

SERUM FERRITIN AND HEMOGLOBIN LEVELS OF MOTHERS AND THEIR NEWBORNS*

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SUMMARY: Altinkaynak S, Alp H, Bastem A, Selimoğlu M, Energin M. (Department of Pediatrics, Atatürk University Faculty of Medicine, Erzurum, Turkey). Serum ferritin and hemoglobin levels of mothers and their newborns. Turk J Pediatr 1994; 36: 289-293.

In this study, hemoglobin, serum ferritin, serum transferrin, transferrin saturation, serum iron and total iron-binding capacity were measured in venous blood taken from 52 primiparous mothers approximately one hour before delivery and in cord blood from their newborns after birth. The mean maternal serum ferritin level was 12.9 ± 8.9 ng/ml. This value was lower than that of healthy women. The mean serum ferritin level of cord blood was 103.0 ± 54.1 ng/ml. While we found no correlation between maternal and cord blood hemoglobin values, we observed a significant positive correlation between serum ferritin values in maternal and cord blood. Only the serum ferritin levels of mothers whose iron stores had been depleted were significantly reflected in their babies' levels ($p < 0.001$). There was no statistically significant difference in other parameters ($p > 0.05$). It is concluded that serum ferritin levels, which are affected earlier than hemoglobin levels, should be measured for the diagnosis of occult iron deficiency. *Key words: hemoglobin, ferritin, mother, newborn.*

Iron components keep their balance in the body with construction and usage and can be categorized into two groups. The first group of components includes those having enzymatic and metabolic functions, of which hemoglobin is the most important. The second group comprises components related to iron supplementation and transportation.

Iron bound to apoferritin is stored as ferritin in iron stores. Ferritin and hemosiderin together comprise 20 percent of total body iron. Serum ferritin is mainly an intracellular protein and a useful indicator of iron stores. A serum ferritin level of 1 ng/ml reflects 8 mg of stored iron. Serum ferritin levels that are less than 10 ng/ml in children and 12 ng/ml in adults suggest that iron stores have been depleted¹⁻³.

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Iron deficiency anemia is the most commonly encountered type of anemia in childhood, even in developed countries. In our developing country, especially in our region, this problem clearly needs more attention. In our country, the nutritional status of pregnant women and children is inadequate; sensitive tests reflecting the amount of iron stores are affected by the iron status of the body before the hemoglobin level decreases. These tests are used to detect mild anemia in our country.

We planned this study to investigate the value of serum ferritin levels compared to hemoglobin levels for diagnosing occult iron deficiency in newborns and their mothers.

Material and Methods

This study included 52 primiparous mothers without complications and their neonates born at Atatürk University Faculty of Medicine Gynecology and Obstetrics Department between January and October, 1990. Blood samples were taken from mothers' peripheral veins one hour before delivery and from newborns' umbilical cords. Hemoglobin levels were measured by semi-automatic hematologic analyzer Cell. Dyn 1500; serum ferritin by Ferritin Enzyme Testing Kits of Medix Biotech Inc; and serum transferrin by Hitachi-705 autoanalyzer. The serum iron-binding capacity was calculated using the following formula: Total Iron Binding Capacity = Unsaturated Iron Binding Capacity + Serum Iron Level. Data were assessed by Student's t test, and linear regression analyses were made⁴.

Results

The fifty-two mothers in this study were between the ages of 18 and 39 years, with a mean age of 26 ± 5.3 years. The mean birth weight of the newborn infants was 3136 g (2500-4400 g), with gestational ages of 38-40 weeks. Twenty-seven of the newborns were female (52%) and 25 were male (48%). The ratio of girls to boys was 1.1.

Hemoglobin, serum ferritin, serum transferrin, transferrin saturation, serum iron and total iron-binding capacity levels from the venous blood of mothers and the cord blood of newborns are shown in Table I.

