# IMPACT OF NUTRITION COUNSELLING AND SUPPLEMENTS ON THE MINERAL NUTRITURE OF RURAL PREGNANT WOMEN AND THEIR NEONATES

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**ABSTRACT**

*Sixty six young women from low and lower middle income groups selected from 8 villages of Ludhiana district in the first trimester of pregnancy were divided equally into Experimental (E) and Control (C) Groups, out of which only 60 subjects reached to the term. Folifer and calcium tablets were supplied to E group from second trimester till delivery along with, regular medical supervision and nutrition education about additional nutrient needs. Intake of all the nutrients were less than the Recommended Dietary Allowances in the E and C groups during the third trimester. However, the requirement of iron, calcium, folk acid, vitamin $B_{12}$ Vitamin D and ascorbic acid were met in group E due to supplementation. The Fe, Ca and Cu levels improved significantly during the third trimester in group E. The cord serum levels of Fe, Ca and Cu were also significantly higher in Group E. The relationships between maternal and cord blood levels of Fe, Ca and Cu were also significantly higher in Group E. The relationships between maternal and cord blood levels of Fe, Ca, Cu and Zn were significant, the co-efficients of correlation being 0.67, 0.92, 0.97and0.43, respectively. Serum Mn had an insignificant correlation with other minerals. The results indicated that 86.7, 94.7 and 44.8% variation ($r_2$) in cord serum Ca, Cu and Fe levels was determined by the corresponding maternal serum levels. It is concluded that regular medical supervision, supplementation and nutrition education significantly improved the nutriture of the pregnant women and their neonates.*

**Keywords:** *Neonates, Pregnant women, Serum minerals, Nutrition.*

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Anemia is a universal important public health problem, the prevalence in India being as high as 60-70%. Pregnancy is a period of great anabolic activity during which, rapid growth rate takes place especially during third trimester and the maternal requirements increase significantly. Acute iron deficiency anemia generally precipitates in third trimester and is responsible for the high maternal and infant mortality rate. Anemia induces irreversible changes in placental morphology, morphometry and histology. Such placenta has reduced iron content and total mitochondrial and cytoplasmic protein levels. The transfer of iron from mother to fetus is proportionately reduced, resulting in low fetal hepatic iron content(l).

The maternal serum calcium declines during pregnancy because of the physiologic hypoalbuminemia and dietary inadequacy(2). A decline in circulating zinc concentration begins early in pregnancy and continues to term(3). Similarly, requirements of other minerals like copper and manganese are expected to increase but how the maternal levels influence the neonatal level needs to be investigated.

## Material and Methods

Sixty six pregnant women in the age group of 18-28 years from low and lower middle income groups from eight villages of Ludhiana district were chosen and divided equally into Experimental (E) and Control (C) Groups. Out of 66 subjects, five subjects, two and three from Groups E and C, respectively, aborted in the third month of their pregnancy. One neonate died during the delivery time in Group E.

The number of visits to Subsidiary Health Cetre (SHC) made by each subject for medical check up were recorded both for Group E and C. The Group E was provided with medical supervision and nutrient supplements in the form of folifer tablets (60 mg iron and 500 $\mu g$ folic acid) and calcium (Sandoz) tablets (500 mg of calcium gluconate, 15 mg ascorbic acid, 1 $\mu g$ vitamin $B_{12}$ and 100IU of vitamin $D_3$) regularly from the fifth month onwards. Group C was provided medical supervision along with folifer tablets as per the Government practice.

A pamphlet 'Diet during pregnancy' was published in vernacular and distributed to the subjects of Group E in their first trimester of pregnancy. Nutrition knowledge given in the pamphlet was reinforced by four individual and three group contacts in Group E during the second and third trimesters of pregnancy.

A complete record of food intake of each subject was kept by the 'weighment of cooked food' method for two consecutive days during first and third trimesters of pregnancy. Whatever the subjects consumed during the day was weighed and one fifth of the total weight was kept aside. The food samples of each subject were stored in decontaminated polythene containers, homogenized and dried for biochemical analysis. The energy and crude protein (NX6.25) content of the diets were analysed by the AOAC(4) methods. The total lipids, vitamin $B_{12}$, folic acid, ascorbic acid and retinol equivalents of the diets were calculated from the Nutritive Value Tables of Indian Foods(5).

