

## Serum Trace Elements (Zinc, Copper and Magnesium) Status in Iraqi Patients with Acne Vulgaris :( Case- Controlled Study)

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### Abstract

Recently on the dermatological fields, the serum levels and the roles of Zn, Cu and Mg have been studied especially in acne vulgaris, but the results were controversial. The aim of the present study is to investigate a relationship between the severity of acne and the serum levels of zinc (Zn), copper (Cu) and magnesium (Mg) and to demonstrate the status of serum levels of zinc, copper, and magnesium in Iraqi male patients with acne vulgaris and to compare it with those of healthy controls. This case controlled study was conducted in the Department of Dermatology and Venerology and in the Poisoning Consultation Center of Baghdad Teaching Hospital between May 2009 to January 2010. Forty- five male patients with acne vulgaris, their ages ranged from 18-30 ( $21.82 \pm 3.77$ ) years and 45 healthy male subjects as controls, their ages ranged from 18-30 ( $22.18 \pm 3.85$ ) years were included in this study. Patients were subdivided into three groups according to the severity of their acne; mild acne group (n=15), moderate (n=15) and severe acne group (n=15). Investigations included serum estimation of Zn, Cu and Mg in both patient and control groups. The data obtained from this study showed that the (mean $\pm$ SD) values of serum levels of Zn was significantly decreased in severe acne group compared with controls, mild and moderate type of acne group ( $P < 0.05$ ). Serum Mg concentration was significantly lower in severe acne group compared with mild and moderate acne group ( $P < 0.05$ ). With regard to serum Cu, there were no significant differences among groups of patients with acne vulgaris. This study revealed a significant association between serum levels of either Zn or Mg with the severity of acne.

**Key words:** Acne vulgaris, zinc, copper, magnesium.

### الخلاصة

أن مستوى وأهمية الخارصين والنحاس والمغنيسيوم في مصل المرضى المصابين بالأمراض الجلدية وخاصة مرض حب الشباب تم دراسته ولكن النتائج كانت متباينة. أن هدف هذه الدراسة هو تقييم مستوى العناصر المعدنية (الخارصين، النحاس، المغنيسيوم) في مصل الذكور العراقيين المصابين بمرض حب الشباب والذكور الأصحاء ودراسة العلاقة بين مستوى هذه العناصر وشدة حب الشباب. لقد تم إجراء هذه الدراسة في قسم الأمراض الجلدية والتناسلية والمركز الاستشاري للسموم في مستشفى بغداد التعليمي للفترة من أيار ٢٠٠٩ ولغاية كانون الثاني ٢٠١٠. ذكر مصاب بحب الشباب تتراوح أعمارهم بين (١٨-٣٠ سنة). المعدل + الانحراف المعياري لأعمارهم هو (٢٨,١ - ٢٧,٣) سنة و ٤٥ ذكر صحيح (مجموعة السيطرة) بنفس الفئة العمرية (١٨-٣٠ سنة). المعدل + الانحراف المعياري لأعمارهم هو (٢٢,١٨ - ٢٢,٨٥) سنة. تم شمولهم في هذه الدراسة. أن مجموعة المرضى تم تقسيمها إلى ثلاث فئات حسب شدة حب الشباب: فئة حب الشباب النوع البسيط وعددهم ١٥, فئة حب الشباب النوع المتوسط وعددهم ١٥, فئة حب الشباب النوع الشديد وعددهم ١٣. الفحوص تشمل تحديد مستوى الخارصين، النحاس، والمغنيسيوم في مصل الأشخاص الأصحاء والمرضى. أظهرت نتائج الدراسة عدم وجود فرق إحصائي معنوي في مستوى العناصر (الخارصين، النحاس، المغنيسيوم) بين مجموعتي المرضى والأصحاء. لكن، مستوى الخارصين قد أنخفض بمستوى إحصائي معنوي لدى فئة حب الشباب النوع الشديد مقارنة مع مجموعة الأصحاء ومجموعة فئة حب الشباب النوع البسيط ( $P < 0.05$ ). كذلك أظهرت الدراسة انخفاض إحصائي معنوي في مستوى المغنيسيوم لدى فئة حب الشباب النوع الشديد مقارنة مع فئة حب الشباب النوع البسيط ( $P < 0.05$ ). وفي ما يخص مستوى النحاس، لا يوجد فرق معنوي بين فئات حب الشباب. يمكن الاستنتاج من هذه الدراسة بأن هناك علاقة معنوية بين مستوى كل من الخارصين والمغنيسيوم في مصل المرضى المصابين بحب الشباب مع شدة المرض.

