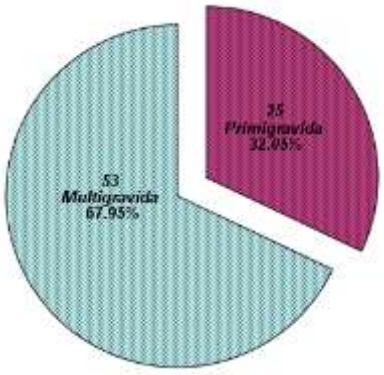

Figure 2: Parity Status of Women n=78

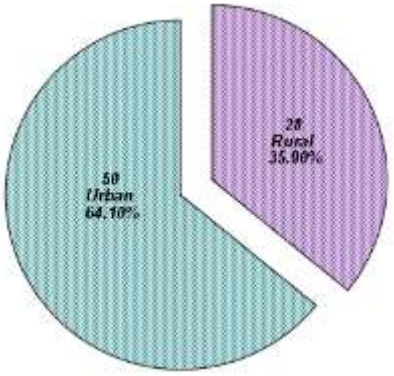

Figure 3: Residential Status of Women n=78

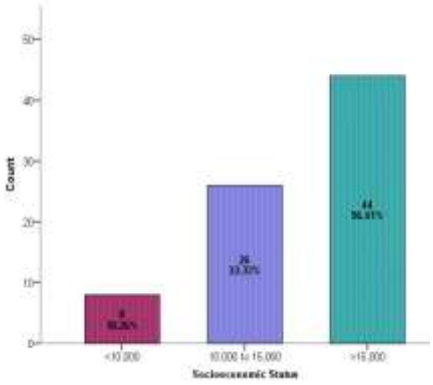

Figure 4: Socioeconomic Status n=78

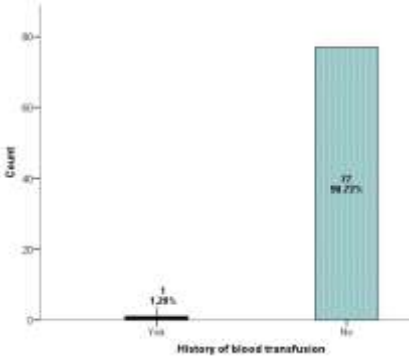

Figure 5: History of Blood Transfusion n=78

Table 2: Hematological Parameter (n=78)

Variables	Mean	Std. Deviation
HB (gm/dl)	11.71	0.523
RBC(x 10^{12})	4.193	0.27
HCT(%)	40.76	7.97
MCV(fl)	77.14	8.79
MCH(PG)	27.59	2.15
MCHC(g/dl)	30.60	2.73

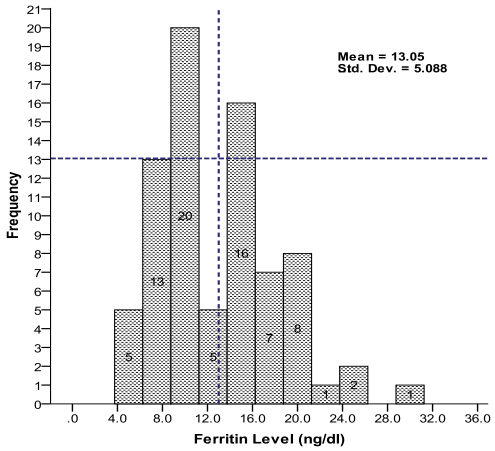

Figure 6: Mean Serum Ferritin Level in Non-Anemic Pregnant Women (n=78)

43(55.1%) of non-anemic female were found to have Iron deficiency state on the basis of serum ferritin estimates ≤12 ng/ml

Table 3: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Between Age Groups

Age Groups (Years)	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
21 to 30	43	14.07	5.36	12.41	15.72	0.049
31 to 40	35	11.80	4.48	10.26	13.34	

