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Physiology

A STUDY OF SERUM ZINC LEVEL IN MATERNAL AND UMBILICAL CORD BLOOD AMONGST PREGNANT WOMEN OF LOWER ASSAM WITH REFERENCE TO NEONATAL OUTCOME.

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ABSTRACT **Introduction and Objectives:** Zinc plays a very important role in physiological functions of the body which has been established in due course of time through a multitude of research works, animal experimentations etc. A different aspect of the functions of zinc is unravelled till date and the present study is one such maiden effort. This study was carried on in the Lower Assam region to find out the effect of socioeconomic status diet and external supplementation of zinc of pregnant mothers and their newborns.

Materials and Methods: It is a cross sectional study and a series of zinc estimations are made by double beam spectrophotometric methods. Blood sample was obtained under proper aseptic and antiseptic conditions, strictly stored under refrigeration, centrifuged and analysis done. The results obtained in parts per million and the data is compiled and presented statistically.

Result: It was seen that the maximum number of pregnant women were from lower socioeconomic group and the mean values of the highest and the lowest serum zinc level were observed in women of upper middle income group and lower income group, a finding which correlates with various studies carried on from time to time. This study was conducted from September 2017 to February 2018.

Conclusion: This is a maiden study aimed to reduce the morbidity and the mortality of the neonates and to reduce the burden in the society. It becomes possible through balanced diet and zinc supplementation of pregnant women. Intake of phytates should be very judicious so that the absorption of zinc from the gut is proper which otherwise will reduce the bioavailability of zinc in the body leading to difficult neonatal outcomes.

KEYWORDS : Zinc, Lower Assam, supplementation.

Introduction

Zinc is known from the good olden times. The interest in the systemic uses of zinc began with a laboratory accident during a series of wound healing studies by W. J. Pories in rats. Its significance in human health was identified later, when Prasad et.al, held zinc deficiency as the causative factor for the Zinc Deficiency Syndrome characterized by extreme degree of stunting, anaemia, hypogonadism, anorexia and heptosplenomgaly in young Iranian adults[1]. Nowadays, zinc as a micronutrient has many physiological roles in the body. Increase or decrease of it leads to various and subtle problems in the body. It is found concentrated in our bones, pancreas, kidneys, liver and retina. The proven benefits of zinc are seen in the improvement of athletic performance and strength, supports both male and female reproductive health as well as fertility, boosts immune function, exerts sensitivity to insulin, improves sleep, cognition, elevates mood and avoids depression, serves as an antioxidant by quenching the free radicals through its association with metallothionein.

Zinc as a mineral present in many foods, plays an essential role in construction of developing cells and DNA of the foetus during pregnancy. It plays a very important role in genetic transcription and replication. Therefore, a healthy intake of zinc as a part of well-balanced diet and as supplementation is crucial. Maintaining a healthy intake of zinc throughout pregnancy has been linked to premature birth. The daily requirement is 7mg – 13mg per day. It may go up to 20mg per day depending upon the person concerned.

Dietary principles which include avocados, well-cooked oysters, oatmeal, nuts, beans, soya, dairy products and eggs are the richest source of zinc. Wholegrain bread, fortified cereals and corn also provide zinc, but the phytates they contain can inhibit the absorption of zinc from other foods. To maximise the intake from other sources, regular eating of these foods are not advised at the same time.

Materials and Methods

The present study was carried on with the objectives to find out the effect of socioeconomic status and diet on the serum zinc level of the mother and to see whether external zinc supplementation bears any relation to the newborn. Hundred pregnant women of different socioeconomic status and their newborns were considered for the present study. Twenty women who were not pregnant were also allowed to participate in the study. They gave full consent to the study and a detailed history was taken. The patients were from Lower Assam region which also included various tribal groups. Babies of these mothers were fully examined after birth.

5 ml of umbilical cord blood samples were collected immediately after the delivery of the baby. 5ml of maternal blood samples were collected one hour before delivery under aseptic and the antiseptic conditions. Glass vials should not be used for storage of blood and serum because it might lead to chemical interaction between zinc present in the blood sample with the metallic constituents of glass. Sampled blood is allowed to clot in the room temperature. Serum obtained is subjected to centrifugation of 3000 rpm, for 15 minutes. The samples obtained are strictly labelled and hence it is ready for final zinc estimations by Flame Atomic Absorption Spectrophotometry (double beam).

Serum zinc levels were estimated in parts per million (ppm).

1ppm = 1mg/L =0.1mg% = 1µg/ml = 100µg/dl.

Results and Observations

The present study was carried on in the departments of Physiology and blood sample was collected from the department of Obstetrics and Gynaecology, Fakhruddin Ali Ahmed Medical College and Hospital. A total of two hundred and twenty serum zinc estimations were done. Data once collected was presented statistically.