### Introduction

Acne vulgaris is the most common cutaneous disorder manifested by comedones, papules, pustules and cysts. The etiology of acne appears to be multifactorial, involving follicular hyperkeratinization, hormonal function, proliferation of Propionibacterium acnes, increased sebum production and inflammation<sup>(1)</sup>. Despite a significant body of scientific literature, the sequence of events

leading to the production of acne lesions is not well understood<sup>(1)</sup>. Specific dietary agents and certain supplements are known to enhance the health and appearance of the skin by improving immune function at the skin level and providing therapeutic bioactive agents that assist in the treatment of many skin conditions, such as psoriasis, eczema and acne<sup>(2, 3)</sup>.

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It has become increasingly clear that nutritional factors such as vitamins and minerals are involved in the pathogenesis of acne<sup>(4)</sup>. Previous studies over the last three decades have shown that zinc(Zn) levels are lower in patients with acne than healthy subjects and that oral and topical combination of zinc may be of therapeutic value<sup>(5,6)</sup>. Pohit *et al.* in 1985 suggest that people with acne have lower-than-normal levels of Zn in their bodies<sup>(7)</sup>. This fact alone does not prove that taking zinc supplements will help acne, but several small double-blind studies involving a total of more than 300 people have found generally positive results<sup>(8)</sup>. The results of El-Saaiee *et al.* in 1983 revealed differences in the copper and iron content of the sera between 30 individuals complaining of moderate acne vulgaris type II and healthy individuals, although they were statistically not significant. The Zn content showed no changes compared to the control group<sup>(9)</sup>. Recently, Nasiri *et al.* in 2009 indicated that serum zinc levels in 30 Iranian acne patients were lower than that of 35 healthy controls; however, this difference was not significant ( $P=0.32$ )<sup>(10)</sup>. Many studies including an epidemiological Iraqi study had showed that acne vulgaris in general was more common in males than females (74.24%) versus (61.9%)<sup>(11,12,13)</sup>. So the aims of the present study are 1) to demonstrate the status of serum levels of zinc, copper, and magnesium in Iraqi male patients with acne vulgaris and to compare it with those of healthy controls and 2) to investigate the relation between the severity of acne and the serum levels of the elements of respect.

## Subjects and Methods

This case controlled study was carried out in the Department of Dermatology and Venerology and in the Poisoning Consultation Center of Baghdad Teaching Hospital from May 2009 to January 2010. The study involved 45 male patients with acne vulgaris, aged range between 18-30 (mean $\pm$ SD; 21.82 $\pm$  3.77 years). Patients were divided into three groups according to the severity of their acne. A mild acne group that included 15 patients, a moderate acne group of 15 patients and a severe acne group of 15 patients. Scoring the severity of acne was according to the following rule:

1. Mild acne: In which the count of papules is less than 10 and the count of pustules is less than 20.
2. Moderate acne: In which the count of papules ranges from 10 to 30 and the count of pustules ranges from 20 to 40.

3. Severe acne: In which the count of papules is more than 30 and the count of pustules is more than 40<sup>(14)</sup>. Exclusion criteria were intake of oral zinc, magnesium, or copper supplements or multivitamins containing such elements three months before the study, and the presence of any metabolic disease that affected serum elements levels. Control group involved were 45 healthy males without acne, and were matched for age 18-30 years (mean $\pm$ SD; 22.18 $\pm$  3.85 years), and body mass index (mean $\pm$ SD; 23.04 $\pm$ 1.38 Kg/m<sup>2</sup>).

Five milliliters of peripheral venous blood was collected from each patient and control male in plain test tubes, left to clot, then centrifuged at 2500 rpm for 10 minute. The separated serum stored at -20°C until the time of mineral assay. Serum zinc, copper, and magnesium were determined using flame atomic absorption spectrophotometer (AA-646 Shimadzu, Japan). Samples were diluted 1:10 with n-butanol solution as diluents<sup>(15)</sup>. Levels of serum Zn, Cu, and Mg were calculated after application of absorbancies on suitable calibration curve for each element made from standard solutions. SPSS version 6 for window was used for all statistical analysis. Statistical significance was assessed by ANOVA and student t-tests. The linear regression test was applied for the correlation between different parameters, and the significance of the r-value was checked using t-test. P-values of less than 0.05 were considered significant.

