Original Article

Selenium, Zinc and Magnesium Status of Hiv Positive Adults Presenting At A University Teaching Hospital in Orlu-eastern Nigeria

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ABSTRACT

BACKGROUND: Human immunodeficiency virus (HIV) infection is associated with increased nutrient requirement. Information on micro-mineral status in HIV infected in Nigerians is lacking. We evaluated the impact of HIV infection on selenium, zinc and magnesium status of HIV infected adults presenting at Imo State University Teaching Hospital.

METHODOLOGY: Fifty one (51) consecutive adult HIV patients (aged 18-56 years), presenting at the HIV treatment unit of the hospital over a period of 3-months who gave informed written consent participated. Also 48 HIV sero-negative adults (aged 19-59 years) were recruited as controls. Blood samples were collected from all subjects for mineral estimation by atomic absorption spectrophotometry. Results were presented as means (±SD) and variables compared using unpaired t-test.

RESULT: Selenium, zinc and magnesium levels in HIV patients were 0.23±0.08 mmol/L, 9.04±1.26 mmol/L and 104.61±24 mmol/L respectively. Minerals in controls were 0.29±0.09 mmol/L, 9.73±1.15 mmol/L and 125.57±29.55 mmol/L respectively. All minerals were significantly lower in HIV patients ($P < 0.05$). In male controsl, mineral levels were 0.32 ± 0.08 mmol/L, 9.97 ± 2.96 mmol/L and 94.93 ± 28.63 mmol/L respectively. In male HIV patients minerals were 0.02 ± 0.06 mmol/L, 8.74 ± 1.23 mmol/L and 93.42 ± 19.79 mmol/L respectively. All minerals were significantly lower in male HIV patients than male controls. In female controls selenium, zinc and magnesium levels were 0.28 ± 0.09 mml/L, 9.57± 1.17 mmol/L and 121.39 ± 29.89 mmol respectively. Minerals in female HIV patients were 0.25 ± 0.08 mmol/L, 9.17 ±1.29 mmol/L and 110.77 ± 24.42 mmol/L respectively. There were no significant differences in respective micro-mineral level between female controls and female HIV patients.

CONCLUSION: Selenium, zinc and magnesium were depleted in HIV infected suburban Nigerian subjects. Depletion was predominant in males possibly due to better health seeking behavior of females than males causing early presentation in females.

KEY WORDS: HIV, Selenium, Zinc, Magnesium, Micro-mineral, nutrition.

Date Accepted for Publication: 3rd April, 2012

NigerJMed 2012: 165-168

INTRODUCTION

The serum levels of minerals depend on a balance between intake on the one hand and utilization and excretion of the minerals on the other hand. In chronic infection such as HIV there is high cellular turnover of the immune system resulting in high nutrient requirement. In addition, there is reduced nutrient intake occasioned by poor appetite. These two factors account for observed mineral depletion widely reported in HIV infection [1-7]. There are no reports of selenium, zinc and magnesium status in HIV infection in Nigerian subjects.

Selenium is an essential element with antioxidant properties meditated through glutathione peroxidase [8]. Selenium was earlier viewed as a toxin. In the United States serum selenium levels generally range from 80-250µg/L. Upper tolerable limit is a consumption of 400µg/day whereas depletion is likely on consumption of 30µg/day or less [9].

Selenium depletion worsened cardiovascular risk in healthy Saudi males [10]. Along with omega-3 fatty acids this micro-mineral accounts for reduction in cardiovascular events [11]. Selenium depletion was found to be an independent predictor of survival in HIV infection[2]. Supplementing this micro-mineral in HIV infection improved serum levels by 50% and reduced cardiovascular events by 24% [12].

Zinc plays several roles in metabolism such as stimulation of DNA synthesis, protein synthesis, bone formation and immunity. Normal plasma level is 67-183µg/dl.

