ORIGINAL ARTICLE

Serum Zinc and Serum Protein Levels in Lower, and Upper/Upper Middle Socioeconomic Groups

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ABSTRACT

Aim: To assess the levels of zinc (Zn^{+2}) and proteins in sera (albumin, globulin, total proteins and albumin / globulin ratio) of different socioeconomic groups.
Methods: Hundred subjects in total were investigated. Out of these, 50 belonged to the lower socioeconomic (LSEC) group and 50 belonged to the upper / upper middle socioeconomic (USEC) group with equal distribution of gender. Estimation of serum zinc, serum total proteins and serum albumin were made by colorimetric methods whereas the determination of globulin in serum was done by deducting the value of albumin from total proteins in serum. The ratio, serum albumin/globulin (A/G) was also calculated. A comparison of all parameters was made between the two socioeconomic (SEC) groups.
Results: Results revealed significantly low serum zinc, serum proteins and serum albumin in LSEC class in comparison with USEC class. The A/G ratio in serum was also low in the LSEC class in comparison with USEC class and the difference was significant. Generally serum Zn^{+2} showed positive correlation with serum proteins in a significant manner.
Conclusion: The LSEC class has low serum zinc levels and low serum proteins levels and hence is at greater risk of developing diseases related to low serum proteins.
Keywords: Serum zinc, Serum proteins, socioeconomic groups

INTRODUCTION

Zinc (Zn^{+2}) is an important element present in all living organisms. It is essential for ideal buildup of humans and is present in almost all cells of living organisms.[1,2]After iron the most plentiful metal in organisms is zinc. A total of 2 – 3 g zinc is present in human body, out of which skeletal muscle contains 60% and bone contains 30%. All that remains appear in body fluids.[3,4]Deficiency of zinc manifests itself as malformed gonads in males, stunted growth, coarse skin, defective immune system, low intelligence level, and enlargement of liver & spleen.
All these presentations are corrected by supplementation of zinc.[5] Zinc works along with tRNA synthetase and tRNA synthetase is dependent on zinc. It is needed for replication of DNA and transcription indivision of cells.[3]The role of zinc in metabolism of nucleic acids and synthesis of proteins is crucial.[6]Proteins and nucleic acids synthesis are reduced in tissues which have less zinc.[7]

The largest content of zinc (188.5 – 341 mg / kg) is present in Oyster also known as shell fish. Zinc is present in optimum amount in meat, poultry and milk, whereas food obtained from plants is not considered as a good source.[8,9]A good content of Zn^{+2} is present in human milk.[10]The small intestine is the site of Zn^{+2}absorption after oral administration, and its excretion occurs through kidneys, skin and in feces[11].Many factors exert adverse effects on absorption of zinc of which phytate content in the diet is the most important.[12]Phytates are among the ingredients of foods; like vegetables, corn, cereals and rice, all of which are derived from plants. These phytates (inositol pentaphosphates and hexaphosphates) inhibit Zn^{+2}absorption.[13]Hence diets of plant origin may cause Zn^{+2} deficiency and proteins deficiency. Poor people of rural and urban areas frequently take these foods due to their comparatively low prices as compared to animal food[14].
Considering the above information it appears that individuals who do not take food of animal origin are prone to suffer from deficiency of zinc. Expensive animal food is not afforded by the poor people of Pakistan and hence they are at risk to develop deficiency of Zn^{+2} along with deficiency of proteins. This study was outlined to determine serum Zn^{+2} and proteins levels in low SEC, and upper/ upper middleSEC classes.

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MATERIALS AND METHODS

This study was carried out in physiology department of Services institute of medical sciences (SIMS), Lahore. The study type was cross sectional and analytical. Hundred medically fit subjects, ten to thirty years of age, with equal gender difference were selected. Fifty of them were taken from upper SEC class and 50 from lower SEC class. The subjects who had a monthly earning < Rs.3200/- equal to US$ 1.25 per individual on a daily basis were kept in the lower SEC class. The subjects having a monthly income of Rs.4000/- per individual along with ownership of their own house were kept in upper SEC class. The procedure was explained to the subjects and their consent was taken, followed by history taking and general physical examination. The subjects suffering from diabetes mellitus and hypertension, cigarette smokers and those who were on regular drugs and medicines including multivitamins were not included in the study.