## Results

Table 1 shows the clinical and biochemical data for healthy male subjects and male patients with acne. The results revealed that there were no significant differences in mean ( $\pm$ SD) values of age and BMI between healthy controls and the mild, moderate and severe type of acne. Table 1, also shows the mean( $\pm$ SD) values of serum Zn, Cu, and Mg in patients with mild-, moderate-, and severe-acne types and male controls group. Concerning serum Zn levels in patients with severe acne type where was a significant lower levels (79.67 $\pm$ 7.19 mg/dl) than that of healthy males (102.42 $\pm$ 18.10 mg/dl,  $P=0.0001$ ), mild acne type(116.67 $\pm$ 12.34 mg/dl,  $P=0.0001$ ), and moderate acne type(95.67 $\pm$ 9.58 mg/dl,  $P=0.003$ ). Furthermore, patients with moderate type of acne had significantly lower levels of serum Zn mean ( $\pm$ SD) value than that of mild acne type ( $P=0.0001$ ). The mean ( $\pm$ SD) value of serum Cu levels did not differ significantly ( $p=0.085$ ) among the acne group types and controls as well as among the acne patient

**Table 1: Clinical and biochemical data for healthy male controls, - mild, - moderate, and - severe types of acne vulgaris patients.**

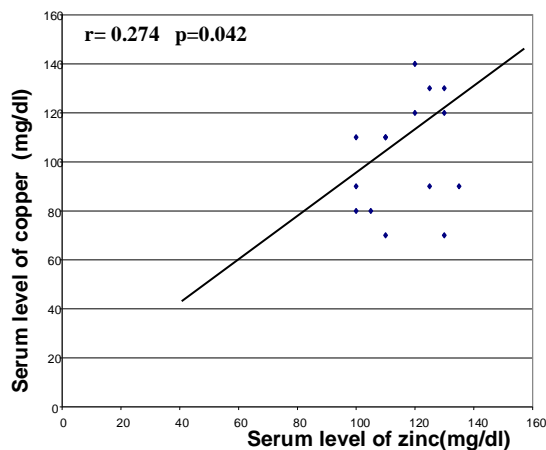
Parameters	Controls (n=45)	Mild acne (n=15)	Moderate acne (n=15)	Severe acne (n=15)
Age(year)	22.18±3.85	21.33±3.41 <sup>NS</sup>	22.07±4.32 <sup>NS</sup>	22.06±3.75 <sup>NS</sup>
BMI(Kg/m <sup>2</sup> )	23.04±1.38	22.91±1.24 <sup>NS</sup>	22.6±1.33 <sup>NS</sup>	22.77±1.41 <sup>NS</sup>
Zn(mg/dl)	102.42±18.10 <sup>a</sup>	116.67±12.34 <sup>a</sup>	95.67±4.58 <sup>b</sup>	79.67±7.19 <sup>c</sup>
Cu(mg/dl)	97.56±14.48 <sup>a</sup>	102.67±22.82 <sup>a</sup>	98.67±18.85 <sup>a</sup>	95.33±15.06 <sup>a</sup>
Mg(mg/dl)	1.14±0.17 <sup>a</sup>	1.29±0.18 <sup>b</sup>	1.20±0.18 <sup>b</sup>	1.13±0.20 <sup>a</sup>

-BMI: body mass index

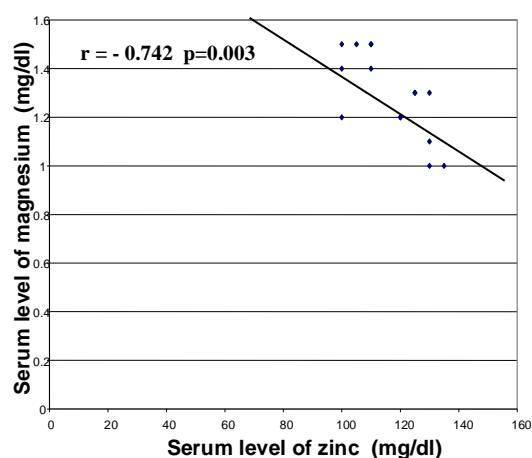
-NS: non significant

-Values with non identical superscripts(a, b and c) within each parameter were considered significant.

