IRON DEFICIENCY ANEMIA
SIGNIFICANCE OF SERUM FERRITIN IN DIAGNOSIS IN PREGNANT FEMALES OF PAKISTAN

ORIGINAL
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DR. GHAZALA IRSHAD, MBBS, M.PHIL
Assistant Professor,
Deptt. of Biochemistry,
The University of Lahore.

DR. SAMINA KOUSAR, M.PHIL, PHD
Assistant Professor,
Deptt. Of Biochemistry,
The University of Lahore

DR. SAGHIR AHMAD JAFRI, TI, AF
Professor Institute of Molecular Biology and Biotechnology,
The University of Lahore

Dr. Irshad Ali, MBBS, DA
Senior Registrar,
Deptt. of Anaesthisia,
Shrif Medical City Hospital, Lahore

ABSTRACT... Anemia is very common especially in developing countries and in Pakistan 70-80% of pregnant population is suffering from iron deficiency anemia. Ferritin is intracellular globular iron storage protein. The low level of ferritin indicates lack of iron that may lead to anemia and its high values may indicate iron overload. **Objective:** To determine the incidence of anemia on the basis of ferritin in three socioeconomic groups i.e. poor, middle and upper class and in three trimesters of pregnancy. **Materials & Methods:** Total 45 pregnant females were selected and divided in three categories of poor, middle, and upper class based on their socioeconomic status. Serum ferritin levels were measured by ELISA method. **Results & Conclusions:** Total mean serum ferritin (ng/ml) level were found to be 18.5± 3.5, 14.6± 3.0, 14.7± 3.6 in first, second and third trimesters respectively. Serum ferritin was very low in all three socioeconomic groups and it was lowest in poor class as compare to middle and upper class. It was concluded that serum ferritin is a good and reliable marker for detection of iron deficiency anemia during pregnancy as compared to hemoglobin.

Key words: Anemia, Ferritin, Iron, Pregnant females, ELISA

INTRODUCTION

Anemia is a worldwide health problem and in developing countries about two third of pregnant women population are affected by this disease[1]. Iron deficiency type of anemia is most prevalent due to nutrient deficiency all over the world[2]. Iron deficiency affecting 500million people i.e. about 30% population all over the world[3]. In Pakistan 70-80% of pregnant population is suffering from iron deficiency anemia[4]. Iron deficiency can result from dietary lack, impaired absorption, increased requirement of iron and chronic blood loss. Dietary intake is rare in industrial world but very common in developing countries where food is less deficient in absorbable organic iron. When total body iron level lowered a sequence of events is observed. The progression of iron deficiency corresponds three stages. Stage one also called as iron depletion or pre latent iron deficiency stage in which reduced iron store without reducing serum iron level. This stage can be detected by serum ferritin level estimation[5]. Second stage exists when iron stores are exhausted with hemoglobin level remaining high a lower limit of normal level Usually patients complain generalized fatigue or malaise in this stage[6]. In third stage blood hemoglobin level falls below normal level, MCV is also reduced[7]. Iron deficiency anemia is actually manifestations of diseases so patients may present with irritability, palpitation, dizziness, breathlessness, headache and fatigue[8].

Anemia is one of the common complications of pregnancy. Iron stores are already low in most of women at the beginning of pregnancy while its iron requirements are greater in pregnancy than in non pregnant state although absorption rate for iron after first trimester increases and continues throughout pregnancy yet iron stores were low at delivery[9]. The fetus requires 300 mg of iron and increased hemoglobin mass and red blood cells of mother requires 500mg of iron so collectively 800 mg of iron is required in the course of pregnancy[10]. The concentration of hemoglobin is lowest between 25th and 30th week. This phenomenon is called physiological hemodilution[4]. Diagnosis of iron deficiency anemia during pregnancy is very important because it is associated with pre-term delivery and low birth weight of fetus and inferior neonatal health[11]. Iron deficiency anemia especially the more severe form has been known to be associated with increased mortality and even mild iron deficiency anemia may increase the rate of premature delivery[12]. There are evidences, which

indicate that pre eclampsia, and eclampsia may occur most frequently in iron deficient anemic women[13].

Ferritin is intracellular globular iron storage protein of 450 KDA containing 24 subunits of light and heavy chains of ferritin and found in every cell[14]. Ferritin releases iron in controlled fashion[15] and normal level of ferritin is 30-300 ng/ml in males and 15-200ng/ml in females[3]. The low level indicates lack of iron which may lead to anemia and its high values may indicate iron overload e.g. hemochromatosis or porphyria. In acute phase it may be elevated in the course of chronic diseases, infections and cancer. Many studies proved serum ferritin as single best and non-invasive test and a reliable marker for iron store estimation especially during pregnancy[16].

During pregnancy due to physiological dilution fall in hemoglobin occur, oftenly increase in MCV, frequently abnormal serum iron transferrin, less sensitivity to transferrin saturation and fluctuation of serum iron take place and only serum ferritin is found efficient test for detection of iron deficiency anemia[17]. Latent iron deficiency (depletion of iron stores without anemia) is very common during pregnancy and is very difficult to detect but its diagnosis is very important for health of fetus and mother routinely used parameters are useful for detection of overt deficiency but not for latent deficiency[18]. During pregnancy low serum ferritin but normal hemoglobin level indicates deficient iron store and these females are prone to develop iron deficiency anemia[19].