Table 1. Distribution of Non Pregnant women according to the socio-economic status (SES):

SES			Serum Zinc Level (µg/dl)		
			Range	Mean	S.D.±
UI	2	10	78.6 – 96.8	87.71	9.1
UMI	4	20	71.3 – 109.0	94.23	14.39
LMI	7	35	56.7 – 120.3	86.70	22.02
ULI	5	25	57.0 – 93.02	79.37	11.99
LI	2	10	63.6 – 66.9	65.25	1.65
Total	20				

Approximate equivalent (SES category)	Per capita family income (₹/month)
Upper income group ----------	10000 and above
Upper middle income (UMI) ----------	5000 – 9999
Lower middle income (LMI) ----------	2000 – 4999
Lower income (LI) ----------	Below 2000

Among twenty non-pregnant women 35% belong to lower middle income group, 25% in upper lower income group, 20% in upper middle and 10% belongs to lower income group. It is observed that mean serum zinc level of lower income group is the lowest.

Table – 2. Distribution of pregnant women according to the socio economic status (SES)

SES	Numbers	Percentage	Serum Zinc level (µg/dl)		
			Range	Mean	S.D. ±
UI	8	8	25.8 – 70.8	50.81	17.75
UMI	16	16	35.4 – 75.9	57.48	12.72
LMI	24	24	22.6 – 83.5	54.22	16.86
ULI	49	49	27.9 – 67.6	42.91	11.31
LI	3	3	28.8 – 40.1	35.9	5.05
Total	100				

Among hundred pregnant women, 49% are from upper lower income group, 24% belongs to lower middle while 16% cases are from upper middle and 8% belong to upper socio-economic status. Only 3% of the study population are from lower income group. Highest mean serum zinc is found in women of upper middle income group. It is observed that mean serum zinc levels are coming down according to the socio-economic status from upper middle income to lower income group, lowest being in the lower income group, women in the upper socio-economic status show slightly lower mean zinc level.

Table – 3. Distribution of Non pregnant women according to the diet

Diet	Numbers	Percentage	Serum Zinc level (µg/dl)		
			Range	Mean	S.D. ±
Veg	14	70	56.7 – 109.0	79.14	16.22
Non-Veg	6	30	66.9 – 120.3	96.34	15.89
Total	20				

The above table shows 70% of women of the control group are vegetarian and 30% are non-vegetarian. The mean serum zinc levels observed in both the groups are79.14 µg/dl and 96.34 µg/dl respectively.

Table – 4. Distribution of pregnant women according to diet

Diet	Numbers	Percentage	Serum Zinc level (µg/dl)		
			Range	Mean	S.D.±
Veg	74	74	22.6 – 83.5	47.36	14.35
Non-veg	26	26	25.8 – 75.9	51.25	16.27
Total	100				

The above table shows that 74% of the pregnant mothers are vegetarian with mean serum zinc level of 47.36 µg/dl and 26% are non-vegetarian with mean serum zinc level of 51.25 µg/dl.

Table – 5. Cord serum zinc level according to the diet of the mothers.

Diet	Numbers	Percentage	Serum zinc level (µg/dl)		
			Range	Mean	S.D. ±
Veg	74	74	38.3 – 123.6	70.32	18.15
Non-veg	26	26	40.0 – 121.3	78.11	24.72
Total	100				

The above table shows that the cord blood of 26 new-borns of non-vegetarian mothers shows higher mean serum zinc levels than 74 new-borns of vegetarian mothers. But cord blood of each group significant higher mean serum zinc level than respective maternal zinc levels.

Table – 6.Mother's serum zinc level according to the supplementation of mother with zinc

Groups of Mother	Numbers	Percentage	Serum Zinc level (µg/dl)		
			Range	Mean	S.D. ±
Supplemented	18	18	29.5- 83.5	48.01	14.23
- Regularly	6	6	39.4- 83.5	59.35	14.43
- Irregularly	12	12	29.9- 64.1	41.5	10.69
Not supplemented	82	82	22.6- 82.6	48.64	14.99

The above table shows that 82% is not supplemented with zinc during pregnancy. Only 18% is supplemented with zinc through different commercial preparations containing different forms of zinc taken by the mothers. Out of 18 mothers only 6 of them took zinc regularly for different period of gestation. Mean serum zinc level of mother's blood of supplemented and non-supplemented group is 48.01 µg/dl and 48.64 µg/dl. Again, higher mean maternal serum zinc level is observed (59.35 µg/dl) in women who took zinc preparations regularly than the women who took zinc preparation irregularly (41.15 µg/dl).

