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Using atomic absorption in detection of Rheumatoid arthritis

Alia'a S.A. Al-Faraji

Center For Market Research & Consumer Protection, University of Baghdad, Baghdad, Iraq.
alia.sadon@yahoo.com

Abstract

Copper, zinc, iron and chromium were determined by atomic absorption spectrophotometer (AAS) in blood serum of patients with rheumatoid arthritis. A total of 20 patients with age range (20-60) years compared with normal control. The analysis of results showed that the mean value of concentration of these elements were significantly lower in patients with rheumatoid arthritis with different cases: No treatment, treatment for short time and treatment for long time compared to that of healthy and the LSD for these metals ($P< 0.05$). This may provide good clues about developing of rheumatoid arthritis disease unless the imbalance of these elements in blood serum to be corrected .

Keywords: Atomic absorption spectrophotometer (AAS), Trace elements, Rheumatoid arthritis.

Introduction

Rheumatoid arthritis (R.A.) is one of the collagen disease. Rheumatoid arthritis term is derived from Greek for a flowing stream or river. It is an autoimmune disease (Dey and Dey, 2009; Ali and Al-Zubaidi, 2012). The disease usually begins between 25 and 55 years but may affect both older and younger people. Rheumatoid arthritis affects about 3% of the female and 1% of male population in temperate climate (Dey and Dey, 2009; Mookerjee, 2010). Although the precise cause of Rheumatoid arthritis is not yet established, it is possibly true that in genetically predisposed persons, continuous antigenic stimulation (be it viral or bacterial) may lead to a chronic synovial injury and gradual destruction of joints if the process is not arrested by treatment (Mookerjee, 2010; Ala *et al.*, 2009). Rheumatoid arthritis is characterized by increased activity of macrophages which produce toxic form of oxygen. Such oxygen has been suggested as mediator also of Rheumatoid inflammation (Munthe *et al.*, 1986). Rheumatoid arthritis typically presents as symmetric arthritis affecting the small joints of the hands and feet, ankles, knees, wrists, elbows and shoulders. Proximal interphalangeal joints, metacarpophalangeal joints are particularly involved. Rheumatoid arthritis is a chronic systemic disease of unknown aetiology involves tissues other than joints and tendons (Dey and Dey, 2009). Typical form of the disease is symmetrical, destructive and deforming polyarthritis affecting small and large synovial joints with associated systemic disturbances , a variety of extra-particular features and the presence of circulating anti globulins antibodies (Rheumatoid factor)(Cerhan *et al.*, 2003). Meanwhile trace elements are widely distributed in variable proportion in human body and they play a vital role in growth. Zinc is a part of every cell in the body and forms apart of over 300 enzymes that have functions ranging from proper action of the body hormones to cell growth. Zinc deficiency can cause growth retardation (Florianczyk, 2008). Zinc is important in the maintenance of proper immune response (Rink and Haase, 2006). Copper is an essential part of key metalloenzymes as ceruluplasmine, cytochrome, oxidase, tyrosinase and monamine oxidase (Ala *et al.*, 2009). Copper enters in a large number of enzymes in addition ceruloplasmine, as it will be necessary for the work of an enzyme super oxide dismutase (SOD) as well as an oxidation enzyme lysyl oxidase, which is one of the necessary enzymes in the synthesis of connective tissue, it is believe that lack of this enzyme leads to decrease of copper, which leads to adverse effects in bone and connective tissue (Colak *et al.*, 2001). Excess cupper as with excess Iron can cause free radical production and damage , also deficiency of cupper results in poor collagen integrity with resultant blood vessel rupture (Satish and Reshu, 2009). Chromium is one of the newer essential trace elements. Have a great role in maintaining good health, chromium may have a function in the control of glucose and lipid metabolism (Jonathan,

1981). Iron carries oxygen to the cells and is necessary for the production of energy (Brig *et al.*, 2005; Khanna, 2008). Iron is available in both a ferrous and ferric. Iron in the ferrous form is better absorbed than ferric Iron. Many people with Iron deficiency anemia die from infection because of weak end immune systems. Iron's role in maintaining immunity covers every aspect of how the systems work (Cerhan *et al.*, 2003). Iron is also needed to help produce antibodies and to maintain your white blood cell count (Brig *et al.*, 2005). A significant amount of is stored as ferritin and hemosiderin. Iron played a potential role in oxidative stress mediated injuries and pathologies e.g. Rheumatoid arthritis (John, 2001; Majhi and Srivastava, 2010).