Zinc depletion may lead to increase in free radical formation [14, 15], severe immure dysfunction mainly affecting T helper cells and decreased lean body mass [15]. Through increased formation of inflammatory cytokines zinc depletion may enhance atherosclerosis and increase cardiovascular disease [13, 15]. Zinc depletion in HIV infection may, hence, be very adverse. Zinc depletion was reported in 23% of HIV infected person with depletion commoner in males [3-6].

Magnesium is an essential mineral distributed half each in bones and soft tissues respectively. Over 70% is ultra

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filtered. Low serum magnesium may cause cardiac arrhythmias and sudden death [16].

Normal serum concentrations range from 1.8mg/dl (0.74mmol/L) to 2.3g/dl (0.95mmol/L) but serum levels may not accurately mirror magnesium status since magnesium is predominantly an intracellular cation. Nonetheless, reduction in serum levels is specific to magnesium depletion [17]. Low plasma and erythrocyte magnesium was reported in HIV infection and even lower in HIV subjects who consume alcoholic beverages regularly [18].

This study evaluated the effect of HIV infection on the micro mineral status of patients presenting at a suburban Nigerian university teaching hospital.

MATERIALS AND METHOD

Study Area: Orlu is the largest of the 3 senatorial (geopolitical) districts of Imo State Nigeria. It has only one HIV treatment centre which is the Imo State University Teaching Hospital Orlu. Orlu has a population of about 9,351 located in latitude 5,7833 longitude 7,0333 [19].

Subjects: All consecutive adult HIV positive patients presenting over a 3 months period at the HIV treatment unit of Imo State University Teaching Hospital were chosen. Only HIV positive subjects who have never been on antiretroviral drugs (drug naïve subjects) and who gave informed written consent participated. Control subjects were age and sex matched volunteers recruited from the area. Only healthy-looking HIV sero-negative subjects participated as control.

Sample Collection: Eight (8mls) of fasting venous blood samples were collected into plain containers once from each subject. Samples were allowed to clot and retract and thereafter centrifuged at 5,000 revolutions per second. The supernatant sera were aspirated using a Pasture's pipette into sterile plain tubes, labeled and stored frozen at 18°C. At the end of sample collection, these frozen samples were transported in ice packs to International Institute of Tropical Agriculture, Ibadan, Oyo State, Nigeria for laboratory analysis.

Sample Analysis: All minerals were estimated using atomic absorption spectrophotometer (AAS model 205, Buck Scientific, United States of America).

Data Analysis: Statistical analysis was done using unpaired Student's t-test. P values less than 0.05 were taken as significant. Results were presented as mean (± standard deviation).

Ethical Considerations: Ethical approval was obtained from the Imo State University Teaching Hospital Ethic Committee on Biomedical Research. Informed written consent was obtained from each subject.

RESULT

A total of 99 subjects comprising 51 HIV positive patients (18-56 years) and 48 HIV sero-negative subjects (19-59 years) participated. Of the HIV patients 62.8% were females and 37.2% were males, while 60.4% HIV sero-negative subjects were females and 39.6% were males. Selenium, zinc and magnesium levels in HIV patients were respectively 0.23 ± 0.08 mmol/L, 9.04 ± 1.26 mmol/L and 104.61±24 mmol/L. In control subjects these minerals were respectively 0.29 ± 0.09 mmol/L, 9.73± 1.1 mmol/L and 125.57 ± 29.55 mmol/L. All minerals were significantly lower in HIV positive subjects compared to control subjects ($P < 0.05$, table 1). In male control subject selenium, zinc and magnesium levels were 0.32 ± 0.08 mmol/L, 9.97 ± 2.96 mmol/L and 94.93 ± 28.63 mmol/L respectively. In male HIV positive patients the respective minerals were 0.02 ± 0.06 mmol/L, 8.74 ± 1.23 mmol/L and 93.42 ± 19.79 mmol/L.

