Essential Trace Element Levels Among Apparently Healthy Geriatrics In A Semi-Urban Community In Nigeria.

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ABSTRACT: This study was designed to assess the selected trace element levels among apparently healthy geriatrics (test) in Ekpoma and compare it with levels among healthy young adults (control). Blood samples were collected from the study population using standard techniques. The serum trace element levels were then determined using atomic absorption spectrophotometer. Our result showed that there was a significant increase in selenium and chromium levels in geriatrics when compared with control ($P < 0.05$). there was a non significant decrease in serum Manganese and Zinc levels in geriatrics when compared with control. The serum copper and magnesium levels were higher in geriatrics when compared with control, however, this was not statistically significant ($P > 0.05$). It can therefore be concluded that apparently healthy geriatrics in Ekpoma have adequate essential trace element intake when compared to the younger population.

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INTRODUCTION

The interest in trace element research in clinical medicine has become an exciting frontier, during the last two decades the number of publications on this subject has progressively increased (McCall et al., 1971). They are essential elements needed in minute quantities for the proper growth, development and physiology of the human body (Goldstein, 1990). Trace elements can either be essential or non essential. Essential race elements are those that are required by an organism to maintain normal complex metabolism (e.g. metalloproteins) which are required in enzymatic activities and can play structural role in connective tissues or cell membranes. Non-essential trace elements are considered toxic and are not required for physiologic processes. Without essential elements the organism can not complete its life cycle or achieve normal healthy growth. The levels of these elements in biological fluid are affected by environmental, dietary and age factors. There deficiency results in suppression of both cell mediated and humoral immunity, this leads to increased susceptibility to infection and increased morbidity and mortality. Additionally infections aggravate trace element deficiency by reducing nutrient intake, increasing losses and interfering with utilization by altering metabolic pathways (Calder and Jackson, 2000). With ageing a variety of changes are observed in the immune system, which translates into less effective, innate adaptive immune responses and increased susceptibility to infections (Field et al., 2000). Supplementation with essential trace elements like selenium, copper, zinc, magnesium, chromium as well as with antioxidants such as vitamin C and E can counteract potential damage caused by reactive oxygen species to cellular tissues and modulate immune response. Supplementation with trace elements can modulate cell mediated immune response to pro inflammatory Th2 cytokine regulated response with enhanced innate immunity (Romicu, 2005) and maintenance of metabolic homeostasis in human body (Maugh, 1973). However, all essential trace elements become toxic when their concentration becomes excessive, usually this happens when the levels exceed 40-200 folds those required for correct nutritional response (el-Yazigi, 1991). The principal routes of excretion being through feaces, sweat, urine, hair and nails.

MATERIALS AND METHODS

Study Area

This study was conducted in Ekpoma, a semiurban community in Edo State Nigeria. This community lies between longitude 05^0 04^0E and latitude 05^0 04^0N and 05^0 43^0N (CSSR, 2007) with

an estimated population of over 67,000 inhabitants (NPC, 2007).

Study Subjects

A total of 680 apparently healthy geriatrics and a total of 190 young adults were recruited for this study after obtaining ethical permission from an ethical review board and appropriate informed consent from the subjects. The recruited participants were appropriately age and sex matched and were grouped into test (60-90years) and control groups (apparently healthy younger age group between 20-25 years).

Sample Collection/Analysis

Blood samples (5mls) were collected by venepuncture into a plain container. The samples were spun in a bucket centrifuge at a speed of 2500rps to separate serum from red cells. The serum obtained was stored in a chest freezer at a temperature of -20^0C. Serum trace elements (copper, zinc, chromium, magnesium and selenium) levels were determined by atomic absorption spectrophotometer technique as described by Kaneko (1999).

Data Analysis

Data obtained was analyzed using SPSS version 17 statistical soft ware package. Results were expressed as mean±SD and a p value of <0.05 was considered significant.

RESULTS

A total of 860 serum samples were analyzed. The samples were pooled from 670 apparently healthy geriatrics and 190 apparently healthy young adults. As shown in Table 1, the mean serum manganese, zinc, selenium and copper levels in geriatrics were 66.34±3.58ug/dl, 128.00±10.98 ug/dl, 68.94±3.42ug/L and 69.37±2.86 respectively. There was no statistically significant difference between most serum trace element levels and control (P > 0.05). However, a statistically significant increase in serum selenium and chromium levels when compared with control (P < 0.05) was observed. Table 2, revealed the serum trace element profile in male and female geriatrics. There is however, no significant difference in serum trace element level in male and female geriatrics.