Minerals, *viz.,* iron, calcium, zinc, copper and manganese from food and serum samples were analysed in the Atomic Absorption Spectrophotometer (GBC-902) after wet digestion by the method of Piper(6). After birth of the neonates, the blood from the placental end of the cord was collected and the serum minerals listed above were analysed.

The results were analysed statistically in the computer PC-AT/386. Analysis of variance (ANOVA) was used to study the effect of nutritional supplements on the mineral status of the pregnant women during the third trimester and cord blood. Coefficient of correlation (r) was calculated to study ^he relationship between maternal mineral status during third trimester and cord mineral status followed by the coefficient of determination ($r^2$). values for determining levels of significance. Regression equations for predicting cord serum mineral levels from corresponding maternal serum levels were also developed.

## Results

There is an overall dietary inadequacy of all the nutrients in both the trimesters in the Groups E and C. There was no statistically significant difference in the dietary intake of nutrients in the two groups during first trimester. The average daily energy intakes during first and third trimesters in Groups E and C were 1565 and 1607 and 1897 and 1713 Kcal, respectively. The daily

protein intake during the corresponding trimesters in Groups E and C was 43.4 and 45.0 and 54.0 and 48.4 g, but it was still below the RDA. There was a significant ($p<0.05$) improvement in the intake of energy and protein of the Group E as compared to Group C during third trimester. There was also dietary deficiency of all the nutrients in both the groups during third trimester except copper and manganese. However, 11 e requirement of iron, calcium, vitamin $B_{12}$, folic acid, ascorbic acid and vitamin D was met only in Group E during the third trimester due to supplementation. The intake of copper and manganese was within the range of suggested Recommended Dietary Allowances in both the groups.

The data in *Table I* show that there was no statistically significant difference in the serum mineral levels in Groups E and C during first trimester. The average serum

**TABLE I**–*Serum Mineral Levels of Pregnant Women and Cord Blood*

| Subjects | Blood Analysis | | | | |
|---|---|---|---|---|---|
| | Iron (μg/dl) | Calcium (μg/dl) | Zinc (μg/dl) | Copper (μg/dl) | Manganese (μg/dl) |
| *Trimester I* | | | | | |
| Experimental | 47.6±0.8 | 8.9±0.04 | 72.8±0.08 | 72.6±0.2 | 0.7±0.04 |
| (n=33) | (20.1) | (3.9) | (9.4) | (16.2) | (6.6) |
| Control | 36.9±0.8 | 8.9±0.05 | 71.8±0.07 | 71.2±0.2 | 0.7±0.05 |
| (n=33) | (19.0) | (5.2) | (9.0) | (17.3) | (6.7) |
| *Trimester III* | | | | | |
| Experimental | 51.9±1.1 | 9.5±0.02 | 69.5±0.07 | 92.9±0.14 | 0.8±0.03 |
| (n=31) | (16.2) | (3.3) | (8.7) | (12.8) | (7.7) |
| Control | 38.3±0.9 | 8.9±0.03 | 61.3±0.06 | 82.2±0.2 | 0.8±0.01 |
| (n=30) | (23.2) | – | (9.05) | (13.0) | (7.9) |
| 'F' ratio | 151.2** | 116.3** | 4.05* | 128.7* | 3.8$^{NS}$ |
| *Cord blood* | | | | | |
| Experimental | 120.3±2.0 | 9.5±0.7 | 110.3±0.1 | 20.1±0.4 | 1.6±0.04 |
| (n=30) | (26.2) | (3.9) | (8.4) | (18.01) | (5.9) |
| Control | 108.7±2.5 | 9.0±0.1 | 108.9±0.1 | 17.7±0.4 | 1.6±0.07 |
| (n=30) | (29.4) | (4.9) | (8.9) | (20.1) | (6.9) |
| 'F' ratio | 22.4** | 62.9** | 1.55$^{NS}$ | 125.1** | 3.0$^{NS}$ |

