

# Copper Nutriture Amongst Pregnant Women in a Rural Area of India

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**Objective:** Assessment of copper nutriture amongst pregnant women of a rural area in India.

**Method:** A community based cross-sectional study was conducted amongst pregnant women (PW) in a rural block (randomly selected) of Haryana State, India. All the villages of the block were listed and six villages were randomly selected for the detailed study. Two hundred and eighty-two PW with gestational age 28 weeks and more were enrolled into the study. Data on age, gestational age, socio-economic status, and other demographic parameters were collected by utilizing a pre-tested semi-structured questionnaire. Copper nutriture was assessed by measuring the serum copper levels (by the atomic absorption spectrophotometric method) and the dietary intake of copper (by the 24-hr dietary recall methodology).

**Results:** The mean serum copper concentration of the study subjects was  $192.9 \pm 60.9$   $\mu\text{g/dl}$ . Only 2.7% of the PW had deficient copper nutriture (serum copper concentration  $< 80$   $\mu\text{g/dl}$ ). Dietary intake data revealed that 75% of the PW were consuming 50% and more of the recommended dietary allowance (RDA) for copper (2g). A significant positive correlation ( $p < 0.01$ ) was found between gestational age and serum copper levels.

**Conclusion:** The prevalence of copper deficiency amongst PW was 2.7%.

**Key words:** Copper nutriture, copper deficiency, pregnancy, dietary intake

Copper is an essential trace element important for growth and development. Its deficiency during embryonic and fetal development may result in numerous structural and biochemical abnormalities (1). Copper deficiency during pregnancy has been associated with low birth weight (2). Clinical manifestations of maternal copper deficiency include fetal death, early neonatal death, neurological abnormalities, abnormal lung development, and skeletal abnormalities (3). Limited community based data is available on the copper nutriture amongst pregnant women (PW) in India, hence the present study was conducted to obtain new comprehensive data.

## Material and Method

A community based cross-sectional study was

conducted amongst PW in a rural block (randomly selected) of Haryana State, India. All the villages of the block were listed and six villages were randomly selected for the detailed study. The study was undertaken during the months of November 2000 – October 2001. All PW with gestational age of 28 weeks and more, in the selected villages were enrolled for the study.

Socio-demographic profile of the PW was collected by undertaking domiciliary visits. Data were collected on the parameters of age, gestational age, socio-economic status, and other demographic parameters by utilizing a pre-tested semi-structured questionnaire. Informed consent from the PW was taken to participate after explaining the objectives of the study. Copper nutriture of the PW was assessed by measuring serum copper levels and the dietary intake of copper.

Blood from the antecubital vein was drawn from the subjects and collected in previously labeled polypropylene tubes. The samples were transported in ice packs to the central laboratory where they were centrifuged at 3500 rpm at 4°C for 30 minutes for separation of the serum. The serum was collected and stored at (-) 80°C until analysis. Copper concentration was determined in triplicates by the standard atomic absorption spectrophotometric method (4). Serum sample of known copper levels (Seronorms) was also measured with each batch of assay for internal quality control. Mean of the three values was considered as the serum copper concentration of the study subject. Serum samples with copper levels less than 80.0  $\mu\text{g/dl}$  were considered as the sign of copper deficiency (4).

The dietary intake of the individual subjects was assessed using the 24hr dietary recall methodology (5). The dietary intake of energy and copper was calculated by utilizing the data on Nutritive Value of Indian Foods published by the Indian Council of Medical Research (6).

The descriptive statistics was calculated for sample size, percentage, mean and standard deviation along with the range of the quantitative variables. To compare the mean serum copper levels amongst PW of different gestational age, one-way anova analysis of variance (ANOVA) was utilized. Multiple comparison test was carried out to identify significant difference in the mean

Table I. Distribution of pregnant women according to serum copper levels.

Serum Copper ( $\mu\text{g}/\text{dl}$ )	n	%	Mean $\pm$ SD	Range
Less than 80.0	7	2.7	55.6 $\pm$ 5.6	24.0 – 68.3
80 – 109.9	6	2.4	100.6 $\pm$ 8.2	90.0 – 106.7
110.0 and more	242	94.9	199.1 $\pm$ 55.7	110.0 – 433.3
Total	255	100.0	192.9 $\pm$ 60.9	

Table II. Nutrient intake of pregnant women according to the recommended dietary allowances during pregnancy.

