Short Communication

Serum zinc levels amongst pregnant women in a rural block of Haryana state, India

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Introduction: Zinc deficiency is wide spread in developing countries. Its deficiency during pregnancy has been documented to be associated with growth retardation, congenital abnormalities, and low birth weight. Limited community based data is available on the serum zinc levels during pregnancy from Haryana State, India. Hence the present study was undertaken. **Methods**: A community based cross sectional study was conducted amongst 283 pregnant women with gestational age of 28 weeks or more. Each pregnant woman was inquired about her age, obstetric profile, socio-economic status, and other demographic parameters by utilizing a pre-tested semi-structured questionnaire. Blood from the antecubital vein was drawn to assess the serum zinc levels utilizing the atomic absorption spectrophotometer. Nutrient intake was assessed by the standard 24-hr dietary recall method. Statistical tests were applied to the data collected. **Results**: Mean serum zinc level was 61.1 ± 16.6 µg/dL. Almost 64.6% of the women had zinc deficiency. The dietary data revealed that 58.9 % of the women were consuming calories less that 75% of the recommended, indicating an overall poor food intake. Dietary zinc intake revealed that 86.2 % of the women were consuming less than 50% of the recommended (15 mg). A high prevalence of zinc deficiency (64.6%) was found amongst the pregnant women possibly due to the low dietary intake of zinc. There is a need to undertake multi-centric studies in various parts of the country to assess the serum zinc levels, magnitude of zinc deficiency and factors leading to zinc deficiency amongst pregnant women in India.

Key Words: Serum zinc levels, zinc deficiency, pregnant women, pregnancy, rural India

INTRODUCTION

Zinc deficiency is a major public health problem in South East Asia with nearly 95% of the population being at risk due to low dietary zinc intake.[1] Its deficiency has been associated with complications during pregnancy, growth retardation, congenital abnormalities, and low birth weight.[2] Zinc plays an important role in processes of gene replication, activation and repression, as well as DNA transcription and translation and protein synthesis during periods of rapid growth**,** emphasizing its importance during periods of gestation and fetal life.[3] An inadequate dietary intake of zinc before and during pregnancy might be a high risk not only for the women, but also for their fetus.[4,5] It has been documented that 82% of the pregnant women worldwide are likely to have inadequate dietary intake of zinc.[6] Limited community based data is available on the serum zinc levels during pregnancy from India. Hence, the present study was conducted to assess this in a rural block in India.

MATERIALS AND METHODS

A community based cross sectional study was conducted in a rural block from November 2000 to October 2001. All blocks in the district of Faridabad in the Haryana State, India, were enlisted and one block was randomly selected. Further, in the block selected, all villages were listed and six were randomly selected. All pregnant women with gestational age of 28 weeks or more were enrolled for the study. The gestational age of the women was calculated by inquiring about the last menstrual period of the women. The Ethical Committee of All India Institute of Medical Sciences, New Delhi, India, ethically approved the study. The objectives of the study were explained to the women and informed consent was obtained. Women willing to participate were enrolled for the study. Each eligible pregnant woman was inquired about her age, first date of her last menstrual period and socio-economic status by utilizing a pre-tested semi-structured questionnaire of the Udai Pareek classification.[7] This classification has been standardized to assess the socio economic status of rural populations. The scores are given on the basis of materialistic things the study subjects possess such as animals, type of housing (permanent: made of bricks or temporary: made of mud), owning farm lands, etc.

Non-fasting morning blood samples from the antecubital vein was drawn from the women and collected in previ-

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ously labeled polypropylene tubes. The tubes were transported in ice packs to the central laboratory. The blood samples were centrifuged at 3500 rpm at 4°C for 30 minutes, which separated the serum. The serum was collected in eppendorf vials and stored at (-) 80°C until analysis. Zinc level was determined in triplicates by the standard atomic absorption spectrophotometric method.[8] Serum sample of known zinc levels (Sero AS, Norway) was estimated with each batch of assay for internal quality control. Mean of the three values was reported as the serum zinc level of the study subject. For the batch of estimation, where the serum zinc level for the control was over or underestimated, the batch of estimation was repeated. Serum samples with zinc levels less than 66.0 µg/dL were considered as deficient zinc samples.[9]

Data on dietary intake of zinc and calories was collected utilizing the 24 hour dietary recall methodology.[10] The amount of raw food used for cooking the family meal, the total volume of food cooked and the volume of cooked food consumed by the enrolled woman was recorded using standard tools (utensils). The data so obtained were utilized for calculating the amount of raw food consumed and subsequently nutrient intake of women. The intake of zinc and calories was obtained by using the food composition data published in book entitled Nutritive Value of Indian Foods, published by National Institute of Nutrition, Indian Council of Medical Research (ICMR). Recommended Dietary Allowances suggested by the ICMR were utilized to assess the adequacy of nutrient intake.[11]

The data collected was subjected to statistical tests utilizing the SPSS-13.0 version.

RESULTS

Two hundred and eighty three pregnant women (mean age: 22.9 ± 3.3 years) with gestational age of 28 weeks or more were included in the study. The obstetric profile of the pregnant women revealed that 50.9, 32.5 and 16.6 percent of them were with gestational age of 28 to less than 32 weeks, 32 to less than 36 weeks and 36 weeks and more, respectively. The distribution of the pregnant women according to their socio-economic status is shown in Table 1.

Blood collection was undertaken amongst 257 women. There was a refusal from 26 pregnant women. The characteristics of these women were similar to the women who consented to provide blood sample for the study. The mean zinc concentration of the women was 61.1 ± 16.6 µg/dL. Almost 64.6% (n=166) of the study subjects had deficient serum zinc levels (Table 2).