From each individual 5 ml of blood was drawn by aseptic means. From the blood sample serum was extracted and stored at a temperature of four degree

celsius. Assessment of serum Zn^{+2} was done by colorimeter using kit made by spectrum[16]. Biuret reagent was used in calorimetric method for the determination of total proteins in serum[17]. Modified bromocresol essay was used in calorimetric procedure for the determination of total albumin in serum[18]. For the assessment of both, total proteins and albumin, in serum; Spectrum made kits were used. Serum A/G ratio was calculated. Statistical programme for scientific studies was applied for analysis of data; and determination of standard deviation (SD) and arithmetic mean for every parameter was done. Student's t – test was applied for estimation of significant difference between the different groups. Correlation of Pearson was applied for finding any correlation between Zn^{+2} and proteins in serum and a p-value of less than 0.05 was regarded significant.

RESULTS

Table 1 compares values of Zn^{+2}, albumin, globulin, albumin / globulin ratio and total proteins in sera of different SEC classes. Zinc in serum was significantly low in low SEC class than in upper / upper middle SEC class (p=0.000). Similarly, levels of total proteins and albumin in serum were lower significantly (p=0.000) in low SEC class in comparison with upper / upper middle SEC class. There was no prominent difference of serum globulin levels between the two SEC groups. Table 2 & figures 1-3depicts correlation of zinc in serum with albumin, globulin, albumin / globulin ratio and total proteins insera of the two socioeconomic classes. Correlation between zinc and total proteins in serum was significantly positive in the entire subjects of upper / upper middle SEC class. Similarly there was a significantly positive correlation of zinc and albumin in the same group of subjects.

Table 1: The comparison of Zn^{+2} and Proteinsin serum in the two SEC groups

Parameter	Upper / upper middle SEC group (n=50)	Lower SEC group(n = 50)	P value
Serum Zn^{+2}(µgm/dl)	111.05±13.66	77.28±14.90	0.000*
Serum proteins (gm/dl)	7.81±0.49	7.18±0.57	0.000*
Serum albumin(gm/dl)	4.61±0.51	4.01±0.44	0.000*
Serum globulin(gm/dl)	3.20±0.43	2.28±0.35	0.888
Albumin / Globulinratio	2.46±0.34	2.28±0.35	0.011*

Values expressed as Mean±SD * p<0.05–significant

Table 2: Correlation of serum $Zn^{+2}$with serum Proteins in the two SEC groups.

Correlation of serum zinc with	Upper / upper middleSEC (n=50)		LowerSEC(n=50)	
	r value	p value	r value	p value
Serumproteins(g/dl)	0.307	0.030*	0.349	0.013*
Serum albumin(g/dl)	0.458	0.001*	0.215	0.133
Serum globulin(g/dl)	-0.188	0.192	0.187	0.193
Serum A/G Ratio	0.272	0.056	-0.006	0.967

* p <0.05 ─ Significant

Fig.1: Significantly positive correlation between zinc and proteins in serum in total individuals of upper / upper middle SEC class

