RELATION OF MATERNAL AND CORD BLOOD SERUM FERRITIN

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SUMMARY

Iron status including Hb, S. Ferritin, S. Iron and TIBC was evaluated at parturition in 50 mothers and their term newborn infants. The mean maternal S. Ferritin was 18.8 ng/ml (range 4-90 ng/ml) compared to a mean of 96.47 ng/ml (range 20-290 ng/ml) in newborns. The Cord S. Ferritin and S. Iron levels decreased with the depletion of maternal iron stores.

INTRODUCTION

Iron deficiency is probably the most common nutritional disease all over the world. The incidence is much higher in developing countries and during pregnancy. India is considered to have the highest prevalence of nutritional anaemia in women. Between 60-80% of pregnant women have been found to be anaemic mainly due to iron deficiency (Baker and De Maeyer - 1979). The iron content of the newborn infant is an important source of iron for haemoglobin formation in the first few months of life since the iron content of milk is low. There are also reports on the development of iron deficiency anaemia in Indian infants at 6 months of age. (Gopalan et al 1974) S. Ferritin assay is a simple, sensitive guide of body iron stores in normal healthy adults and in those with iron deficiency and iron overload (Jacobs et al 1972) and in infants and children (Siimes et al 1974). In view of this we studied the effects of maternal anaemia and iron depletion on the foetal iron stores.

PATIENTS AND METHODS

Fifty pregnant women, coming from middle and low income group admitted to Govt. Lady Goshen Hospital, Mangalore contributed to this study.

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(age range 17-36 years, each had 1-6 pregnancies). All of them had a full term normal delivery. No patient had any bleeding during her pregnancy or was transfused with blood. None of these patients had any associated liver disease, malignancy or inflammatory conditions. Their babies were all at term and of normal weight.

When the mothers were admitted for delivery, blood samples were obtained for determination of Hb, S. Iron, total iron binding capacity (TIBC) and S. Ferritin. Similar tests were done on Cord blood samples.

Hb was estimated by the Sahli's method, S. Iron and TIBC were measured by colorimetric Batho phenanthroline method and serum Ferritin by Ferritin Enzyme Immuno-assay test kit for the quantitative determination of Ferritin in human serum. (medix biotech Inc. Test kit. M.B. - 1055 L-20, Lenicohn centre Drive, Foster city).

RESULTS

The laboratory findings are summarised in Table I. Average maternal Hb was 9.18 G/dl. (range 4-13 G/dl) and cord Hb was 15.86 G/dl (range 14-18 G/dl). In 41 (82%) mothers Hb was <11 G/dl and among these 41, S. Ferritin was <30 ng/ml (deficient iron stores) in 35 (84.4%) and < 15 ng/ml (depleted iron stores) in 25 (61%). Hb was > 11G/dl in 9 mothers (18%) and of these S. ferritin was <30 ng/ml in 6, (66%) and <15 ng/ml in 3(33%). There was a significant corelation between maternal S.Ferritin and Hb (r=0.489).

The mean maternal S. Ferritin was 18.8 ng/ml (range 4-90 ng/ml) and cord S. Ferritin was 96.47 ng/ml (range 20-290 ng/ml). The relation between maternal S. Ferritin and cord S. Ferritin was investigated (Table II). When the maternal S. Ferritin concentration was <10 ng/ml there was a positive correlation with cord S. Ferritin which was not statistically significant (r=0.199). When the maternal Ferritin levels were > 30 ng/ml the correlation coefficient was equal to 0.167 which shows negative correlation but again the relation was not stastically significant (P> 0.05). The relation of mat.S.Ferritin to cord S. Iron was investigated, as the maternal Ferritin increased, cord iron value also increased. There was a positive correlation between the two (r=0.695) which was stastically significant.

Table I
Different parameters of mothers and newborns (cord blood) at the time of delivery.

Parameters	Mean (range) for mothers	Mean (range) for newborns (cord blood)
Hb (G/dl)	9.18 (4-13)	15.86 (14-18)
S.Iron (µg/100ml)	120.78 (35-334)	206.56 (49-650)
TIBC (µg/100ml)	386.98 (106-692)	375.96 (128-608)
S.Ferritin (ng/ml)	18.8 (4-90)	96.47 (20-290)

Table II
Parameters of iron metabolism related to high and low maternal Ferritin concentration.

Group	No.	Maternal Ferritin (ng/ml)	Maternal Iron (µg/100ml)	Maternal Hb (G%)	Cord Ferritin (ng/ml)	Cord Iron (µg/100ml)	Cord Hb (G%)
Maternal Ferritin <10ng/ml	17	7.59 (4-8)	98.93 (40-334)	8.6 (4-11.6)	94.85 (8-241.6)	236.94 (90-650)	15.84 (14-18)
Maternal Ferritin 10-30 ng/ml.	24	16.94 (10-28.6)	114.6 (40-334)	9.35 (6-2.12)	90.52 (8-241.6)	213.11 (90-650)	15.70 (14-18)
Maternal Ferritin >30 ng/ml.	9	44.97 (34-90)	126.22 (73-287)	9.8 (7.13)	154.48 (73.4-290)	164.88 (49-351)	16 (14-18)

Table III
Maternal & cord S. Ferritin concentrations in relation to parity.

