Determination of Serum Zinc, Copper and Manganese Concentration in Arthritis Patients

Rana Abd Alaly[*], Ahmed Ali Abdulsahib[*], Rana Saheb Khalaf[*], and Abbas Abd zaid Barrak[**]

[*]Chemistry Department-College of Science- Babylon University.[**]Hilla Teaching Hospital

e-mail:emanflowr@yahoo.com

الخلاصة

التهاب المفاصل هو التهاب مزمن يصيب المفاصل .ان الهدف من هذه الدراسة هو بيان تأثير بعض العناصر التي تعمل كمضادات اكسدة كالزنك ،النحاس والمنغنيز على خطر الاصابة بالتهاب المفاصل ،اجريت الدراسة على ٢٤ مصاب من الذكور فقط تتراوح اعمارهم بين ٣٣-٤٠ سنة مع ٢٠ شخص من نفس الجنس والفئة العمرية كمجموعة سيطرة. بينت النتائج حدوث انخفاض معنوي في مستويات الزنك ،النحاس والمنغنيز لدى المرضى مقارنة بالأصحاء حيث كانت قيم (p-value) هي (٠,٠٠ ،٠,٠٠ و٠,٠٠١) على التوالي.

Abstract

Arthritis is a chronic an inflammation of the joints, the aim of this study was to explain the effect of antioxidant trace elements(zinc ,copper and manganese) on risk of arthritis. This study included 24 patients (men only) aged 33-40years and 20 apparently healthy men were used as a control group .The results showed significantly decrease in a zinc, copper and manganese concentration in arthritis patients compared with healthy control P-value(0.00,0.00 and 0.001) respectively .

Key Words: *Inflammation, Joints, Arthritis, Antioxidant, Trace Elements*

Introduction

Arthritis is a chronic inflammation of the joints and is a common condition that causes pain and inflammation (swelling) of the joints and bones, the main symptoms of arthritis include pain ,stiffness, restricted movements of the joints, inflammation and swelling and warmth and redness of the skin over the joint [1].

It is generally begins in the small joints of the hands and the feet then transported to the larger joints, the inflamed joint lining or synovium extends and erodes the articular cartilage and bone ,the cause of which disease can associate with many factors, first of all an extensive range of nutrient deficiencies are involved antioxidant and caused joint problems[2]. Clinical trials have revealed that oxidative stress may increase free oxygen reactive species (ROS) formation and reduce antioxidant defenses[3] .Antioxidant play an important role as part of the mechanism that protects against tissue damage caused by reactive oxygen species, the functions of antioxidant enzymes are linked to anti-inflammatory properties, copper (Cu), zinc (Zn) and manganese (Mn) are necessary trace elements for cellular protection against the harmful effects of ROS ,therefore trace elements have a protective role against the inflammation as cofactors for antioxidant enzymes[4-6].

Zinc is present in all organs tissue and fluids of the body, it binds to a number of biological molecules and influences their conformation stability and activity[7]. It serves as a catalyst for enzymes responsible for DNA replication ,gene transcription ,RNA and protein synthesis

[8]. It is important for several human functions including growth and development , bone metabolism, neuropsychiatric and immune functions[9].Copper may act as an antioxidant getting extricate of free radicals that can damages cells and DNA, it helps the body absorb iron and it is necessary to make energy to the body[10].Signs of possible copper deficiency include anemia , low body temperature , bone fractures and osteoporosis , low white blood cell count , irregular heartbeat , loss of pigment from the skin and thyroid problems[11].

Manganese is a trace mineral that is present in tiny amounts in the body, it helps the body form connective tissue, bones, blood clotting factors and sex hormones also plays a role in fat and carbohydrate metabolism [12]. Manganese is a component of the antioxidant enzyme super oxide dismutase (SOD) which helps fight free radicals, free radicals occur naturally in the body and can damage cell membranes and DNA, antioxidants such as SOD can help neutralize free radicals and reduce or even help prevent some of the damage they cause[13].

Methods

Zinc ,copper and manganese were determined by atomic absorption spectrometer in wavelength are 283.3,218.9 and 279.5 nm respectively[14] Blood samples were collected from 24patients (men only), aged 33-40 years, and 20 healthy as the same sex aged 33-40 years as a control group, all samples of patients are collected from Morjan hospital . After clotting, serum was separated by centrifugation at 3000 rpm, the analytical determinations described below were either performed immediately or stored at -20°C for used within 72 hours**.**

Statistical analysis

All results are expressed as a mean ± SD(standard deviation), comparison between patients and controls were performed by the student's t- test. A value of p – value less than 0.05 was considered statistically significant.

Results and Discussion

Zinc metal works as anti-oxidant and protects against free radicals generation in muscles, it is an essential mineral that is needed by the body to make about 300 enzymes, each of these enzymes has role in various functions such as cell reproduction, immunity, protein synthesis, wound repair, vision, free radical protection and immunity[15]. The results showed significant decrease in patients compared with healthy control(p= 0.00) **Table 1**.