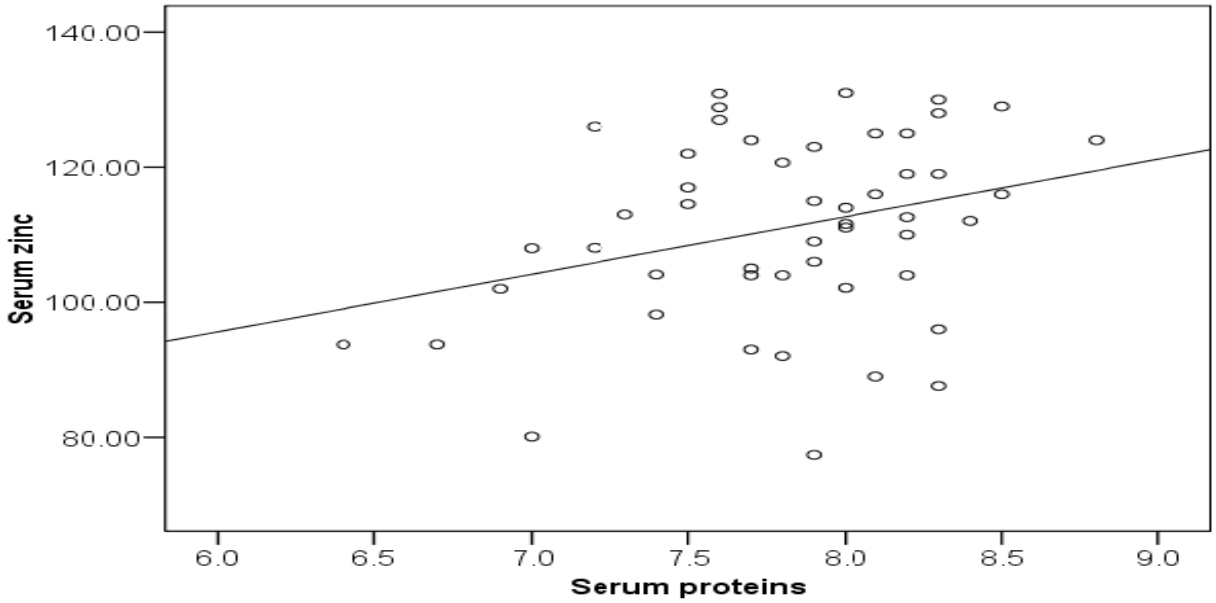


Fig. 2: Significantly positive correlation between zinc and proteins in serum in total individuals of lower SEC class

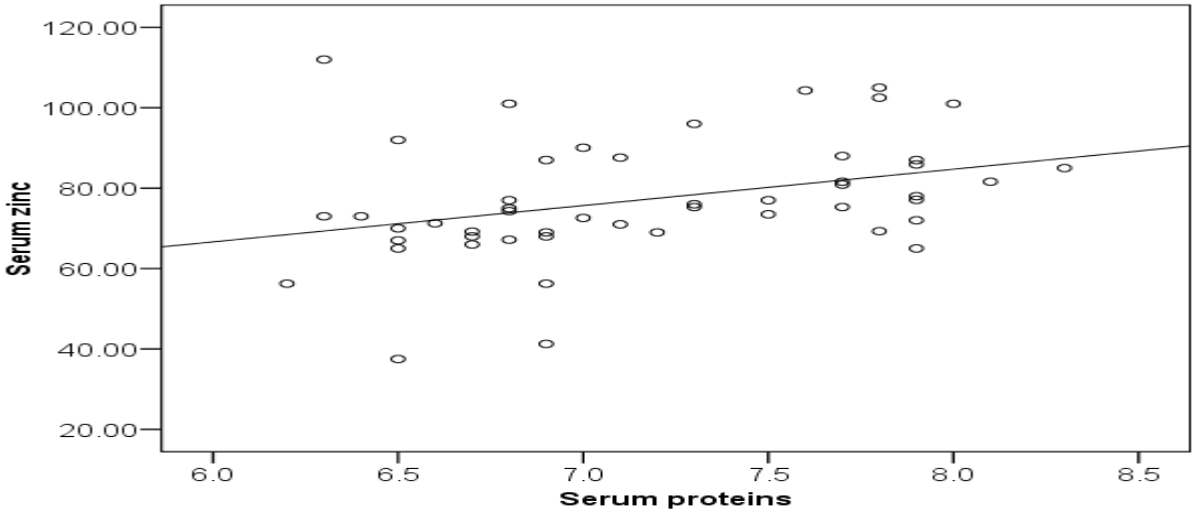
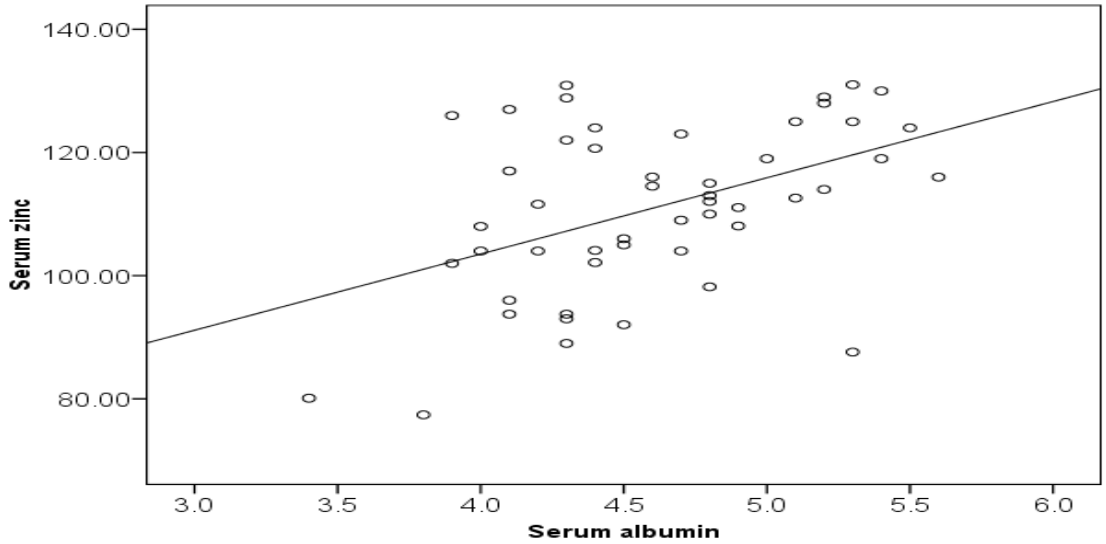