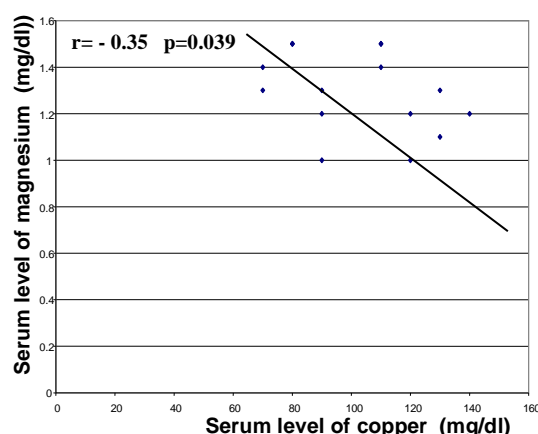
groups themselves. With the regard to serum Mg serum level, the mean ( $\pm$ SD) value of serum Mg was significantly decreased in severe type of acne patients ( $1.13 \pm 0.20$  mg/dl) when compared with that of mild acne type ( $1.29 \pm 0.18$  mg/dl,  $P = 0.011$ ), moderate ( $1.20 \pm 0.18$  mg/dl,  $p = 0.011$ ) with no significant differences in the level of serum Mg compared to control group. Furthermore, the results of the present study revealed a significant correlation among the serum levels of the studied elements (Zn, Cu, and Mg) in the mild, moderate and severe type of patients with acne vulgaris ( $p < 0.05$ ). As shown in the following figures:



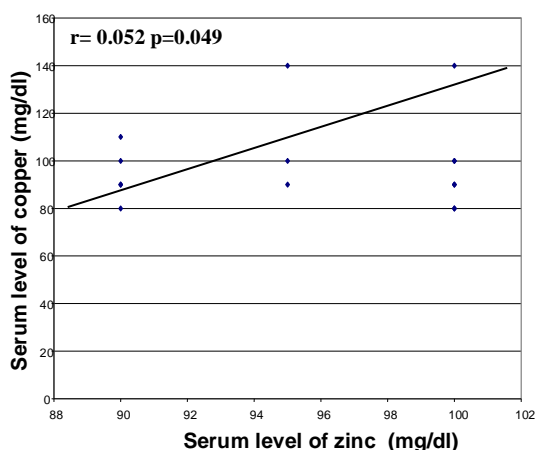
**Figure 1: Correlation between serum levels of copper and zinc in mild acne patients**



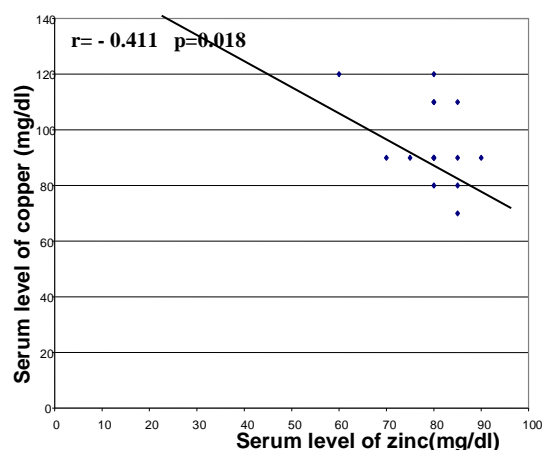
**Figure 2: Correlation between serum levels of magnesium and zinc in mild acne patients**



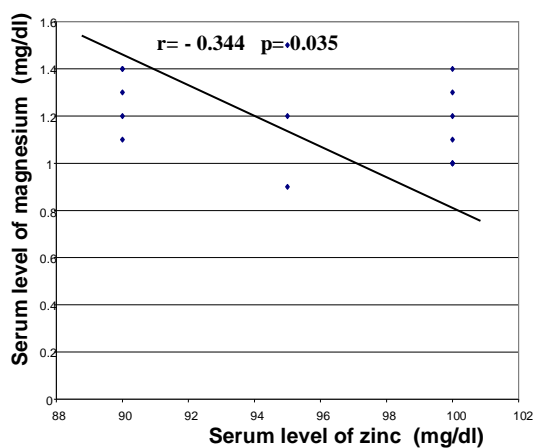
**Figure 3: Correlation between serum levels of magnesium and copper in mild acne patients**



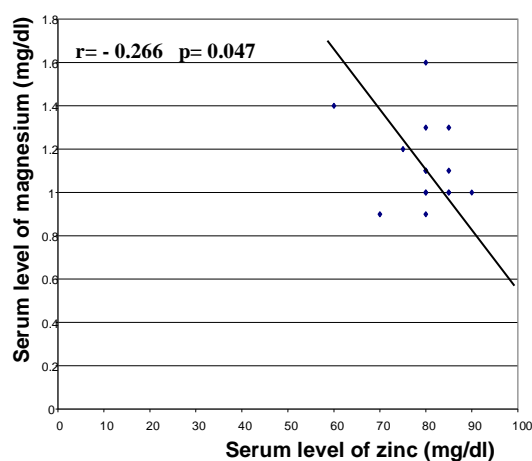
**Figure 4: Correlation between serum levels of copper and zinc in moderate acne patients**



