ORIGINAL ARTICLE

The Normal Range of The Trace Element Zinc In Human Adults of Bangladesh: A Preliminary Study

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Abstract

The trace element zinc in whole blood of healthy adults of Bangladesh were studied by the method of atomic absorption spectrophotometry. As a greater proportion of the people of Bangladesh have lack of knowledge regarding nutrition, subjects were chosen from two different socio-economic background. Similarly the age range of the subjects were between 18 to 45 years. This was to see the existance of any age difference. The obtained mean ± 3SE for zinc were 112.3 ± 9.63µmol/L in males and 109.27 ± 7.29 µmol/L in females. There being no significant sex differences.(P>0.4). Between the urban and rural population no significant difference was observed. Similarly no difference was bserved between the age groups. In the present study of the trace element in blood the effect of nutrition was negligible though the subjects were chosen from two different socio-economic backgrounds.

Introduction

The role of trace elements in health and disease is an extremely important area of research, mainly because of a better understanding of their roles. Micro- nutrients, both organic (vitamins) and inorganic (trace elements) play number of roles in metabolism, as co-enzymes, cofactors or prosthetic groups of enzymes, hence they are necessary for the utilization of protein, amino acids, carbohydrates and fats. Deficiency develops by a disparity of requirement and provision of trace elements. With the development of new techniques and accurate measurement of trace elements in food and biologic specimens, critical functions of elements are also determined. It has become increasingly evident that a marginal deficiency of a number of trace elements including zinc, copper and selenium is fairly common even in affluent countries.[1]

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Knowledge of the normal levels in human tissues and body fluids is indispensable to detect any alteration resulting from inadequate intake of trace elements through the diet, disease conditions, or environmental pollution.[2]

Zinc is an essential element, it acts as a co-factor of many enzymes[3]. Nutritional deficiency of the trace element zinc has been reported to cause various disabilities in humans; these include growth retardation, deformed bone formation, diabetes mellitus, hypogonadism, anemia, diarrhea, altered behavior etc[4]. Bangladesh has a poor educational background and hence the knowledge and awareness about nutrition is greatly lacking. A great proportion of its population is victim of malnutrition especially related to trace elements[5]. Research works on trace elements carried out at different times in Bangladesh are related to specific diseases and conditions like pregnancy and malnourishment, e.g. Kwashiorkor

So far no reference range for the essential trace elements like zinc has been established for the healthy adults of Bangladesh. Also the variations of such trace elements due to different socio-economic status and urban rural living conditions have not been studied. The

establishment of blood normal ranges for zinc is necessary because the ranges vary considerably between global populations.

To study the trace element level of zinc apparently healthy adults comprising equal numbers of males and females having their ages between18-45yrs were selected from the urban area of Dhaka city and rural areas of Gazipur District. The urban subjects were chosen to represent a higher socio-economic background in contrast to the rural subjects with a lower socio-economic background. The blood samples were withdrawn with the written consent of each subject after a brief medical and dietary history followed by a clinical examination. Subjects having anemia, asthma, hypertension and previous history of jaundice were excluded from the test. The blood samples so collected were preserved at -20 degree Celsius for few days Subsequently after acid digestion the trace elements were estimated by the method of atomic absorption spectrophotometry.

Subjects

50 males and 50 females were grouped into three age groups

Group I was formed by 16 subjects having their ages in between 18~25 yrs.

Group II was formed by 20 subjects having their ages in between 26~35 yrs.

Group III was formed by 14 subjects having their ages in between 36~45 yrs.

Materials, Methods & Equipment

Water

All water used was doubly deionised distilled water stored in acid washed polyethene container to make completely metal-free. Blood sample tubes, pipette tips and glass wares were soaked in 20 % nitric acid for at least 24 hrs then washed several (6) times in doubly deionised distilled water and oven dried. All the items were stored in polyethene bags with their tops tied.

Blood sampling

Blood samples were taken by 5 ml or 10 ml disposable plastic syringes with steel needle. Samples were immediately transferred to acid washed glass containers containing 200 µl of 10% EDTA and mixed carefully so that blood did not come into contact with the cap of the container as caps are unstable to acid treatment and could therefore, not be rendered metal-free.