Table 4: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among Parity Groups

Parity	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
Zero	36	13.71	5.64	11.78	15.61	0.204
One	20	13.67	4.82	11.41	15.93	
More than one	22	11.41	4.10	9.59	13.22	

One Way ANOVA

Table 5: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Between Gravida

Gravida	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
Primi	25	14.62	5.71	12.26	16.97	0.061
Multi	53	12.31	4.64	11.03	13.59	

Table 6: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women

SES	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
<10,000 Rs	8	9.87	1.72	8.43	11.32	0.024
10,000 to 15,000 Rs	26	11.86	5.21	9.76	13.92	
>15,0000 Rs	44	14.33	5.07	12.78	15.87	

One Way ANOVA

Table 7: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Between Gestational Age

Gestational Age (Weeks)	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
< 36 Weeks	62	13.74	5.32	12.39	15.09	0.017
≥36 weeks	16	10.37	2.84	8.85	11.89	

Table 8: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among HB

HB (gm/dl)	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
≤ 11 gm/dl	21	11.16	3.81	9.43	12.89	0.006
11 – 12 gm/dl	46	12.94	4.82	11.51	14.37	
>12 gm/dl	11	17.09	6.34	12.82	21.35	

One Way ANOVA

Table 9: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among RBC Count

RBC Count (x 10^{12})	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
3.1 to 4	35	11.92	4.81	10.27	13.58	0.079
4.1 to 4.8	43	13.96	5.17	12.37	15.55	

Independent sample t –test

Table 10: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among HCT

HCT	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
≤ 40%	51	12.15	4.77	10.80	13.49	0.030
>40%	27	14.76	5.30	12.66	16.85	

Independent sample t –test

Table 11: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among MCV

MCV (fl)	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
≤76	23	9.74	3.03	8.43	11.05	0.0005
>76	55	14.43	5.15	13.04	15.82	

Independent sample t –test

Table 12: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among MCH

MCH (pg)	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
≤30	57	11.05	3.73	10.11	12.09	0.0005
>30	21	18.33	4.53	16.27	20.36	

Independent sample t –test

Table 13: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among MCHC

MCHC (sldl)	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
≤30	43	9.95	2.99	9.03	10.87	0.0005
>30	35	16.82	4.52	15.30	18.41	

Independent sample t –test

Table 14: Comparison of Mean Serum Ferritin Level in Non-Anemic Pregnant Women Among Inter Pregnancy Interval

Inter Pregnancy Interval	n	Mean	Std. Deviation	95% Confidence Interval for Mean		P-Value
				Lower Bound	Upper Bound	
≤1	52	12.78	5.42	11.27	14.29	0.85
1-3	10	12.45	3.80	9.72	15.17	

Independent sample t –test

DISCUSSION

Physiological changes during pregnancy, and the extra nutritional demand by the fetus makes anemia the most common complication in pregnant women. There are two kinds of anemia commonly of concern in pregnancy. The first is the physiological anemia in pregnancy, which is caused by increased blood volume and hemodilution during pregnancy. In this kind of anemia, hemoglobin will usually not be less than 11.0 gm/dl [11]. Another kind of anemia is nutritional anemia, which is caused by the competitive absorption of the maternal nutrients by the fetus, resulting in maternal nutritional insufficiency and thus producing anemia. The most commonly seen nutritional anemia in pregnancy is iron-deficiency anemia and folate-deficiency anemia. During