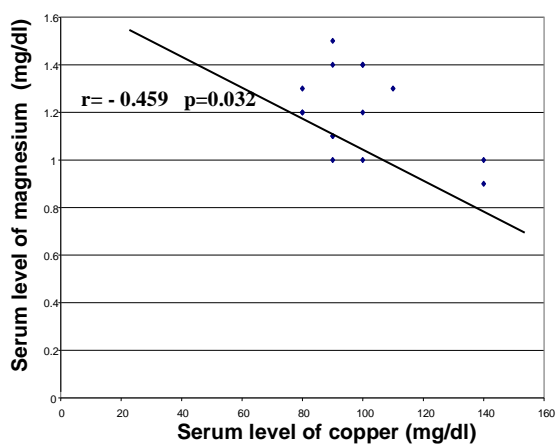
**Figure 7: Correlation between serum levels of copper and zinc in severe acne patients**



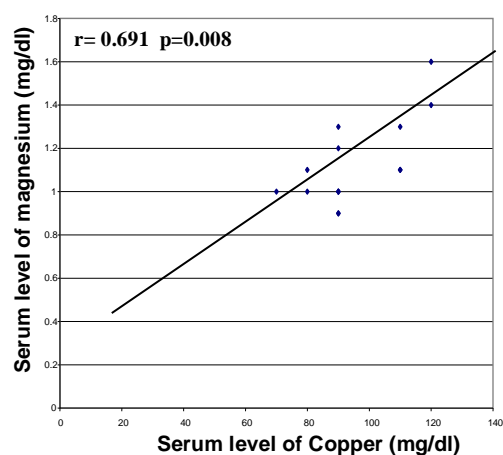
**Figure 5: Correlation between serum levels of magnesium and zinc in moderate acne patients**



**Figure 8: Correlation between serum levels of magnesium and zinc in severe acne patients**



**Figure 6: Correlation between serum levels of magnesium and copper in moderate acne patients**



**Figure 9: Correlation between serum levels of magnesium and copper in severe acne patients**

## Discussion

The present study showed that serum Zn levels in patients with the severe type of acne were significantly lower than that of healthy controls, mild, and moderate types of acne. These data are in agreement with that reported by Michaelsson *et al* in 1977 and Amer *et al* in 1982<sup>(16,17)</sup> who showed that serum Zn level was significantly reduced in severe acne male patients compared with controls. These authors suggested that low levels of zinc in the serum of patients with severe acne may provide a rationale for the beneficial effect of oral zinc treatment seen in clinical practice<sup>(16)</sup>. The mineral zinc is emerging as a vital nutrient for skin health and appearance. Zinc nutritional status is necessary for oil gland function, local skin hormone activation, wound healing, skin inflammation control and regeneration of skin cells. Zinc supplementation has been used with success in the treatment of many acne cases<sup>(18)</sup>. Studies indicated that most individuals consume only 8-9 mg/day of zinc from dietary sources, whereas the recommended daily requirement (RDA) for zinc is set at 15 mg/day for adults<sup>(19)</sup>. A review reported by Preston R in 2002, indicated that lack of zinc is a recipe for acne<sup>(20)</sup>. Nasiri *et al* in 2009 concluded from their study that zinc as an anti-inflammatory element may play a role in the pathogenesis of acne, and there is a need for further studies<sup>(10)</sup>. The present study also found that serum magnesium level was significantly decreased in severe type of acne compared with mild and moderate type of acne patients. Magnesium is a vital element for the production of proteins and enzymes in every tissue of the body. This includes the proteins and enzymes of skin cells where new cells are constantly being produced. It is also absolutely essential for the proper use of Pyridoxine, and it was suggested that taking of about 500 mg of the intended element each day is essential<sup>(20)</sup>. Copper is an important element for numerous metalloenzymes and metalloproteins such as superoxide dismutase that are involved in energy and antioxidant metabolism. Superoxide dismutase (Cu-metalloenzyme) protects human skin cell from peroxidative damage, as human keratinocytes contain high concentrations of polyunsaturated fatty acids and also possess a significant ability to generate a reactive oxygen species (ROS), mainly superoxide anion and hydrogen peroxide<sup>(21)</sup>. Although, this study showed that there were no significant differences in serum copper level among patients with different type of acne with control groups. Further studies are needed to show the beneficial effect of Cu compounds in prevention and treatment of

acne vulgaris. In Conclusion; this study revealed significant association between each of Zn and Mg levels with the severity of acne.

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