Nutrient	RDA	Mean	< 25% of RDA	25-50% of RDA	50-75% of RDA	>75% of RDA
Energy (kcal)	2175	1524	1.7	18.3	41.7	38.3
Copper (mg)	2	1.6	1.7	23.2	28.4	46.7

Table III. Distribution of pregnant women according to the mean serum copper levels in different gestational age.

Gestational age (in weeks)	N	Serum Copper Level $\mu\text{g}/\text{dl}$ (Mean $\pm$ SD)
28 - < 32	128	182.0 $\pm$ 49.8
32 - < 36	85	201.8 $\pm$ 77.5
36 and more	42	208.0 $\pm$ 46.8
Total	255	192.9 $\pm$ 60.9

copper levels amongst the pairs of groups of PW with gestational age 28 - < 32 weeks, 32 - < 36 weeks and 36 weeks and more. The results were considered significant at 5% level of significance. The data collected was subjected to statistical tests utilizing the SPSS-7.0 version.

## Results

Two hundred and eighty-two PW with gestational ages of 28 weeks and more were included in the study. The mean age of the PW was  $22.9 \pm 3.3$  years. Almost 52% (n=146) of them were in the age group of 18-22 years. Eighty percent (n=225) of the PW were of gestational age 28-32 weeks. Blood samples could be taken from 255 PW but not from 27, due to non co-operation, fear, and other cultural reasons. The socio-economic profile and the other demographic characteristics of these 27 PW were similar to the other PW enrolled in the study.

The mean serum copper level of the study subjects was  $192.9 \pm 60.9 \mu\text{g}/\text{dl}$  (range = 24.0 – 433.3  $\mu\text{g}/\text{dl}$ ). About 2.7% of the PW were found deficient in copper levels (Table I). The mean daily intake of calories and copper amongst the study subjects was 1524 Kcal and 1.6 mg, respectively. Forty-seven percent of the PW were consuming 75% and more of the RDA for copper (7) (Table

II). Further analysis revealed that there was a significant positive correlation ( $p < 0.001$ ) between gestational age and serum copper levels. Pregnant women of 28 - < 32 weeks of gestation had lower serum copper levels in comparison to the PW of gestational age 32 - < 36 ( $p = 0.02$ ) and 36 weeks and more ( $p = 0.003$ ), respectively. However, PW of gestational age 32 - < 36 weeks and 36 weeks and more were comparable in terms of mean serum copper levels ( $p = 0.63$ ) (Table III).

## Discussion

Copper deficiency during embryonic and fetal development results in numerous structural and biochemical abnormalities. Copper deficiency during pregnancy is associated with low birth weight, fetal death, early neonatal death, neurological abnormalities, abnormal lung development, and skeletal abnormalities. Limited data is available on the copper nutriture amongst pregnant women (PW) in India.

The present study revealed that 2.7% of the PW had copper deficiency. The mean serum copper concentration was  $192.9 \pm 60.9 \mu\text{g}/\text{dl}$  (range = 24.0 – 433.3  $\mu\text{g}/\text{dl}$ ). Earlier studies have documented serum copper levels amongst PW between 93.6 – 308.8  $\mu\text{g}/\text{dl}$  (8 - 14). The serum copper

level of our study is in agreement with the earlier research data reported. A significant positive correlation ( $p < 0.001$ ) between gestational age and serum copper levels was found which is similar to earlier studies (9,15,16). It has been earlier reported that the increase in serum copper during pregnancy is mainly in bound form due to increase in the carrier proteins, ceruloplasmin; in response to stimulation by elevated levels of maternal estrogens. The mean dietary intake of copper amongst the PW was 1.6 mg/day. Earlier studies conducted in developing countries have documented an intake of copper between 1.2–1.5 mg/day (17,18). Only 2.7% of the PW had copper deficiency inspite of low intake of copper, possibly because of the increased copper retention during pregnancy as mentioned earlier.

The findings of our study revealed that only 2.7% of the PW had copper deficiency, indicating adequate copper nutriture amongst pregnant women in India.

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