pregnancy, physiological alterations in plasma volume and red cell mass diminish the reliability of Hb estimation or determination of hematocrit.[12] Serum ferritin levels start decreasing as the pregnancy advances.[13] Ferritin being an acute phase reactant may show falsely elevated levels during pregnancy. Hence detection of elevated levels of soluble transferrin receptorsTfRs in the presence of normal Hb helps to detect the iron deficiency state before anemia develops. Soluble transferrin receptor STfR is neither influenced by acute phase reactions nor it is influenced by hemodilution in pregnancy [14]. Detection of latent iron deficiency during pregnancy is difficult to assess by using traditional parameters because of physiological alterations in the plasma volume and red cell number. Serum ferritin is therefore considered as a better parameter to detect latent iron deficiency. During pregnancy, low serum ferritin concentrations in the presence of normal hemoglobin indicate deficient iron stores.[15] Such females are prone to develop overt iron deficiency anemia. In this study to determine mean serum ferritin level in non-anemic pregnant women, A total of 78 non-anemic pregnant women, between 15 to 45 years whose hemoglobin level>11gm/dl during 1st and 3rd trimester and>10.5gm/dl during 2nd trimester were included.

In our study Mean serum ferritin level in non-anemic pregnant women was 13.05±5.088 nm/dl. Out of 78 cases 55.1% of non-anemic female were found to have Iron deficiency state on the basis of serum ferritin estimates ≤12 ng/ml. Chao Hung et al in their study of 198 non-anemic women found 46.46% had iron depletion, with serum ferritin < 20 pg/l; among them, 35 (17.68%) had serum ferritin below 12 pg/l, which indicated definite iron deficiency in spite of the absence of clinical anemia. [16]Most of women were between 21-30years of age, 55.1% and 44.8% were between 31-40 years of age, making average age of women 30.15±3.36 years. Out of 78 pregnant females, 32.05% were primigravida and 67.95% were multigravida. In our study mean serum ferritin level was not significant among parity groups and also not significant in multigravida and primigravida women. However the risk of developing iron deficiency and anemia in pregnant women is increased with increasing parity[17,18]. This could be due to the loss of iron and other nutrients during increased and repeated pregnancies and also the possibility of sharing of resources with the fetus. Food selection and intake is a multifactorial behavior influenced by affordability and the food culture prevalence. It is demonstrated that family income positively correlates the frequency and quantity of consuming protective foods and energy foods. Although knowledge about foods and their requirements play an important role in food selection, since there is a close association between food intake behaviors and Nutritional Status of people, [19]. Our findings support this as Mean serum ferritin level was significantly low in those women whose socio economic status was low, In our study females with monthly income <10,000 Rs had Mean serum ferritin level of 9.8 ng/ml, monthly income of 10,000 to 15,000 Rs has 11.6 ng/ml and monthly income of >15,0000 Rs has 14.3 ng/ml.

It is a well-known fact that maternal iron stores become exhausted during second and third trimesters of pregnancy. A study conducted at Inha University Hospital, Korea revealed significantly decreased serum ferritin levels in the third trimester as compared to the first trimester of pregnancy.[20] We found Mean serum ferritin level was significantly low in women with ≥36 gestational weeks showing inverse proportion relationship among gestational age and mean serum ferritin level. In pregnancy, serum ferritin concentration is maximum at 12–16 weeks gestation, then falls with advancing gestation to reach a nadir at the third trimester [21-23]

CONCLUSION

In pregnancy, plasma volume, erythropoesis, and fetoplacental unit demand rise, causing iron defficiency. All pregnant women should be tested for iron status. Proper ID surveillance among pregnant women ensures accurate recording, assessment, and introduction of serum ferritin test early in the first trimester with the first ANC visit to catch afflicted pregnant.