All minerals were significantly lower in male HIV patients when compared to male control subjects (P <

Table 1: Serum levels of selenium, zinc and magnesium in control subjects and HIV positive patients who have never been on antiretroviral drug (drug naive patients)

Mico-mineral	HIV Sero-negative Controls (n = 48)	Drug-naive HIV positive patients (n = 51)	P value
Selenium (mmol/L)	0.29 ± 0.09	0.23 ± 0.08	0.000
Zinc (mmol/L)	9.73 ± 1.15	9.04 ± 1.26	0.007
Magnesium (mmol/L)	125.57 ± 29.55	104.61 ± 24.16	0.000

Table 2: Serum levels of selenium, zinc and magnesium in male HIV positive drug-naïve patients and male HIV sero-negative control subjects.

Micro-mineral	Male HIV sero-negative controls (n = 19)	Drug naive male HIV positive patients (n = 18)	P value
Selenium (mmol/L)	0.32 ± 0.08	0.02 ± 0.06	0.000
Zinc (mmol/L)	9.97 ± 2.96	8.74 ± 1.23	0.006
Magnesium Mmol/L	94.93 ± 28.63	93.42 ± 19.79	0.000

Table 3: Serum levels of selenium, zinc and magnesium in female HIV positive drug-naïve patients and female HIV sero-negative control subjects.

Micro-mineral	Female HIV sero-negative controls (n = 29)	Drug-naïve female HIV positive patients (n = 31)	P value
Selenium (mmol/L)	0.28 ± 0.09	0.25 ± 0.08	> 0.05
Zinc (mmol/L)	9.57 ± 1.17	9.17 ± 1.29	> 0.05
Magnesium (mmol/L)	121.39 ± 29.89	110.77 ± 24.42	> 0.05

0.05, table 2). In female control subjects, selenium, zinc and magnesium levels were respectively 0.28 ± 0.09 mml/L, 9.57± 1.17 mmol/L and 121.39 ± 29.89 mmol. These minerals in female HIV positive patients were respectively 0.25 ± 0.08 mmol/L, 9.17 ±1.29 mmol/L and 110.77 ± 24.42 mmol/L. There were no significant differences in respective micro-mineral level between female control subjects and female HIV positive subjects (table 3).

DISCUSSION

The depletion in selenium, zinc and magnesium in HIV patients as observed in this study is similar with studies in developed countries [1-7]. HIV infection exerts a metabolic stress on the patients leading to high nutrients requirement. In addition poor appetite which is a constitutional symptom of most illnesses worsens micro nutrient depletion.

In HIV patients on antiretroviral therapy selenium depletion were noted[3,7]. This suggests the need for selenium supplementation in HIV even in treated patients. Selenium supplementation reduces cardiovascular risk[10] and its depletion was associated with high risk of HIV-related mortality[2]. The observed reduction in serum selenium in male HIV positive patients compared to their female counterparts may be related to a late presentation of the male patients at seeking healthcare or perhaps females tend to feed better since they are responsible for preparing food for the family.

Zinc plays a crucial role in immunity[15]. There is immune impairment in zinc depletion. Zinc depletion is widely reported in white subjects, mostly occurring together with selenium depletion[1,3,4,6,7]. Use of antiretroviral therapy does not reverse the depletion of zinc and selenium [3,7]. As in selenium, the observed reduction in serum zinc in male HIV positive patients compared to their female counterparts may be for the same reason. In HIV patients on antiretroviral drugs zinc depletion was reported more in men (40%) than women (36%) [6] .This was possibly early seeking of health care services by females than males.

In this study, magnesium was significantly lower in drug-naïve HIV patient than in HIV sero-negative controls. Magnesium depletion was reported to occur early in HIV infection[18]. Like in selenium and zinc, we observed magnesium depletion in male HIV patients compared with male controls. In female HIV patients, however, the serum level of magnesium was similar to that of HIV sero-negative control subjects.

CONCLUSION

Selenium, zinc and magnesium depletion were observed in HIV positive antiretroviral drug-naïve suburban Nigerian patients. Micro mineral depletion

predominates in males. In Nigeria where micronutrients are not evaluated in management of HIV patients our observation makes it expedient to introduce selenium and zinc supplementation to all HIV infected patient whether treated (anti-retroviral therapy) or not.

CONFLICT OF INTEREST

There is no conflict of interest. The burden of funding of this work was completely borne by the researchers.

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