The aim of this work was to examine the differences between the levels of Copper, Zinc, Iron and Chromium in different cases in patients with Rheumatoid arthritis and in healthy individuals.

Materials and Methods

Subjects: The present study was conducted on Rheumatoid arthritis patients of Baghdad, Iraqi population. Twenty (20) subjects were chosen in the present study, and they were grouped as normal healthy subject and Rheumatoid arthritis patients in group: No treatment, treatment for short time and including the concentrations of trace elements in the four groups (Table 1).

Analysis of minerals in the blood serum: A shimadzu model 660G-Japan Flame Atomic Absorption Spectrophotometer FAAS were used for analysis of blood serum samples, which were centrifuged through the preparation of samples then dilution the serum with deionized water for analysis. Samples were taken from patients who had been admitted to Yarmuk hospital with positive diagnosis of rheumatoid arthritis disease from (July-February) 2013-2014 , the analysis of trace elements was done in Ibn Sina State Company Labs. Copper, Zinc, Iron and Chromium were analyzed by flame atomic absorption spectrophotometer . Serum samples were obtained from 20 patients (males and females) their ages ranged between (20-60) years.

Statistical analysis: The Statistical Analysis System – SAS (2010) was used to effect of different factors in study parameters. Least significant difference (LSD) test was used to significant compare between means in this study (SAS, 2010).

Results and Discussion

The results of the present study showed a low concentration of copper, zinc, iron and chromium (Table 1) in the serum of rheumatoid arthritis patients than those of healthy subjects. In the case of no treatment, the concentration of copper, zinc, iron and chromium were (0.1008±0.0048, 0.1535±0.0182, 0.2483±0.0158, 0.0127±0.0011) ppm respectively. While in the case of treatment for short time were (0.0758±0.0009), (0.0872±0.0013), (0.1473±0.0121), (0.0050±0.0009) respectively. The case of treatment for long time were (0.0653±0.0023), (0.0747±0.0025), (0.1574±0.0134), (0.0023±0.0004) respectively. These results agree with Ali and Al-Zubaidi (2012) and with Mierzecki and *et al.* (2011) and with Taysi and *et al.* (2003) and with Ala and *et al.* (2009). While these results disagreement with Meshitsuka and *et al.* (1996) and with Hashmi and Shah (2012) and with Taneja and Mandal (2009). These results due to the deficiency of copper, zinc, iron and chromium. So supplementation of these trace elements could be necessary to get a beneficial from trace elements rebalance in blood serum. We suggest that the deficiency of serum copper, zinc, iron and chromium might be used in early diagnosis and treatments of rheumatoid arthritis.

Table(1): Serum trace elements of patients R.A. and healthy control group (ppm)

Case	Mean ± SE of metal (ppm)			
	Cu	Zn	Fe	Cr
No treatment	0.1008 ± 0.0048	0.1535 ± 0.0182	0.2483 ± 0.0158	0.0127 ± 0.0011
Treatment for short time	0.0758 ± 0.0009	0.0872 ± 0.0013	0.1473 ± 0.0121	0.0050 ± 0.0009
Treatment for long time	0.0653 ± 0.0023	0.0747 ± 0.0025	0.1574 ± 0.0134	0.0023 ± 0.0004
Control	0.1136 ± 0.0087	0.1964 ± 0.0191	0.2628 ± 0.0195	0.0156 ± 0.0009
LSD Value	0.0148 *	0.0381 *	0.0445 *	0.0026 *

* ($P<0.05$).

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