Research Article

Variation of Antioxidant Trace Elements (Zinc and Copper) Status for Overweight Patients in Eastern of Algeria

Karouche Saida*[1], Rouabah Abdelkader[1], Rouabah Leila[1], Mehennaoui Smail[2], Necib Youcef[1], Mehennaoui Fatima Zohra[3].
[1]Laboratory of Molecular and Cellular Biology, Faculty of Natural Sciences and Life, University 1 of Constantine Algeria.
[2] Laboratory of Environment, Health and Animal Production, University El Hadj Lakhdar of Batna Algeria.
[3] Laboratory of Biology and Environment, Faculty of Natural Sciences and Life, University 1 of Constantine Algeria.
***Corresponding author's E-mail:** saidabmc86@yahoo.fr

Accepted on: 13-12-2013; **Finalized on:** 31-03-2014.

ABSTRACT

This article examined the status of two trace elements (Zn and Cu) for some overweight patients with a BMI ≥ 25, of Ain Fakroun, located in eastern Algeria. Zn and Cu level were determined in the serum collected from fasting blot. The serum level of Zn is reduced in obese patients (BMI ≥ 30 kg / m²); with high serum copper in women compared to men *(P < 0.05)*. Serum level zinc was significantly higher in men than in women at p < 0.05. Blood pressure was positively associated with waist circumference, obesity and age, obesity increases with age *(P < 0.05).* This study confirmed the decrease in antioxidant status (zinc) of the obese subject with the concomitant increase in oxidative status of copper.

Keywords: Overweight, obesity, antioxidant status, traces elements (zinc and copper).

INTRODUCTION

The physiological production of the radical oxygen species (ROS) is regulated by defense systems consist of enzymes (superoxide dismutase, catalase and glutathione peroxidase), antioxidant small molecules (carotenoids, vitamins C and E, glutathione, uric acid, bilirubin) and proteins (transferrin, ferritin, and ceruloplasmin) which hold the transition metal in an inactive state for the formation of ROS. Some trace elements such as copper, zinc, selenium is essential for the activity of antioxidant enzymes (Cu, Zn-SOD, Mn-SOD and Se-GPx).[1]

Trace elements are materials present in small quantities in an organism and help it function. [2]

Zinc has been the subject of numerous studies experience in humans and animals; these studies[3, 4, 5] have shown its involvement in many physiological and pathophysiological mechanisms as well as in energy metabolism.[6]

Zinc is also an inducer of metallothionein, [7] proteins with antioxidant activity and an inhibitor of ROS production reactions induced by copper. Zinc is involved in several areas of action to regulate insulin activity against free radical attack and maintain its biological activity.[8] This trace element modulates the expression of enzymes and genes insulin response;[9] it is also involved in hormonal signal transduction by its antioxidant effect. Indeed, some transduction systems such as protein kinas activity are extremely sensitive to oxygen radicals.[9]

The nutritional origin of oxidative stress is mainly due to an overall insufficiency of dietary intake of fruits, vegetables, cereals and a decrease in nutrient density of meals too rich in saturated fats and sugars rapid absorption.[10] Dietary intakes of antioxidants participate in the balance of pro/ antioxidants. According to Houston, [11] the zinc intake should be between 15 and 30 mg / day.

Obesity and oxidative stress are closely linked; increased fatty mass, especially intravisceral, insulin resistance, chronic inflammation, endothelial dysfunction and hypertension are the main factors of increased oxidative stress in patients with metabolic syndrome.[12] The balance sheets of overweight subjects (BMI > 25) indicate a higher oxidative stress in patients with BMI < 25.[13]

In this context, the ultimate objective is to study the variation of the antioxidant status of trace elements (zinc and copper) in overweight patients.

MATERIALS AND METHODS

This study included 43 patients with a BMI ≥ 25kg/m^2 of both sexes, higher at 18 years, in the town of Ain Fakroun. Blood samples were taken at the elbow crease vein in subjects fasted for at least 12 hours in tubes containing lithium heparin.

The samples were analyzed in the laboratory of the Environment, Health and Animal Production, University of El Hadj Lakhdar Batna (Algeria).

Plasma zinc and copper were determined by atomic absorption spectrophotometer; [14] the spectrophotometer used in this study is the spectrophotometer atomic air-acetylene flame brand SHIMADZU AA-6800.

The wavelengths of the elements to be analyzed are first determined on the device (324.7 nm for copper, zinc 213.8 nm). Then, the different readings of the calibration range to establish the calibration curve resulting absorbance versus concentration.