All values are mean + S.E.
Figures in parentheses denote (CV%).
* Significant at 5% level.
** Significant at 1% level.
NS: Non-significant.

iron levels during the first trimester were 47.6 ± 0.8 and 36.9 + 0.80 ^g/dl among the pregnant women in Groups E and C, respectively. The corresponding levels during third trimester were 51.9 ± 1.1 and 38.3 ± 0.9 Mg/dl. A statistically significant ($p<0.01$) improvement in serum iron levels was found in Group E during the third trimester. The mean serum calcium levels during third trimester was significantly ($p<0.01$) elevated in Group E as compared to Group C. It may be attributed to the regular daily intake of 500 mg calcium (Sandoz) tablets starting from the fifth month till the delivery. There was, however, a fall in the serum zinc levels in the third trimester in both the groups but the difference in the two groups was statistically significant ($p<0.05$), the level being higher in Group E. On the other hand, there was an improvement in the serum copper levels during the third trimester being significantly ($p<0.01$) higher in Group E as compared to Group C. A small increase in the serum manganese levels was obtained during the third trimester in both the groups but no statistically significant difference was observed between the two groups.

As is evident from *Table I,* the average cord serum iron levels were 120.4 ± 2.0 and 108.7 ± 2.6 /µg/dl in Groups E and C, respectively. The average value of cord serum iron obtained in Group E was higher than Group C and the difference was highly significant ($p<0.01$). The cord serum calcium levels in the cord blood were 9.5 ± 0.06 and 9.0 ± 0.1 µg/dl in Groups E and C, respectively. The corresponding copper levels were 20.1 ± 0.4 and 17.7 ± 0.4 µg/dl. Differences of serum calcium and copper levels were statistically significant ($p<0.01$) between the two groups. The differences of serum zinc and manganese levels of cord blood between the two groups were, however, statistically not significant.

The results also revealed highly significant ($p<0.01$) coefficient of correlation between maternal and cord serum copper levels, the value of V being 0.97. This was closely followed by a strong correlation between maternal and cord serum calcium levels ($r = 0.92$). Maternal and cord serum iron and zinc levels had also positive and significant ($p<0.01$) correlation, the value of 'r' being 0.67 and 0.43, respectively. Maternal serum manganese had, however, non-significant correlation with the serum manganese levels in the cord blood.

### *Regression Equation for Predicting the Cord Serum Minerals from Maternal Serum Minerals*

The linear regression equations of cord serum mineral levels on maternal serum levels were worked out and are given below along with % variance ($r^2$). *Figure 1* depicts regression lines for maternal and cord serum calcium and iron levels.

$$Y_1 = 0.556 + 0.9481\ X_1 \quad r^2 = 86.72 \quad (a)$$

$$Y_2 = 0.002 + 0.2707\ X_2 \quad r^2 = 94.73 \quad (b)$$

$$Y_3 = 93.00 + 0.537\ X_3 \quad r^2 = 44.78 \quad (c)$$

$X_1$, $X_2$, $X_3$ represent maternal serum calcium, copper and iron.

$Y_1$ $Y_2$, $Y_3$ represent cord serum calcium, copper and iron.

The value of co-efficient of determination ($r^2$) in equation (a), (b) and (c) revealed that nearly 87, 95 and 45% of the variation in calcium, copper and iron in the cord blood was explained by the variations in the corresponding maternal levels, respectively. Cord serum zinc and manga-

