Clinical Nutrition xxx (2014) 1–4

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Orginal article

A longer time of exposure to antiretroviral therapy improves selenium levels

Erika Grasiela Marques de Menezes Barbosa [a,*], Fernando Barbosa Júnior [c], Alcyone Artioli Machado [b], Anderson Marliere Navarro [b]

[a] Department of Foods and Nutrition, Faculty of Pharmaceutical Sciences, University of São Paulo – UNESP, Brazil
[b] Department of Internal Medicine, Faculty of Medicine of Ribeirão Preto, University of São Paulo – FMRP/USP, Brazil
[c] Department of Clinical and Toxicological Analyses and Bromatology, Faculty of Pharmaceutical Sciences of Ribeirão Preto, University of São Paulo – FCFRP/USP, Brazil

ARTICLE INFO

Article history:
Received 21 November 2013
Accepted 25 March 2014

Keywords:
Selenium deficiency
HIV
Antiretroviral therapy

SUMMARY

Background & aims: Selenium is an essential mineral for immunological function, performing crucial functions at the cellular level. This micronutrient has been determined to be frequently deficient in HIV infected patients, with correlations between reduced immunological function and greater susceptibility to opportunistic infections. Our aim was to evaluate the influence of time of exposure to antiretroviral therapy (ART) on the biochemical profile of selenium in HIV-infected patients.
Methods: We performed a cross-sectional study on 50 HIV-positive men with different quantitations of viral load and CD4+ T cells, who were either receiving or not receiving ART. Dual energy X-ray absorptiometry (DXA) to determine body composition, biochemical analysis of selenium and albumin, anthropometric measurements were performed. The subjects were divided into groups according to the use of ART or not: The Control Group (CG) was 10 treatment-naïve volunteers, Group G < 2 was 20 volunteers on ART for less than 2 years, and Group G > 2 was 20 volunteers on ART for >2 years.
Results: The body mass index showed that all subjects were of normal weight. The group with a longer time of exposure to ART (G > 2) had undetectable viremia and a higher CD4+ T cell count: 593.1 ± 234.6 mm^3. Selenium values (μg/L) were 55.9 ± 11.9 for CG, 52.1 ± 10.5 for G < 2, and 66.9 ± 20.8 for G > 2, with a significant difference between groups G < 2 and G > 2 ($p < 0.05$), and only G > 2 showed normal selenium values.
Conclusions: Most of the men studied showed selenium deficiency, except for the subjects with a longer exposure to antiretroviral treatment. Thus, an adequate selenium concentration is related to better control of virology and of immunologic function.

1. Introduction

Selenium is an essential mineral for immunological function, performing important functions in the cell. This micronutrient has an important impact on the immunity of persons infected with human immunodeficiency virus (HIV), playing an important role in the modulation of viral expression, in the prevention of HIV replication and in the delay of disease progression.[1]

Today, with the advances of antiretroviral therapy (ART), there has been a decline of mortality among HIV-infected individuals, as well as an increased life expectancy,[2] but concern has arisen about long-term nutritional status and the associations between selenium deficiency and reduced immunological function, increased viremia and greater susceptibility to opportunistic infections.[3] In addition, HIV itself can lead to the temporary or even permanent loss of body reserves of proteins, vitamins and minerals, and the use of some antiretrovirals increases the need for antioxidants and micronutrients.[4]

Selenium deficiency is common in HIV-infected patients and is greater during the early stage of the infection, and the reduced serum selenium values are correlated with albumin levels and total lymphocyte counts.[5] Drain et al.[6] showed an association between the reduction of albumin and low micronutrient concentrations in ART-naive HIV-infected individuals, with selenium deficiency persisting after the beginning of ART because of its relation to the

* Corresponding author. Avenue Bandeirantes, 3900, Monte Alegre, Ribeirão Preto – SP 14049-900, Brazil.
E-mail addresses: erikagmm7@yahoo.com.br, erikagmm7@hotmail.com (E.G. M. de Menezes Barbosa).

http://dx.doi.org/10.1016/j.clnu.2014.03.012
0261-5614/

inflammatory state caused by the infection itself. Another randomized study conducted on HIV-infected patients showed that selenium contributes significantly to the increase of CD4+ T cell count and to the reduction of viremia, though these findings need to be replicated.[7]

Thus, the combination of good adherence to ART, adequate nutrition and absence of mineral deficiency is likely to effectively contribute to improving the health of HIV-infected patients. On this basis, the objective of the present study was to determine the influence of time of exposure to ART on the biochemical profile of selenium in HIV-infected patients.

2. Methodology

A cross-sectional study was conducted on 50 HIV-seropositive men with different levels of viral loads and who were pre and post initiation of ART. Exclusion criteria were: use of mineral nutritional supplements, a history of thyroid disease, dysabsorptive syndrome and diabetes mellitus, and the presence of renal dysfunction and/or pancreatic insufficiency. The volunteers were recruited at the University Hospital, Faculty of Medicine of Ribeirão Preto, University of São Paulo (HCFMRP-USP). The study was approved by the local Ethics Committee (protocol n° 2605/2010) and all subjects gave written informed consent to participate.

Data regarding duration of HIV infection, time of exposure to ART, CD4+ T cell count and quantitation of viral load were obtained from the medical records of HCFMRP-USP. The volunteers were divided into groups according to use of ART or not: The Control Group (CG) was 10 treatment-naïve volunteers, Group G < 2 was 20 volunteers on ART for less than 2 years, and Group G > 2 was 20 volunteers on ART for >2 years.