Newborns of mothers whose iron stores had been depleted (< 12 ng/ml) ($p < 0.001$) had significantly lower levels of serum ferritin (76.5 ± 27.7 ng/ml) as compared to the levels of newborns of mothers with adequate iron stores (153.2 ± 56.8 ng/ml) (Table II). Statistical differences between other parameters were not significant ($p > 0.05$).

Table I: Values Detected from Venous Blood of Mothers and Cord Blood of Their Newborns (n: 52)

	Mother X ± SD	Newborn X ± SD	Mother, Newborn	
			t	p
Hemoglobin (g/dl)	12.2 ± 1.4	16.0 ± 1.5	13.2	< 0.001
Serum Ferritin (ng/ml)	12.9 ± 8.9	103.0 ± 54.1	11.8	< 0.001
Serum Transferrin (mg/dl)	280.8 ± 31.3	205.1 ± 37.6	11.2	< 0.001
Transferrin Saturation (%)	12.4 ± 2.3	45.0 ± 10.5	21.8	< 0.001
Serum Iron (µg/dl)	42.6 ± 7.0	110.4 ± 10.6	38.4	< 0.001
Total Iron Binding Capacity (µg/dl)	348.1 ± 50.7	260.3 ± 53.7	8.6	< 0.001

Table II: Hemoglobin, Serum Ferritin Values and Other Parameters of Mothers Whose Iron Stores are Depleted (Group IIA), of Their Newborns (Group IIB), and of Mothers Who Have Adequate Iron Stores (Group IA) and of Their Newborns (Group IB).

	Group I A (n: 18)	Group I B (n: 18)	Group II A (n: 34)	Group II B (n: 34)	Group IB vs IIB	
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	t	p
Hb (g / dl)	13.1 ± 0.7	16.1 ± 1.3	11.6 ± 1.4	5.9 ± 1.6	0.1	> 0.5
S.Ferritin (ng/ml)	20.2 ± 12.1	153.2 ± 56.8	9.1 ± 1.7	76.5 ± 27.7	5.7	< 0.001
S.Transferrin (mg / dl)	279.0 ± 33.6	208.8 ± 30.4	281.8 ± 30.2	203.2 ± 41.2	0.2	> 0.05
Transferrin Sat (%)	14.4 ± 1.1	44.8 ± 8.1	11.3 ± 2.0	45.0 ± 11.7	0.1	> 0.05
Serum Iron (µg/dl)	49.2 ± 5.2	111.2 ± 11.3	39.2 ± 5.1	110.0 ± 10.4	0.2	> 0.05
T.I.B. Capacity (µg/dl)	348.3 ± 33.4	256.3 ± 38.4	348.1 ± 58.3	257.7 ± 60.6	0.3	> 0.05

Discussion

The incidence of iron-deficiency anemia is higher in developing countries and during pregnancy and childhood. Moreover, children of mothers with iron deficiency are at risk of developing iron-deficiency in early childhood. In diagnosing occult iron deficiency, serum ferritin measurements that show the status of iron stores provide accurate information^{2, 5-11}.

During pregnancy, the fetus' only iron source is the plasma iron of the mother. Even when the mother's reserve of iron is used up, the fetus can obtain sufficient iron for erythropoiesis from his mother. For that reason, hemoglobin levels of newborns are not affected by occult iron deficiency or empty iron stores of mothers^{3, 10, 12}. Although 34 of 52 mothers had empty iron stores, their babies had normal hemoglobin levels (15.9 ± 1.6 g/dl).

When iron deficiency develops, iron stores are depleted before hemoglobin levels significantly decrease. The most reliable and sensitive indicator of the mother's iron status is her serum ferritin level^{1, 10, 13}. In our study, the mean value of the mother's serum ferritin was 12.9 ng/ml. In some other studies, this level

ranged from 17.3 to 29.1 ng/ml^{8, 10, 12-15}. We concluded that our low values reflected irregular ingestion of iron by mothers during pregnancy and low socioeconomic levels in our region. Only six mothers in our study took iron regularly.