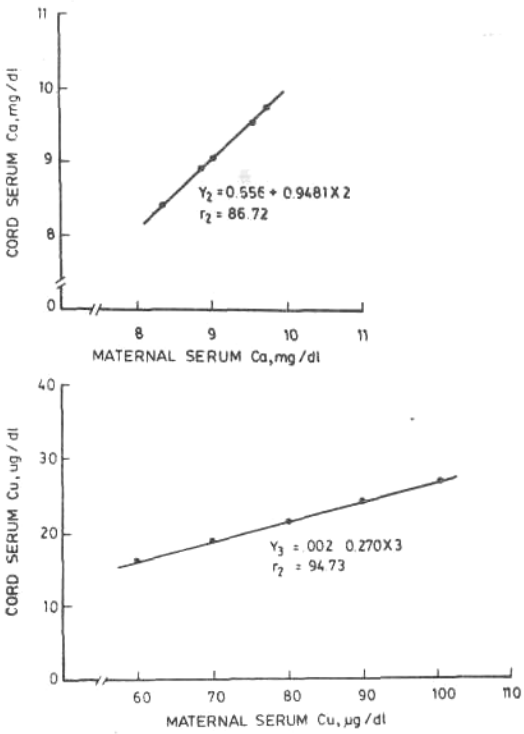


*Fig. 1. Line of Regression of the cord serum Ca and Cu on the maternal serum levels*

nese had non-significant per cent co-efficient of determination ($r^2$) controlled by maternal zinc and manganese, respectively.

It was observed that nutrition counselling resulted in regular visits of the subjects to a doctor for an antenatal check up and getting themselves vaccinated against tetanus during the second and third trimesters by Group E. None of the subjects in Group C visited the doctor for their antenatal check up during the first and second trimesters. All the subjects of Group E took folifer and calcium tablets regularly, while only 37% of the subjects of Group C consumed only folifer tablets during the third trimester, of whom only 30% took them regularly. It was also observed that 33% of the subjects of Group C did not visit the doctor even once during whole of their gestation period. The results also revealed that none of the subjects in the Group C took calcium tablets as these were not supplied free of cost in the subsidiary health centre.

**Discussion**

The present study shows that there was an improvement in the nutrient intake among the subjects in both the groups during third trimester due to increased requirement, being higher in Group E, but it was below the recommendations despite imparting nutrition education to Group E. Earlier studies(7-9) too indicated that the dietary intake of many nutrients fell short of ICMR recommendations in case of pregnant women.

The observed levels of serum iron of the pregnant women were below the normal rang£ of 65-75 /µg/dl as suggested by NIN(IO) indicating iron deficiency anemia among the subjects, though these values were significantly ($p<0.01$) higher in Group E as compared to Group C during the third trimester, but not significantly different during the first trimester. Literature reports(ll-13) too reported that in the treated women, serum iron values were higher towards the end of pregnancy as compared to the untreated groups. The data further indicates that despite nutrition education and iron supplementation, the maternal serum iron level in Group E remained unsatisfactory. It could be because of the very low pre-pregnancy iron status of the women.

The improvement in the levels of serum calcium was observed only in case

of Group E. It may be attributed to the regular intake of 500 mg calcium/day starting from the fifth month onwards till the delivery among the subjects in Group E. NIN(10) too reported that those pregnant women who did not get any type of calcium supplements during gestation had lower serum calcium levels (<9.0 mg/dl).

The data in *Table I* revealed that the levels of cord serum iron and calcium obtained in Group E were higher than Group A and the differences were highly significant ($p<0.01$). Many studies conducted earlier(14-16) have reported that iron status of the newborns was related directly to iron status of mothers. It was also observed that serum iron, calcium, copper, zinc in maternal blood were correlated significantly ($p<0.01$) to respective cord serum levels. Earlier studies(17) also reported that the cord serum calcium was correlated to corresponding maternal level.

The results also revealed that work on similar lines on a large sample is required to quantitate the relationships between maternal and cord blood levels.

A perusal of the data clearly indicated that there was gross dietary deficiency of almost all the nutrients in the two groups. The deficiency of nutrients was more marked during the third trimester especially in Group C. Inspite of the regular intake of folifer and calcium (Sandoz) tablets, the serum minerals status was lower than the normal mineral levels even in Group E due to poor pre-pregnancy status but was better than Group C. The present findings revealed that in the low socio-economic group, nutrition education coupled with medical supervision along with nutritional supplements are likely to result in better nutriture of pregnant women.

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