Fig. 3: Significantly positive correlation between zinc and albumin in serum in total individuals of upper / upper middle SEC class



DISCUSSION

This research work has been conducted to evaluate levels of zinc and proteins in serumin the different SEC classes. Significantly low serum zinc levels were found in the lower SEC class in comparison with the upper / upper middle SECclass. Albumin and total proteins in serum were significantly more in the upper / upper middle SEC class in comparison with the lower SEC class. The levels of globulin in serum were low in the lower SEC class than the upper / upper middle SEC class but the difference was insignificant. The serum albumin / globulin ratio was significantly more in the upper / upper middle SEC class in comparison with the lower SEC class. A study was conducted in female endurance runners, in which supplementation of $ZnSO_4$ was given to the subjects. It was found that it increased the levels of total proteins in their sera.[19] Similarly, impaired synthesis of proteins was corrected by supplementation of zinc in rats.[20]Singla et al found that severe malnutrition was related with low serum zinc levels, and zinc in serum with height according to age were significantly correlated. They also found that in the under-nourished children there were hypoalbuminemia and anemia which was related significantly with reduction of zinc levels in their sera.[21]Another study showed that zinc was significantly low in children suffering from protein energy malnutrition in comparison with healthy children (p value< 0.001). Serum zinc was even lower in kwashiorkor than in marasmus. It was further observed that malnourished children with history of acute or chronic diarrhoea had significantly low serum zinc (P value <0.001) than the children presenting with acute respiratory

infections.[22]Ahn et al found that decrease in intracellular level of zinc caused impaired synthesis of proteins which led to apoptosis of neurons progressing to Alzheimer's disease.[23] In our research we found a significantly positive correlation between zinc in serum, and proteins & albumin in serum. De-Vos et al found that reduced level of zinc in serum had a positive correlation with reduced albumin in serum in chronic alcoholic persons.[24] Balogh et al also observed that zinc and albumin levels in serum were significantly correlated.[25]

CONCLUSION

The LSEC class has low serum zinc levels and low serum proteins levels and hence is at greater risk of developing diseases related to low serum proteins.