REFERENCE

1. Pipkin FB. Maternal physiology. In: Edmonds DK,editor. Dewhursts text book of obstetrics and gyaecology.UK: Blackwell Publishing John Willey And Sons Ltd; 2012. p. 8-59.
2. Emejokar FC, Iyoke CA, Ezegwui HU, Ezugwuo FO, Umeora OU, Ibeasha IO. Rate and predictors of serum ferritin levels in Enugu Nigeria. J Blood Med. 2015;6:261-7.
3. Asif N, Hassan K, Mahmud S, Zaheer HA, Naseem L, Zafar T, et al. comparison of serum ferritin levels in three trimesters of pregnancy and their correlation with increasing gravidity. Int J Pathol. 2007;5(1):26-30.
4. Haq I, Butt IF, Hassan K, Asif N, Tariq W, Mateen Y. Iron status in non-anemic pregnant females during the third trimester. Ann Pak Inst Med Sci. 2008;4(2):88-91.
5. Karimi M, Kadivar R, Yarmohammadi H. Assessment of the prevalence of iron deficiency anemia, by serum ferritin, in pregnant women of Southern Iran. Med SciMonit. 2002;8(7):CR488-92.
6. Mast A. peripheral blood tests in iron deficiency anemia. Bloodline. 2001;1(2):24-27.
7. Hou J, Cliver SP, Tamura T, Johnston KE, Goldenberg R. Maternal serum ferritin and growth. Obstet Gynecol. 2000 Mar;95(3):447-52.
8. Tiwari M, Kotwal J, Kotwal A, Mishra P, Dutta V, Chopra S. Correlation of hemoglobin and red cells indices with serum ferritin in Indian women in second and third trimester of pregnancy. Med J Armed Forces India. 2013 Jan;69(1):31-6.
9. Haider BA, Olofin I, Wang M, Spiegelman D, Ezzati M, Fawzi W. Anemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. BMJ. 2013;346:f3443.
10. Alwan NA, Cade JE, McArdle HJ, Greenwood DC, Hayes HE, Simpson NA. Maternal iron status in early pregnancy and birth outcomes: insight from the baby's vascular health and iron in pregnancy study. Br J Nutr. 2015 Jun28;113(12):1985-92.
11. Scott D, Pritchard J. Anemia in pregnancy. ChnPerinatol. 1974;1:491-505.
12. Bentley DP. Iron metabolism and anaemia in pregnancy. ClinHaematol. 1985;14:613-28.
13. Milman N, Agger AO, Nielsen OJ. Iron status markers and serumerythropoietin in 120 months and newborn infants. ActaObstetGynecol Scand. 1994;73:200-4.
14. Akinsooto PV, Ojwang J, Govender T, Moodley J, Connolly CA. Soluble transferrin receptors in anaemia of Pregnancy. J ObstetGynaecol. 2001;21(3):250–2.
15. Hyder SM, Persson L, Chowdhury M, Lonnerdal B, Ekstrom E. Anemia and iron deficiency during pregnancy in rural Bangladesh. Public Health Nutr. 2004;7(8):1065-70.
16. Chao-Hung Ho I, Chiou-Chung Y, Shin-Hwa Y. Serum ferritin, folate and cobalamin level sand their correlation with anemia in normal ful~term pregnant women. Eur J ObstetGynecolReprod Biol. 1987;26:7-13.
17. Vivek RG, Halappanavar AB, Vivek PR, Halki SB, Maled VS, Deshpande PS. Prevalence of anemia and its epidemiological. Determin Pregnant Women. 2012;5(3):216–23.
18. Elzahrani SS. Prevalence of iron deficiency anemia among pregnant women attending antenatal clinics at Al-Hada Hospital. Canadian J Med. 2012;3(1):10–4.
19. Nti CA. Food consumption patterns, dietary quality and health status of expectant mothers: case studies in suburban and rural communities in Ghana. Int J Consumer Stud. 2002;26(8):7- 14.
20. Choi JW, Pai SH. Change in erythropoesis with gestational ageduring pregnancy. Ann Hematol. 2001;80:26-31.
21. Puolakka J, Janne O, Pakarinen A. Serum ferritin as a measure of iron stores during and after normal pregnancy with and without iron supplements. ActaObstetGynecolScand Suppl. 1980;90:43–51.
22. Kaneshige E. Serum ferritin as an assessment of iron stores and other haematologic parameters during pregnancy. Obstet Gynecol. 1981;57:238–42.
23. Milman N, Agger AO, Nielsen OJ. Iron status markers and serum erythropoietin in 120 mothers and newborn infants. ActaObstetGynecol Scand. 1994;73:200–4.