OBJECTIVE

The objective of present study was to determine the incidence of anemia on the basis of ferritin in three socioeconomic groups i.e. poor, middle and upper class and in three trimesters of pregnancy.

MATERIALS AND METHODS

In this prospective, comparative cross sectional and hospital based study initially 60 pregnant women in first trimester were selected randomly from social security hospital and Sharif medical city hospital Lahore. However, 15 out of sixty could not complete study (3 pregnant women aborted, 2 went pre-term delivery and 10 left the study), finally 45 pregnant females completed the study. These women were divided in three categories of poor, middle, and upper class based on their socioeconomic status assessed from their monthly income and dietary habits. All included women were followed through all three trimesters of pregnancy and their serum ferritin level was estimated. For Serum ferritin cut off value was 12ng/mL during whole pregnancy[20].

Exclusion Criteria

Patients with diabetes, hypertension, renal failure, malignancy or any other serious diseases.

Collection of Samples

Five ml of blood was taken from cubital vein in disposable syringe, 2 ml was allowed to clot for 1½ hour in a separate vial, centrifuged at 3000rpm for 10 minutes and clear serum was separated and kept at-20˚C till further analysis for ferritin.

BIOCHEMICAL ANALYSIS

Serum ferritin by ELISA

Biocheck human ferritin immunoassay test kit catalog No BC-1025 was used for determination of ferritin by using Dia Med ELISA plate reader. Using mean absorbance value for each sample determined the corresponding concentration of ferritin in ng/ml[21].

RESULTS

The institutional ethical review board of Social Security Hospital and University of Lahore approved the study. A written consent and history from each woman was taken and all demographic details were recorded.

Data was collected and assessed by using, analysis of variance (ANOVA) for over all comparison, least significant difference (LSD) for pair comparison and correlation by using method of[22].

Total mean serum ferritin level were found to be 18.5± 3.5, 14.6± 3.0, 14.7± 3.6 in first, second and third trimesters respectively (Table-I).

There significant changes ($p<0.05$) were observed in serum ferritin levels in all three trimesters and non

Table-I. Mean serum ferritin levels (ng/mL) in different socioeconomic groups and in three trimesters

Group	1st Trimester	2nd Trimester	3rd Trimester
Poor	15.9±3.5	12.4±3.3	12.4±3.4
Middle	16.1±3.4	15.3±3.2	16.0±3.3
Upper	19.8±4.0	15.1±3.8	15.3±3.9
Total	18.5±3.5	14.6±3.0	14.7±3.6

Table-II. Analysis of variance (ANOVA) of ferritin (ng/mL) in different socioeconomic groups and three trimesters of pregnancy.

Source	Sum of squares	d.f	Mean square	F	Sig.
Trimesters	333.29	1	333.29	79.5	*0.00
Intercept	33806.84	1	33806.8	60.4	*0.00
Group	439.895	2	219.948	0.39	Ns0.68
Error	23500.52	42	559.536	-	-

significant changes (p>0.05) were observed in ferritin level between all socioeconomic groups (Table II).

DISCUSSION

As anemia is very common health problem worldwide effecting about one third population especially in third world countries[23]. Out of all types of anemia, iron deficiency anemia is most prevalent in pregnant females. The present study was aimed to investigate the levels and relationship of serum ferritin in pregnant population of Pakistan belonging to three socioeconomic groups based on their monthly income status. Routine parameter used by majority of general practitioners of the country for diagnosis of iron deficiency is usually hemoglobin. The present study was an effort to find out other means of diagnosis of iron deficiency anemia with current conventional methods to follow the iron status of different socioeconomic groups in pregnant population. Total 45 pregnant females take part in this study and serum ferritin level was estimated by ELISA method.

The mean serum ferritin level revealed that serum ferritin was very low in all three socioeconomic groups (Table 1) it was lowest in poor class as compare to middle and upper class. The iron stores of all women in spite of their class were at lower limits of normal range i.e. 12-50 ng/ml. The low limits of serum ferritin even in women belonging to upper socioeconomic groups proving iron deficiency as a major nutritive problem of third world countries as stated by Karine and Jennifer[23]. In our study the serum ferritin showed significant changes in different trimesters. Serum ferritin levels were lowest in second trimester as compare to first trimester in all groups and then there was stability or slight improvement in ferritin levels found during third trimester these results were comparable by study of Naghmi et al[4].