Table 1: Sex Related Distribution of Serum Trace Metal Levels in Geriatrics

Serum Parameters	Geriatrics N = 670	Control N = 190
Mg (mg/L)	12.45±0.89	12.41±0.57
Zn (ug/dl)	128.00±10.98	131±13.39
Mn (ug/dl)	66.34±3.58	66.89±4.86
Cu (ug/dl)	69.37±2.86	69.05±3.24
Se (ug/L)	*68.94±3.42	66.00±4.92
Cr (ug/dl)	*68.52±4.35	62.63±4.99

Results are expressed as mean±SD, P <0.05 was considered significant compared with control

Table 2: Sex Related Distribution of Serum Trace Element Levels

Parameters	Male (N = 500)	Female (N = 190)
Mg (mg/L)	12.54±0.86	12.18±0.93
Zn (ug/dl)	129.00±11.24	125.00±9.99
Mn (ug/dl)	66.48±3.38	65.94±4.22
Cu (ug/dl)	69.16±2.90	70.00±2.69
Se (ug/L)	68.94±3.56	68.94±3.05
Cr (ug/dl)	68.22±4.68	69.42±3.12

Results are expressed as mean±SD, P <0.05 was considered significant compared with control

DISCUSSION

The impact of essential trace metals in health and disease has been highlighted in numerous scientific publications. However, insufficient intake occurs in people with eating disorders, smokers, pregnancy, individuals with chronic abuse and in geriatrics (Wood, 1971; Underwood, 1977; Leach and Harris, 1997).

Ageing is the sequential or progressive change in an organism that leads to an increased risk of disease and death. It begins as soon as adulthood is reached and is a part of human life. The process of biological ageing has been linked to deleterious free radical reactions. Trace elements are depleted through the expenditure of energy and are replenished through food and water sources (Abulude, 2006). Copper help in the well functioning of the erythrocyte in the body (Cartwright and Wardrobe, 1998). Zinc plays role in collagen synthesis, DNA, RNA and protein synthesis. Chromium is known to enhance the action of insulin, a hormone critical in the metabolism and storage of fat, carbohydrate and protein. Zinc is a component of numerous metalloenzyme antioxidants and is important for cell growth, replication and immunity (Sivera and Rolan, 2001). Copper is important in absorption and utilization of iron, synthesis of ATP, hormones, blood cells and collagen. Manganese forms part of the antioxidant, superoxide dismutase which helps prevent free radical damage (Verougstrate et al., 2003). Selenium is associated with antioxidant activities and is an important component of the enzyme glutathione peroxidase. A number of this essential trace element has been reported to vary with ageing. Hamilton, (1979); Igic et al., (2002) and all reported that copper levels increase with ageing. Savarinol and Grunch, (2001) reported that the risk of selenium deficiency increased in direct proportion to ageing. Walter et al., (1991) and Gerontol, (1994) both reported that the manganese level exhibit an age dependent linear decrease. In this study, it was observed that manganese level decreases in geriatrics but this decrease was not significant when compared with young adults this agrees with the earlier report of Leach and Harris, (1997) who reported that manganese levels exhibit an age dependent linear decrease. Additionally the serum zinc level decreased with ageing but this decrease was not statistically significant. This report agrees with the report of Savarinol et al., (2001) which stated that serum zinc levels are lower in geriatrics. Our study is also in agreement with the study of Hamilton, (1979) and Igic et al., (2000) who reported that copper levels increases with ageing. The magnesium level also increases with ageing this is corroborated by the findings of Gerontol et al., (1994). However, the increased level of chromium observed in our study is in discordance with the findings of el-Yazigi, (1991) which reported that ageing do not alter chromium levels in geriatrics. This was also the case with selenium which was found to be significantly elevated in geriatrics; however, this finding is in discordance with the finding of Savaranol et al., 2001) who reported a decreased level of selenium in geriatrics. The increased level of selenium in the population under survey may be responsible for the high incidence of prostate cancer and hypothyroidism in the semi-urban community under survey. The geographical location and high content of selenium in Nigerian food stuff as reported by Abulude et al., (2006) may have accounted for the high level of selenium in the geriatrics under survey. In this study, we observed that the serum level of chromium and copper was higher in female geriatrics when compared with male geriatrics. The manganese and magnesium levels in male geriatrics was higher than that of females this finding is in concordance with the report of Johnson and Lykken, (1991) who reported that magnesium and manganese levels are lower in females. The report of Gerontol, (1994) opined that the serum level of zinc is higher in females. This disagrees with the findings of our study which revealed a higher serum zinc level in male geriatrics. The serum selenium and zinc levels in both male and female geriatics were not significantly different. This is in concordance with the result of Gerontol, (1994) which revealed that there is no sex related differences in serum selenium level between male and female geriatrics.

CONCLUSION

Findings from our study suggest that trace element levels increases in age. The elevated level of selenium in geriatrics may be associated with high selenium content in the Nigerian local food stuff. However, elevated chromium levels observed in geriatrics in this environment may be responsible for the high incidence of prostate cancer in the community under survey.

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