We found that the difference between the mean hemoglobin values of mothers and newborns was statistically significant ($p < 0.001$). While MacPhail et al¹² stated that there was a positive correlation between hemoglobin values of maternal blood and umbilical cord blood, other investigators stated the opposite^{9, 10, 15}. We did not see a positive correlation between them.

The mean serum ferritin values of the newborns' cord blood was 103 ± 54.1 ng/ml, which was similar to that cited in the literature^{6, 10, 12, 16, 17}. There was a significant positive correlation between the mean serum ferritin value of mothers

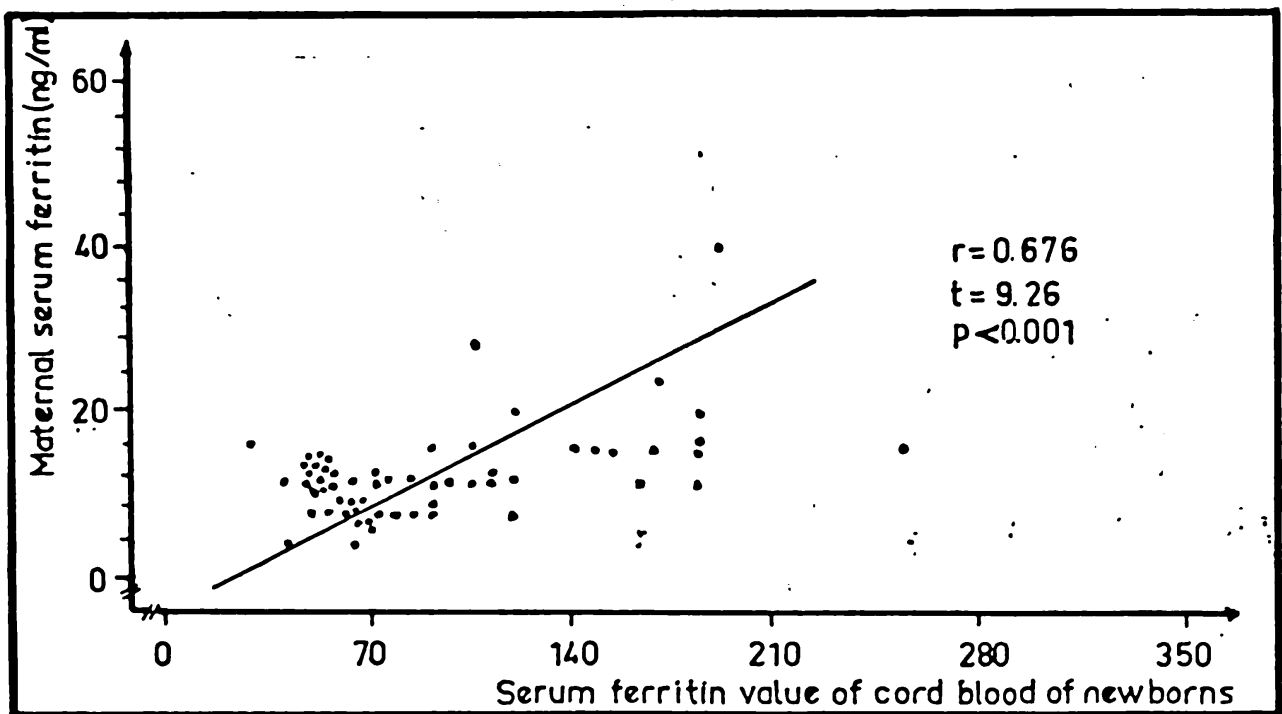


Fig. 1: Correlation between serum ferritin values in maternal and cord blood.

and of newborns-again similar to that cited in the literature^{9, 10, 13} (Fig. 1). In our study, only the serum ferritin levels of mothers whose iron stores had been depleted were reflected in their babies' levels ($p < 0.001$). We did not find such a statistically significant difference in other parameters, as shown in Table II.

In conclusion, because we found no correlation between the hemoglobin values of mothers and children, we recommend that serum ferritin levels, which are

affected earlier than hemoglobin, be measured for the diagnosis of occult iron deficiency.

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