In present study over all Incidence of iron deficiency anemia on the basis of serum ferritin in all three socioeconomic groups was about 66% as 31 women out of 45 had ferritin below 12ng/dl. The incidence of iron deficiency found in poor class on basis of serum ferritin was 75%in first trimester and become increased to 80% in second trimester as during pregnancy depletion of iron stores occur because of maximum utilization of iron and physiological dilution of plasma. In third trimester incidence found 68% as ferritin level become stable or slightly increased and these results comparable with previous study[24]. In case of middle class group, serum ferritin was found depleted in 70% of women (at start of study), this percentage increased to 76% during second trimester and become 64%in third trimester. In upper class women, low ferritin levels were found upto 66%, 75%and 66% in first, second and third trimester respectively

CONCLUSIONS

From the present study it is concluded that serum ferritin is a good and reliable marker for detection of iron deficiency anemia during pregnancy as compared to hemoglobin especially for detection of latent iron deficiency stage and ferritin may be included in routine antenatal care programs for improving the health status of Pakistani women.

REFERENCES

1. Khurshid SR, Nusrat BJ, Nasir K. **Intravenous iron**

sucrose complex therapy in iron deficiency anemia in the pregnant. J Med Asso. 2003; 28:10-12.

2. Loanovo GN, Specter MSJ, Scott K, Rocky MD. **Prospective evaluation of clinical guideline for diagnosis and management of iron deficiency anemia.** Am J of Med. 2002; 113 (4):281-7.

3. Parveen K, Clark M. **Textbook of clinical medicine.** 5th Ed WB Saunders. 2003; 405-416.

4. Naghmi A, Hassan K, Mahmud S, Zaheer HA, Naseem L, Zafar T et al. **Comparison of serum ferritin level in three trimesters of pregnancy and their correlation with increasing gravidity.** Int J Pathol. 2007; 5(1) 26-30.

5. Heinrich HC. **Iron deficiency without anemia.** Lancet 1968;2: 460-63.

6. Verloop MC. **Iron depletion without anemia: a controversial subject Blood** 1970; 36: 657-71.

7. Jacob RA, Sand HH, Kleavy LM, Johnson LK. **Utility of serum ferritin as measure of iron deficiency in normal males undergoing repetitive phlebotomy.** Blood 1980; 56:786-91.

8. Beutler E. **Iron therapy in chronically fatigued non anemic women.** AM J In Med. 1960; 52: 378-94.

9. Bothwell TH. **Iron requirements in pregnancy and strategies to meet them.** Am J Clin Nut. 2000; 72:257-64.

10. Alan HD, Laurran N. **Current obstetric and Gynecologic diagnosis and treatment.** 9TH Ed Mc Graw Hill Companies, New York. 2003; Pp 409.

11. Lindsy HA. **Anemia and iron deficiency effects on pregnancy outcome.** Am J of Clin Nut 2000; 71:42-67.

12. Corriaga MT, Skikne BS, Finley B, Culter B, Cook JA. **Serum transferrin receptor for detection of iron deficiency in pregnancy.** Am J Clin Nut 1991; 54:1077-81.

13. Seshadri S. **Prevalence of micronutrient deficiency particularly of iron, zinc and folic acid in pregnant women in south East Asia.** Br J Nut. 2001; 85:87-97

14. Granier T, Langlois BE, Gallois B, Chevalier JM, Precigoux G, Santamrogia P et al. **Structural description of the active sites of mouse L- chain ferritin at 1.2A resolution.** J. Biol. Inorg. Chem. 2003; 8:1-2.

15. Rachel C, Regina F. **Role of ferritin in iron storage diseases.** J Bio. Inorg Chem. 2000; 6: 88-93.

16. Mast A. **Peripheral blood test in iron deficiency anemia.** Bloodline 2001; 1(2): 24-27.

17. Fai TK, Lao TT. **Hemoglobin and red cell indices correlated with serum ferritin concentration in late pregnancy.** Obs and Gyn 1999; 93: 427-31.

18. Karine T, Jennifer F. **An update on Anemia in less developed countries.** Am J of Tropic Med. 2007; 77(1): 44-51.

19. Hyder SMZ, Persson L, Chowdhury M. **Anemia and iron deficiency during pregnancy in rural Bangladesh.** Public Health Nut. 2004; 7:1065-70.

20. Marti A, Marti P, Comunian G Munoz S. **Prevalence of anemia during pregnancy result of Valencia anemia during pregnancy study.** Arch latinom Nut 2002; 52(1):5-11.

21. White D, Kramer D, Johnson G, Dick F, Hamilton H. **Ferritin bioassay.** Am J Clic Path. 1986; 72: 346-52.

22. Domenic V, Rouike CBP. **Methological and biostatistical foundation of clinical neuropsychology and Medicaland health disciplines.** 2nd Edit. Published in JCEN, TCN, and CN. 1992; 2: 556-567.

23. Karine T, Jennifer F. **An update on Anemia in less developed countries.** Am J of Tropic Med. 2007; 77(1): 44-51.

24. Kaneshige E. **Serum ferritin as an assessment of iron stores and other hematological parameters during pregnancy.** J Obs and Gyn. 1981; 57:238-42.

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Correspondence Address:
Dr. Ghazala Irshad
Senior Demonstrator,
Deptt. Of Biochemistry,
University College of Medicine and Dentistry,
University of Lahore. 1-KM Defense Road,
OFF Raiwaind Road, Lahore, Pakistan.
samkpk@hotmail.com

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