Parity	No.of cases	S. Ferritin maternal	ng/ml cord blood
Para 0	6 (12%)	33.53	97.41
Para 1 & 2	27 (54%)	18.67	100.92
Para >3 17	(34%)	13.85	89.11
Total	50 (100%)		

Table IV
Maternal and cord S. Ferritin in relation to maternal age.

Age Group	No.of cases	Mean Ferritin maternal	Ng/ml cord blood
< 30 yrs.	29 (58%)	22	99.73
> 30 yrs.	21 (42%)	14.42	92.00

Maternal ferritin levels were compared with maternal S.Iron. When maternal S. Ferritin was < 10 ng/ml there was a positive correlation with S. Iron (r=0.162), but it was not stastically significant. When maternal S. Ferritin was more than 30 ng/ml. the relationship with S.Iron was almost negligible (r=0.0042).

No correlation was found between the maternal S. Ferritin and the weight of the baby (mean baby weight 2.9 kg) and between foetal weight and cord S.Ferritin. No relationship was found between the weight of the placenta (mean weight 550 gms) and cord S.Ferritin.

In Table III the maternal S.Ferritin concentrations are related to parity. Maternal S. Ferritin level decreased with increasing parity. Though there was a slight decrease in the cord S.Ferritin of mothers of parity > 3, it was not statistically significant (P> 0.05).

The results were also analysed with respect to maternal age (Table IV). There was a slight decreased in the maternal and cord S. Ferritin with increasing maternal age, however it was not statistically significant (P>0.05).

DISCUSSION

During a normal pregnancy, approximately 1200 mg of iron is required to meet metabolic demands. About 500 mg iron is distributed to the fetus and placenta and hence lost at delivery and in the mother the basal iron losses and increasing Hb mass require an additional 700 mg. (WHO, 1972, Svanberg 1975). Iron requirement in the mother increases as pregnancy progresses, from 0.8 mg/day in the first trimester to 6-8 mg/day in the last month of pregnancy (Svanberg 1975). If iron reserves are inadequate at the beginning of pregnancy and/or iron intake is insufficient during pregnancy, iron deficiency may develop.

From conception until birth a normal foetus acquires 250-300 mg of iron (Burman 1974). During pregnancy the only source of foetal iron appears to be maternal plasma iron. It is believed that maternal iron is transferred through the placenta by active transport against a concentration gradient.

There are conflicting reports on the influence of maternal iron stores on foetal stores. (Rios et al 1975, Hussain et al 1977, Kelly et al 1978, Kaneshige 1980, Milman et al 1987, Bhargava et al 1989).

The biochemical indices of iron metabolism are elevated in cord serum. The serum iron was 171 percent of maternal value and is in agreement with the work of Rios et al (1975) and Kelly et al (1978). The cord serum Ferritin concentration of 96.45 ng/ml is 5 times the maternal level of 18.8 ng/ml. The same order of magnitude between maternal and cord ferritin was reported by Rios et al 1975, Hussain et al 1977, Kelly et al 1978 and Milman et al 1987. However the cord S. Ferritin levels were low as compared to Western values but greater than that reported by Bhargava et al 1989 from India. This may be related to lower iron stores in Indian mothers.

There was no direct correlation between maternal and cord S.Ferritin concentrations which is in agreement with the findings of Rios et al (1975), Hussain et al (1977) Kelly et al (1978) and Bhargava et al (1989). However when the patients were grouped according to whether the mother had low

or above average ferritin levels (Table II) there was a positive correlation when maternal S.Ferritin was low (<10 ng/ml) and negative correlation at higher levels (>30 ng/ml), which was not statistically significant.

When maternal S. Ferritin was correlated with cord S.Iron there was a positive correlation which was statistically significant. Thus the maternal iron store appears to have an effect on the Foetal parameters. A significant correlation between maternal and cord S. Ferritin was reported by Kaneshige (1980) and Milman et al 1987).

The frequencies of low cord ferritin values were similar at all levels of maternal ferritin, suggesting that other factors may also operate to control fetal ferritin concentrations.

As the maternal parity and age increased, there was a slight decrease in the cord S. Ferritin which was not stastistically significant.

No correlation was found between baby weight at term and cord or maternal S. Ferritin and S. Iron. Kelly et al (1978) reported a similar lack of correlation between cord S. Iron and term baby weight.

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