REFERENCES

1. Zia M. Nutrition for Individual, Family and Community. Karachi: Caravan Book House; 2007.
2. Meydani SN, Barnett JB, Dallal GE, Fine BC, Jacques PF, Leka LS, Hamer DH. Serum zinc and pneumonia in nursing home elderly. Am J ClinNutr. 2007; 86:1167–1173
3. Mallikarjuna NR. Medical Biochemistry: 2nd ed. Delhi: New Age International (P) Limited, Publishers.2007.
4. John E, Laskow TC, Buchser WJ, Pitt BR, Basse PH, Butterfield LH, et al. Zinc in innate and adaptive tumor immunity. J Translat Med.2010; 8: 118.
5. Prasad, A.S. Zinc and immunity: Molecular mechanisms of zinc action on T helper cells. J Trace Elem Exp Med. 2003; 16(4):139-163.
6. Halstead JA, Smith JC, Irwin MI. A conspectus of research on zinc requirements of man. J Nutr. 1974;104: 345-78.
7. Winder F,Donney JM. Effect of iron and zinc on nucleic acid and protein synthesis in Mycobacterium Smegmatis. ;184: 742-743.
8. Osis D, Kramer L, Witrowiski E. Spencse H. Dietary zinc intake in man. Am. J. Clin. Nutr. 1972; 25: 582-588.
9. Davidson S. Zinc in the book human nutrition and dietetics. In: Davidson S, Passmore R, Brock JF,Trusswell AS. (Eds.) Human Nutrition and Dietetics. 6th ed. London: Churchill Livingstone; 1975.
10. United States Department of Agriculture (USDA), Agricultural Research Service. USDA nutrient database for standard reference, release 24. USDA.2011.[internet]. Available at:https://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/SR24/nutrlist/sr24a309.pdf
11. Weigand E. Kirchgessnsr M. Total true efficiency of zinc utilization, Determination and homeostatic dependence upon zinc supply status in young rats. J Nutr.1980; 110:469-480.
12. Miller LV, Nancy F, Krebs,Hambidge K M. A mathematical model of zinc absorption in humans as a function of dietary zinc and phytate. J Nutr. 2007; 137(1): 135-141.
13. Lonnerdal B. Dietary factors influencing zinc absorption. J Nutr.2000; 130:1378S-1383S.
14. Rosaldo JL. Zinc deficiency and its functional implications. SaludPublica Mex. 1998; 40: 181-188.
15. Pakistan Economic survey. Government of Pakistan. Ministry of Finance. 2009-2010[internet]. Available at: http://www.finance.gov.pk/survey_0910.html
16. Johnsen O, Eliasson R. Evaluation of a commercially available kit for the colorimetric determination of zinc in human seminal plasma. Int J Androl.1987; 10(2): 435-440.
17. Gornall AG, Bardawill CJ, David MM. Determination of serum protein by means of the biuret reagent. J Biol Chem. 1949;177(2):751-766.
18. Doumas BT, Watson WA, Biggs HG. Albumin standard and the measurement of serum albumin with bromocresol green. ClinChimActa. 1971; 31: 87-96.
19. Nishiyama S, Inomoto T, Nakamura T, Higashi A, Matsuda I. Zinc status relates to hematological deficits in women endurance runners. J Am Coll Nutr.1996;15(4):359-63.
20. EharaY, Yamaguchi M. Zinc stimulates protein synthesis in the femoral metaphysical tissues of normal and skeletally unloaded rats. Res. Exp. Med.1997;196(6): 363-372.
21. Singla PN, Chand P, Kumar A and Kachhawaha JS. Serum, zinc and copper levels in children with protein energy malnutrition. Indian J Pediatr. 1996; 63(2):199-203.
22. Ahmed TM Tariq M. Serum zinc level in children with malnutrition. J PediatrGastroenterol&Nutr. 1998; 27(2): 257.
23. Ahn YH, Kim YH,Koh JY. Depletion of intracellular zinc induces protein synthesis- dependent neuronal apoptosis in mouse cortical culture. Exp. Neurol. 1988; 154(1):47-56.
24. De Vos, Song C, Lin A, Demedts P, Wauters A, Neels H, et al .Lower serum zinc in relation to serum albumin and proinflammatory cytokines in detoxified alcohol-dependent patients without apparent liver disease. Neuropsychobiology. 1999;39(3):144-150.
25. Balogh Z, El-Ghobarey AF, Fell GS, Brown DH, Dunlop J,Dick WC. Plasma zinc and its relationship to clinical symptoms and drug treatment in rheumatoid arthritis.Ann. Rheumat. Dis.1980;39: 329-332.