2.1. Anthropometric assessment

Weight and height were measured and body mass index (BMI) was calculated by the weight/height^2 formula. The patients were classified according to the recommendations of the World Health Organization (WHO), 1998.[8] Body composition (lean mass and fat mass) was determined by *dual energy x-ray absorptiometry* (DXA).

2.2. Biochemical analyses

Peripheral venous blood samples were collected after a 12 h fast for the biochemical analysis of selenium and albumin. The samples were centrifuged and the serum obtained was stored in a freezer at −80 °C until the time for analysis. Selenium concentration was determined by mass spectrometry and albumin concentration by colorimetry using Labtest® kits. CD4+ T lymphocytes were quantitated by flow cytometry using the Multitest® kit and viral load was quantitated by chemiluminescence using the Versant® HIV-1 RNA 3.0 kit.

Normal selenium reference values were obtained from the DRIs[9] and from the publication of Bender and Bender[15] and the reference range of the Labtest® kit (3.5–5.5 g/dL) was used for albumin. The reference values published by the Brazilian Ministry of Health[10] were used for CD4+ T lymphocytes.

2.3. Statistical analysis

Mean, standard deviation and 95% confidence interval were used to describe the quantitative data. The Pearson correlation coefficient (r) was used to determine correlations. One-Way analysis of variance (ANOVA) was used for group comparison regarding continuous variables. When a difference was detected between groups, the Tukey post-test was applied. P-values of less than 0.05 were considered to be significant.[14]

3. Results

The G > 2 patients were the oldest (47.0 ± 10.6 years) and CG patients were the youngest (30.8 ± 9.4 years) and there was a significant difference in age between all groups studied ($p < 0.05$). The BMI was higher for G < 2 (23.2 ± 4.1 kg/m^2) and lower for CG (20.4 ± 6.7 kg/m^2) and, according to the BMI classification of the WHO,[11] all volunteers were of normal weight. Percent fat mass was higher in CG (24.9 ± 7.5), showing no risk for diseases associated with obesity according to the classification of body fat[12,13] (Table 1).

Evaluating the levels of selenium in the total sample set with detectable vs. undetectable viral load (data not shown in tables) found average values of selenium 60.34 ± 17.98 μg/L and 54.99 ± 14.24 μg/L respectively and showed no significant association independent of viral load. Other comparison performed specifically in group on ART treatment <2 years between the levels of selenium (51.74 ± 7.65 μg/L; 52.8 ± 16.37 μg/L) with detectable vs. undetectable viral load found significant association ($p < 0.05$).

The group on ART treatment >2 years had a longer duration of HIV infection and a longer time of exposure to this therapy. At the same time, they had undetectable viremia (<50 copies/mL) and a larger number of CD4+ T cells (mm^3). The duration of HIV infection differed significantly between groups ($p < 0.05$) and only groups G < 2 and G > 2 differed significantly in time of exposure to ART ($p < 0.05$) (Table 1).

Biochemical data are reported as mean + SD (Table 2). Serum selenium was within normal limits (60–120 μg/L)[9,15] only in group G > 2, and a significant difference was observed between groups G < 2 and G > 2 ($p < 0.05$). Albumin values were normal in all groups (3.5–5.5 g/L).

There was no significant correlation between serum selenium values and age, weight, BMI, fat mass, lean mass, duration of HIV infection, CD4+ T cell count, time of exposure to ART or albumin concentration (Table 3).

4. Discussion

Most of the present subjects had a healthy weight, as it is known that malnutrition has an important impact on macronutrient and micronutrient deficiency that may impair resistance to infection and that opportunistic infections have a negative effect on nutritional status.[1]

Several studies have demonstrated the influence of HIV infection and CD4+ T cell count on the nutritional status of

Table 1
General characteristics of HIV-seropositive patients according to study group.

Variables	Control group (CG)	Group <2 years of ART (G < 2)	Group >2 years of ART (G > 2)
n	10	20	20
Age (years)	30.8 ± 9.4^a	34.2 ± 10.6^a	47.0 ± 10.6^b
Weight (kg)	72.2 ± 11.2	70.1 ± 14.8	67.0 ± 9.1
BMI (kg/m^2)	20.4 ± 6.7	23.2 ± 4.1	22.9 ± 2.6
Fat mass (%)	24.9 ± 7.5	23.8 ± 6.8	23.3 ± 5.4
Lean mass (%)	69.4 ± 7.0	70.2 ± 6.1	71.6 ± 5.2
Duration of infection	34.8 ± 20.7^a	34.2 ± 22.8^{a,b}	162.0 ± 62.5^{a,c}
Undetectable VL (%)	12.5	70	100
CD4+ (cells/mm^3)	521.9 ± 82.6	424.1 ± 275.8	593.1 ± 234.7
Time of exposure to ART	0	10 ± 6.7^a	127.2 ± 54.3^b

Note: Tukey Test. Values are reported as mean ± SD. ^{a,b,c} Different letters indicate $p < 0.05$. BMI = body mass index; Duration of infection in months; VL = viral load; undetectable VL: <50 copies/mL; ART = antiretroviral therapy; Time of exposure to ART in months.

Please cite this article in press as: de Menezes Barbosa EGM, et al., A longer time of exposure to antiretroviral therapy improves selenium levels, Clinical Nutrition (2014), http://dx.doi.org/10.1016/j.clnu.2014.03.012