Table 1. Distribution of study subjects according to their socio-economic status

Socio-Economic Status (SES)	n (%)
Lower SES	13 (4.6)
Lower Middle SES	115 (40.6)
Middle SES	117 (41.3)
Middle Upper SES	37 (13.1)
Upper SES	1 (0.4)

(Figures in parenthesis denote percentages)

Table 2. Distribution of pregnant women according to their zinc levels

Zinc level (µg/dL)	Pregnant Women n (%)	Mean ± SD (µg/dL)	Range (µg/dL)
< 66.0 (Deficient)	166 (64.6)	51.9 ± 9.7	18.3 – 58.3
≥ 66.0 (Normal)	91 (35.4)	77.7 ± 13.2	60.0 – 131.7
Total	257 (100.0)	61.1 ± 16.6	18.3 – 131.7

(Figures in parenthesis denote percentages)

Table 3. Distribution of pregnant women according to their dietary intake

Percent Intake of Recommended	Calories (kcal/day)	Zinc (mg/day)
< 50.0	43 (19.3)	194 (86.2)
50.0 – 74.9	89 (39.6)	29 (12.8)
75.0 and more	93 (41.1)	2 (1.0)

(Figures in parenthesis denote percentages)

Data on dietary intake could be collected from only 225 pregnant women. There was a refusal from 58 pregnant women due to cultural reasons. The dietary pattern of the women revealed that 70 % of them vegetarians. The dietary data revealed that 58.9 % of them were consuming calories less that 75% of the recommended, indicating an overall poor food intake. Dietary zinc intake revealed that 86.2 % of the pregnant women were consuming less than 50% of the recommended (Table 3).

Further statistical analysis revealed that no variable was found to be significantly associated with zinc deficiency. However, it was observed that the pregnant women with the calorie consumption of less than 50% of the recommended had a lower serum zinc level compared to the women who had a higher calorie intake (59.8±13.5 vs 63.5±15.1 µg/dL)

DISCUSSION

The present study revealed a high prevalence of zinc deficiency as 64.6% amongst pregnant women residing in rural areas of the block studied. A recent study reported a prevalence of zinc deficiency as 55.5 % in urban slums of Delhi with a lower cut-off of serum zinc levels (<60µg/dL).[12] Another study conducted in India reported a zinc deficiency prevalence of 22% amongst pregnant women of III trimester with a cut-off of only 50 µg/dL.[13]

The mean serum zinc level amongst pregnant women in the present study was 61.1 ± 16.6 µg/dL which was nearly similar to that reported by other studies.[13-15] The mean serum zinc level observed in the present study was lower than reported by few other studies.[16-19]

A recent study conducted in Bangladesh reported a lower serum zinc level amongst pregnant women as compared to our study (47±24 µg/dL).[20] The variation in the serum zinc levels of the studies may be possibly due to the variation in the laboratory estimations.

Although serum zinc levels cannot conclusively assess zinc deficiency, this biochemical indicator has been documented to be the best available marker of risk of zinc

deficiency as it reflects the dietary zinc intake.[21]

The high prevalence of zinc deficiency amongst pregnant women (64.6%) in the present study was due to inadequate dietary zinc intake. Studies conducted in India and other developing countries have also documented zinc deficiency in pregnant women due to less intake of dietary zinc.[18,22] The present study was undertaken in a community, which consumed a diet where the main source of energy was cereals. The presence of higher amount of phytates and dietary fiber in such diet, known to cause poor zinc absorption could be a major contributing factor for high prevalence of zinc deficiency in our study population.[23,24] Hemodilution during last trimester of pregnancy could be another factor for lower zinc levels amongst the pregnant women.[13,17,25,26] Poor pre-pregnancy nutritional status and low serum zinc levels could be other contributing factors leading to low serum zinc levels during pregnancy.

There is a high prevalence of zinc deficiency amongst pregnant women. There is need to undertake multi-centric studies in various parts of the country to assess the serum zinc levels and magnitude of zinc deficiency amongst pregnant women in India.

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AUTHOR DISCLOSURES

Priyali Pathak, Umesh Kapil, Sada Nand Dwivedi and Rajvir Singh, no conflicts of interest.

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印度 Haryana 州的鄉下地區懷孕婦女血清鋅含量

前言：在發展中國家，鋅缺乏普遍存在。有文獻指出，懷孕時期的鋅缺乏與胎兒生長遲滯、先天畸形及低出生體重有相關。在印度 Haryana 州，懷孕婦女血清鋅的基礎資料很有限，因此著手進行這個研究。方法：一個以社區為基礎的橫斷性研究，有 283 名妊娠週數在 28 週或以上的懷孕婦女參與。利用前測的半結構式問卷，詢問每名孕婦有關於他們的年齡、生產資料、社經狀況及其他的人口學參數。抽取前臂尺骨靜脈的血液，利用原子吸收光譜評估血清鋅含量。以標準 24 小時飲食回憶法評估營養素攝取量。用統計檢測收集的資料。結果：平均血清鋅濃度為 61.1 ± 16.6 μg/dL，幾乎 64.6%的婦女有鋅缺乏。飲食資料顯示 58.9%的婦女熱量攝取低於建議量的 75%，表示整體飲食攝取都差。有 86.2%的婦女膳食鋅攝取少於建議量(15 mg)的一半。研究發現在這些孕婦中 64.6%有鋅缺乏，這可能歸因於不足的膳食鋅攝取。需要在國內的不同地區的多個中心進行研究，以評估印度的孕婦血清鋅含量，釐清鋅缺乏的嚴重性及導致鋅缺乏的因子。

關鍵字：血清鋅量、鋅缺乏、孕婦、懷孕、印度鄉下。