Statistical analysis

Data were analyzed using Epi Info Version 3.5.3 for the calculation and comparison of means. P < 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

The variations in serum levels of Cu and Zn are collected in Table 1.

The assay results show that trace elements of individuals recruited have a mean serum level of 112.29 ± 37.97 ug/100 ml for Cu and 120.71 ± 58.01 ug/100 ml for Zn. It is of the order of 116.25 ± 38.87 ug/100 ml, 119.89 ± 61.61 ug/100 ml in women respectively for Cu and Zn. 88, 50 ± 21,24ug/100 ml and 125, 50 ± 32,73ug/100 ml in men respectively for Cu and Zn. The difference is significant at p <0.05 between the two sexes in serum level copper.

It is apparent from Table 2 that individuals with a BMI ≥ 30 kg / m² have a decreased serum Zn and high in Cu level.

Table 3 shows that serum Zn is decreased in obese women and obese men (BMI ≥ 30 kg / m²) compared to overweight (25 ≤ BMI ≤ 29.9). No significant difference at p <0.05 was observed in the plasma level of Cu in two categories of excess weight men. However obese women have a high copper compared to overweight women serum.

Table 1: Variation in serum trace elements according to sex

Variables	Men	Women	Total sample
	Mean ± SEE		
the Cu (ug/100 ml)	88,50 ± 21,24	116,25 ± 38,87	112,29 ± 37,97 *
the Zn (ug/100 ml)	125,50 ± 32,73	119,89 ± 61,61	120,71 ± 58,01

Zn: zinc, Cu: copper, SEE, Standard error of estimate, * Significant at p <0.05.

Table 2: Variation in plasma level of Cu and Zn according to BMI

BMI	Cu (ug/100 ml)	Zn (ug/100 ml)
	Mean ± SEE	
overweight 25 ≤ BMI ≤ 29.9	111,11± 32,83	133,53± 65,15
obesity BMI ≥ 30 kg/m²	113,17± 42,09	111,63± 51,88

Abbreviation: BMI: body mass index.

Table 3: Variation in plasma level of Cu and Zn according to BMI and sex

BMI	Cu (ug/100 ml)		Zn (ug/100 ml)	
	Men	Women	Men	Women
25 ≤ BMI ≤ 29.9	88,00± 0,00	112,47± 33,31	136,00± 0,00	133,38± 67,28
BMI ≥ 30 kg/m²	88,60± 23,75	119,63± 43,89	123,40± 36,14	108,53± 55,68

Correlations between the different parameters of subjects

It is clear from Linear regression coefficients among the different parameters of subjects that the mean blood pressure increases with age (+0,357), waist circumference (+0,315) and BMI (+0,354); obesity increases with age (+0,314); waist circumference was positively associated with age (+0,410); no significant correlation between serum trace elements both at p <0.05.

The results in Table 1 show that the mean levels of zinc and copper in individuals recruited are in the standards, [15] it also confirms the results of the food consumption survey illustrate that patients have a varied diet. A balanced diet also includes cereals, vegetable oils, fruits and vegetables, provide optimal antioxidant intake.

Table 3 shows that the mean serum Zn is decreased in obese women and obese men (BMI ≥ 30 kg / m²) compared to overweight women and overweight men (25 ≤ BMI ≤ 29.9); with elevated serum copper in women compared to men. Our results are comparable to those reported in the literature: the antioxidant status of the obese subject is altered: total antioxidant power of plasma decreased[16] deficits in zinc.[17,18] Indeed, the zinc is a micronutrient possessing an important role in the prevention and reduction of production of free radicals induced by copper,[7] It is the cofactor of superoxide dismutase is an intracellular antioxidant enzyme and is mobilized in the fight against free radicals .[19] The action of zinc by the activation of superoxide dismutase is beneficial in repairing the damage caused by oxidative stress at the cellular level.

In general, serum zinc was significantly higher (p <0.05) in men than in women (Table 3) this could be explained by the sedentary women, whereas it should be noted that the practice of moderate physical activity reduces oxidative stress. [20]

We found that the serum zinc levels in hypertensive individuals is in the standards, however a correlation was found between bass circulating levels of zinc and hypertension, cardiovascular events, type 2 diabetes, dyslipidemia and insulin resistance in the study of Zozaya Garcia et al [21] Similarly, an inverse correlation was reported between blood pressure and serum concentration of Zn.[22]

CONCLUSION

Considering the results of this study, it appears that dietary intake of antioxidants participates in the balance of pro / antioxidants.