Table 1: The Concentration of Zinc (µg /dL) In Arthritis Patients Compared With Healthy Control

Subject	Mean± SD µg /dl	P-value	Sign.
Control	107.915±10.569	-----	-----
Patients	73.323± 15.612	0.00	Sign.

Zn plays an important role in various biological activities in the body homeostasis. For example, it is a co-factor for the synthesis of enzymes, such as superoxide dismutase and glutathione peroxidase, these enzymes can fight free radical production and decline arthritis disorder [16].

Therefore zinc deficiency can cause increasing of arthritis exacerbation and joints may become swollen, painful, and inflamed[17].

Table 2: The Concentration Of Copper (µg /dL) In Arthritis Patients Compared With Healthy Control

Subject	Mean± SD µg /dl	P-value	Sign.
Control	108.75±19.607	-----	-----
Patients	67.101± 4.526	0.00	Sign.

The results shown significant decrease in patients compared with healthy control (p= 0.00) **Table 2**. Due to copper is integral component of antioxidant enzyme(SOD) , it has a reputation of being an effective anti-inflammatory agent in arthritis, therefore cellular production of free radicals occur with copper deficiency then caused inflammation [16].

Table 3: The Concentration of Manganese (µg/dL) in Arthritis Patients Compared with Healthy Control

Subject	Mean± SD µg/dl	P-value	Sign.
Control	0.060 ± 0.004	-----	-----
Patients	0.050 ± 0.005	0.001	Sign.

Manganese is one of several trace elements that is necessary for bone health ,it is help to fight free radicals because it is an important cofactor in antioxidant enzyme (SOD) therefore free radicals may be involved in the development of cellular damage and responsible for the inflammation[18,19].The data shown significantly decreased in arthritis patients compared with healthy control (p= 0.001) **Table 3**. Because manganese deficiency in human body can contribute to bone malformation, weakness and increase arthritis symptoms**.**

Conclusion

Zinc ,copper and manganese are essential for human development and function. Deficiency in these metals are associated with inadequate amount of antioxidant enzymes may be important contributing factor associated with oxidative stress leading to increase damage in arthritis disorders.

References

1) Lawrence R C, Hock berg M C, and Kelsey J**.** *J Rheumatol*. **(1989)**, 16, 427.
2) Hoch berg M C **.** *J Semin arthritis Rheum*. **(1990),** 19, 294.
3) Langseth L. Antioxidant And Diseases Of The Brain ,Antioxidant Vitamins Newsletter. **(1993)**, 4, 3.
4) Choy E H and Panayi G S. *J N. Engi Med*. **(2001),** 344, 907.
5) Mikuls T, Cerhan J, and Criswell L. *J Arthritis Rheum.* **(2002)**,46, 83.
6) Fraga CG. *J Mol Aspects Med.* **(2005)**, 26, 235.
7) Reeve V E, Nishimura N, and Bosnic M. Dietary Zinc, Photoimmunos And Metallothionien, In: Klaassen C, Verlag B, Switzer Land: Birkhauser. **(1999),** p 445.
8) Vallee B L and Falchuk K H. *J Physiol Rev*. **(1993),** 73, 79.
9) Coleman J.E. *J Annu Rev Biochem.* **(1992)**,61, 897.
10) Disilvestro R A, Sakamoto K, and Milner J A. *J Nut. Cancer*. **(1998),** 31, 218.
11) Kumar N, Gross J B, and Ahlskog J E**.** *J Neurology*. **(2004),** 63, 33.
12) Menezes F JA, Novaes C O, Moreira JC, Sarcinelli PN, and Mergler D. *J Environ Res.* **(2011)**, 111, 1, 156.
13) Sarban S, Isikan U E, Kocabey Y, and Kocyigit A. *J Biol. Trace Elem. Res*. **(2007)**,117, 155.
14) Parker M M, Humoller FL, and Mahler D J.*J Clin. Chem.* **(1967)**,40, 13.
15) Case J. P. *J Am. Thera*. **(2001)**, 163, 79.
16) Prasad A S, Bao B, Beck FW, Kucuk O, and Sarkar FH. *J Free Radic. Biol. Med*. **(2004)**, 37, 1182.
17) James R, Kenneth G, Linda A, Ted R, and Lindsey A. *Am. J. Epidemiol*. **(2003),** 157, 4, 345.
18) Odabasi E, Turan M, Aydin A, Akay C, and Kutlu M. *J Ann. Acad. Med. Singapore*. **(2008),** 37,7, 564.
19) Hori H, Ohmari O, Shinkai T, Kojima H, Okano C, Suzuki T, and Nakamur J. *J Neuropsychopharm*. **(2000),** 3, 2, 170.