Chemicals

"Suprapur grade" nitric acid and certified Atomic Absorption Standard Reference Solutions.

Atomic Absorption Spectrophotometry.

Standards, samples and blanks for estimation of zinc were aspirated into a PERKIN ELMER 560 Atomic Absorption Spectrophotometer

Method

Each blood sample was digested by wet digestion method with 2ml of concentrated nitric acid for 24 hrs at room temperature and afterwards in sand-bath by gradually increasing the heat. Most of the acid was evaporated and the residual solution was diluted with deionised water and filtered through Whatman's ashless filter paper (41) into 10 ml volumetric flasks. Blanks containing 2 ml of acid and anticoagulant were similarly evaporated and subsequently diluted. To avoid the possible clogging of the aspirating tube of the spectrophotometer each digested blood sample were filtered through ashless filer papers. The solution thus became five times diluted.

Zinc Standard

Standard solutions were freshly prepared during each measurement by dilution from stock certified Atomic Absorption Standard Reference Solution obtained from Fisher Scientific Company U.S.A. Standard solution of different concentrations (0.1, 0 4, 0.6, & 0.8 ppm) were prepared from the stock 1000 ppm solution after proper dilution with deionised distilled water.

Determination of normal range

25 non fasting clinically healthy males and 25 females (18~45 yrs) were chosen as subjects for the normal range from the residents of a colony (Gazipur area).and each subject was of average socio-economic status and lived in an area of relatively low atmospheric pollution. In a similar manner 25 clinically healthy males and 25 females were selected from Dhaka city dwellers During each run on the atomic absorption spectrophotometer two previously calibrated aqueous controls of different concentration were aspirated into the instrument after aspiration of the treated blood standards. If the calculated value of each came within the pre determined mean value ±2SD then that part of the run was considered in control.

Results

The results obtained in this study are presented in tabulated form. Table-1 shows the results in the male population of two (urban &rural) regions. Table-2 shows the results in the female population of two regions.

Table I-Blood zinc level (mean ± 3SE) in urban and rural male population

Element Zinc	Urban (50)	Rural (50)	t-value	*P-value
Zn^{2+} µmol/L	109 ±13.8	115.6 ± 13.2	1.03	P> 0.3

Table II-Blood zinc level (mean ± 3SE) in urban and rural female population.

Element Zinc	Urban (50)	Rural (50)	t-value	*P-value
Zn^{2+} µmol/L	111.1 ± 10.8	107.4 ±9.6	0.76	P> 0.4

Discussion

The nutritional importance of trace-elements have been established during the last few decades Bangladesh has a poor educational background and hence the knowledge and awareness about nutrition is greatly lacking .The trace-element zinc in whole blood for each individuals were estimated by the method of atomic absorption spectrophotometry because precise and accurate determinations can be made with this technique at a relatively low cost. The effects of age, sex and socio-economic background on the trace-element zinc were evaluated.

In this regard 50 healthy adult males and females with a higher socio-economic living standard were chosen from the urban area of the Dhaka city and 50 adult males and females were chosen from Gazipur district with a lower socio-economic back-ground. A brief clinical examination was done prior to their selection to exclude anemia, jaundice and hypertension. A brief dietary history was also obtained. A written consent was taken from each subject.

The mean ± 3 SE for the trace element zinc in whole blood of healthy adults was established. In the age limit of 18-45 years and urban-rural population as a whole the value-- obtained for zinc were 112.3 ± 9.63 µmol/L in males and 109.27 ± 7.29 µmol/ L in females, showing no significant differences between the sexes (P> 0.4) Between the urban and rural population no significan9.63t difference was observed. Similarly no difference was observed between the age groups.

The mean ± 3SE for the trace element zinc in whole blood of healthy adults was established. The main contributions from this study are summarized as follows:

1. For zinc in the age limit of 18~45 years and urban-rural population as a whole, the values obtained were 112.3 ± 9.63 µmol/L in males and 109.27 ± 7.29 µmol/L in females, showing no significant differences between the sexes (P>0.4). Between the urban and rural population no significant difference was observed. Similarly no difference was observed between the age groups.

2. In the present study of the trace element in blood the effect of nutrition was negligible though the subjects were chosen from two different socio-economic backgrounds. Similarly no age, sex or urban-rural difference was observed.

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