The serum Zn is reduced in obese patients (BMI ≥ 30 kg / m²), therefore the intervention of zinc in the mechanisms of repairing damage caused by oxidative stress through the activation of superoxide dismutase.

Serum zinc was significantly higher ($p < 0.05$) in men than in women.

Blood pressure is positively associated with waist circumference, obesity and age; obesity increases with age.

This study confirmed the decrease in antioxidant status (zinc) of obese subjects with concomitant increase in the parameter of oxidative status (copper).

REFERENCES

1. Erhard L. Cigarette smoking: an undertreated risk factor for cardiovascular disease. J. Atheroscler. 2009, 10-110.
2. Sies H. Total antioxidant capacity appraisal of a concept. J. Nutr. 137(6), 2007, 1493-5.
3. Aggett P.J., Harries. Current status of zinc in health and disease status. Arch. Dis. Child. 54, 1979, 909-17.
4. Bogden J.D. Blood zinc in health and disease. In: Nriagu JO, ed. Zinc in the environment. Part II. Health effects. New York: John Wiley and Sons, 1980, 137-69.
5. Halsted J., Smith J.C., Irwin I.M. A conspectus of research on zinc requirements of man. J. Nutr. 104, 1974, 345-78.
6. Underwood E. Trace elements in human and animal nutrition. Ed. 4th. New York: Academic Press, 1977.
7. Coyle P., Philcox J.C., Carey L.C., Rofe A.M. Metallothionein: the multipurpose protein. Cell. Mol. Life. Sci. 59, 2002, 627-47.
8. Faure P., Lafond J.L., Rossini E., Halimi S., Favier A., Blache D. Evidence for the role of zinc in insulin protection against free radical attack: molecular and functional aspects. Biochim. Biophys. Acta. 1994, 1209-2604.
9. Araki E., Shichiri M., Nippon R. Characterization and expression of the insulin receptor gene and its promoter. 52(10), 1994, 2623-8.
10. Staruchova M., Volkova K., Lajdova A., Mislanova C., Collins A., Wsolova L., Starucch I., Dusinska M. Importance of diet in protection against oxidative damage. Neuroendocrinol. Lett. 27(2), 2006, 112-5.
11. Houston M.C. Treatment of hypertension with nutraceuticals, vitamins, antioxidants and minerals. Expert. Rev. Cardiovasc. Ther. 5, 2007, 681-91.
12. Grattagliano I., Palmieri V.O., Portincasa P., Moschetta A., Palasciano G. Oxidative stress-induced risk factor associated with the metabolic syndrome: a unifying hypothesis. J. Nutr. Biochem. 19(8), 2008, 491-504.
13. Taddei S., Ghiadoni L., Salvetti G., Virdis A., Salvetti A. Obesity and endothelial dysfunction. G. Ital. Cardiol. 7(11), 2006, 715-23.
14. Lamand M. Les oligo-éléments. Dalfoz. Ed. Paris, 1978, 78.
15. Dalle-Donne I., Rossi R., Colombo R., Giustarini D., Milzani A. Biomarkers of oxidative damage in human disease. Clin. Chem. 52(4), 2006, 601-23.
16. Molnar D., Decsi T., Koletzko B. Reduced antioxidant status in obese children with multimetabolic syndrome. Int. J. Obes. Relat. Metab. Disord. 28(10), 2004, 1197-202.
17. Ozata M., Mergen M., Oktenli C., Aydin A., Yavuz Sanisoglu S., Bolu E., et al. Increased oxidative stress and hypozincemia in male obesity. Clin. Biochem. 35(8), 2002, 627-31.
18. Marreiro Ddo N., Fisberg M., Cozzolino SM. Zinc nutritional status in obese children and adolescents. Biol. Trace. Elem. Res. 86(2), 2002, 107-22.
19. Speich M. Plasma zinc and myocardial infarction. J. Am. Coll. Nutr. 6, 1987, 187-8.
20. Ignarro L.J., Balestrieri M.L., Napoli C. Nutrition, physical activity and cardiovascular disease: an update. Cardiovasc. Res. 73, 2007, 326-40.
21. Garcia Zozaya J.L., Padilla Viloria M. Alterations of calcium, magnesium, and zinc in essential hypertension: their relation to the renin-angiotensinaldosterone system. Invest. Clin. 38(2), 1997, 27-40.
22. Bergomi M., Rovesti S., Vinceti M., Vivoli R., Caselgrandi E., Vivoli G. Zinc and copper status and blood pressure. J. Trace. Elem. Med. Biol. 11, 1997, 166-9.

Source of Support: Nil, **Conflict of Interest:** None.