Table- 7.Cord serum zinc level according to the supplementation of mother with zinc

Groups of mother	Numbers	Percentage	Serum Zinc level (µg/dl)		
			Range	Mean	S.D. ±
Supplemented	18	18	40.0- 111.0	73.03	17.49
- Regularly	6	6	64.8- 100.2	79.72	12.29
- Irregularly	12	12	40.0- 111.0	69.69	18.70
Not supplemented	82	82	38.3- 123.6	72.18	20.94

The above table shows that there is not much difference of serum zinc level in cord blood of supplemented mothers from that of non-supplemented mothers. Again, women who are regularly supplemented with zinc showed higher cord serum zinc level than cord serum zinc level of irregularly supplemented group.

DISCUSSION

A series of serum zinc estimations were carried out in pregnant women and their new-borns and in non-pregnant women as well. These studies were carried out to see whether there is any relation with socio-economic status, diet and supplementation with neonatal outcome. Zinc deficiency also alters circulating levels of a number of hormones associated with the onset of labour, and because zinc is essential for normal immune function, deficiency may contribute to systemic and intra uterine infections, both of which are the major causes of pre-term birth. Low birth weight and pre maturity are significant risk factors for neonatal and infant mortality and morbidity [2, 3].

In the present study, it was seen that the maximum numbers of pregnant women were from lower income group. Mean values of highest and lowest serum zinc level were observed in women of upper middle income group and lower income group. Though there was significant difference in serum zinc level between women of upper income group and lower income group, there is no serial fall in serum zinc level as observed according to socio-economic status. Cavdar, A. O. et. al, in his study reported lower serum zinc levels in low socio-economic pregnant women [4].

Non-pregnant control women showed higher values of zinc than pregnant women in all the socio-economic groups. But lower socio-economic status of women showed significantly lower levels than women of upper economic status.

The present study also showed that 70% of non-pregnant women and 74% of pregnant women are vegetarians. Higher mean serum zinc levels in non-vegetarian than vegetarians were observed, but was statistically insignificant ($p > 0.05$).In the non-pregnant women, significantly higher mean serum values was obtained in non-vegetarian ($p < 0.05$) women than in vegetarians. Again cord blood showed no significant difference between pregnant and non-pregnant women.

Though non-vegetarian, non-pregnant women showed higher serum zinc levels than vegetarian non-pregnant women; in pregnant women no significant difference was observed.

On detailed conversation with these non-vegetarian pregnant groups, have added lacto vegetarian diet. So it becomes obvious that the diet phytate have been retained which can reduce the availability of zinc absorption from the lumen of the gut.

It is evident from the present study that 18% of pregnant women who took preparations during pregnancy showed no significant difference in mean serum zinc level from non-supplemented group. But while subdividing the zinc supplemented group into regularly supplemented and irregularly supplemented, it was found that women who were regularly supplemented with zinc had significantly higher serum zinc values ($p < 0.05$) than irregularly supplemented women.

Two recent systematic reviews report meta analyses of randomised controlled trials of zinc supplementation during pregnancy conducted across five continents between 1977 and 2008, largely among women of low socioeconomic status on a variety of neonatal outcomes. Both the reviews concluded that zinc supplementation was associated with a

significant reduction in pre-term birth of 14% and mean serum zinc levels are found to be higher who were supplemented during regularly during pregnancy[5, 6].This study bears a relation with our study as well.

Jameson, S in 1993, estimated the zinc status in pregnancy and found that zinc supplementation given to mothers, who have low serum zinc level, gave favourable results and reduced the frequencies of pre mature birth, placental ablation, peri natal death and post maturity [7]. The effect of zinc supplementation on neonatal outcome was also studied by Golden, R.L.et.al., 1995, after administering zinc to the study group until delivery. Plasma zinc levels were significantly higher in zinc supplemented group and their neonates had greater birth weight [8].

Currently, UNICEF is promoting antenatal multiple micronutrient supplements which includes zinc, iron and folic acid for all pregnant women in developing countries, given that they are likely to have low micronutrient intake from diet alone [9]. This external supplementation has to be widely and regularly employed as because women are from a lower socioeconomic group and their diet is mainly vegetarians as shown from this study.

Conclusion

Most of the women of the present study are from low socioeconomic status whose zinc appeared marginal for pregnancy. This may possibly be due to high fibre and phytate intake, resulting from plant based diet which causes reduced zinc absorption. A firm degree of link between neonatal outcome and the maternal zinc level necessitates further effective and continuous studies excluding the other factors of low birth weight of the babies. This study contributes in its small way to overcome fetal morbidity and mortality. Supplementation is also important together with a balanced diet. Focus has been on iron and folic acid supplementation in this region but zinc intake too needs substantiate implementation either through supplementation or by other means. Our attempt has always been to lessen the burden of the family and the community at large.

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