International Journal of Research and Review
Vol.7; Issue: 10; October 2020
Website: www.ijrrjournal.com
Original Research Article *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Study of the Levels of Trace Elements (Cu, Mg, Zn) in Psoriasis Patients: A Case Control Study

Sara Mohammed[1], Faizan i Asrar Nazki[2], Safa Mohammed[3], Syyeda Anees[4], Bader-UZ-Zaman[5]

[1]MD Biochemistry, Deccan College of Medical Sciences, Santosh Nagar, Hyderabad
[2]MD Biochemistry, Demonstrator, Department of Biochemistry, Government Medical College Srinagar J and K
[3]Postgraduate Student, Department of Biochemistry, Gandhi Medical College Secunderabad
[4]Professor, Department of Biochemistry, DCMS Hyderabad (TS)
[5]Professor, Department of Biochemistry, DCMS Hyderabad (TS)

Corresponding Author: Faizan i Asrar Nazki

ABSTRACT

Aim: To study levels of trace elements (Cu, Mg, Zn) in psoriasis patients
Material and Methods: A total of 50 cases diagnosed for psoriasis were undertaken during the study period in the test group. 50 healthy individuals with no skin disease were taken as control group. The cases were taken from the department of Dermatology. Blood samples were collected and analyzed in the department of Biochemistry, Owaisi Hospital and Research Centre (OHRC). Serum FRAP Assay, Copper, Magnesium and Zinc were estimated in both the groups.
Results: Serum FRAP Assay were lowered in psoriasis patients than controls indicating that total antioxidant levels are decreased in psoriasis than controls. Decreased total antioxidant levels may be due to depressed state of antioxidant system or due to oxidative stress in these patients. Serum copper levels were increased in psoriasis patients than controls. Serum zinc levels in psoriasis patients were significantly low in psoriasis patients when compared to controls. Serum Magnesium levels in psoriasis were significantly decreased in psoriasis patients than controls.
Conclusion: This study highlights the possible role of trace metals copper and zinc in the etio-pathogenesis of psoriasis and also provides a proposed interplay of factors involved in the pathogenesis of psoriasis.

Keywords: Psoriasis, trace elements, FRAP

INTRODUCTION

Psoriasis is a common, chronic, disfiguring, inflammatory and proliferative condition of the skin with both genetic and environmental influences characterized by red, scaly, sharply, demarcated, indurated plaques, present particularly over extensor surfaces and scalp. [1] The incidence world-wide is 2-3%. [2]

Trace elements are those found in such small amounts in the living tissues, of the trace element appearing in the body, ten have been designed essential trace elements: Zinc, copper, manganese, iodine, iron, cobalt, molybdenum, tin, selenium and chromium.[3-5] In biochemistry, a trace element is a dietary mineral that is needed in very minute quantities for the proper growth, development, and physiology of the organism.[6]

Trace elements are essential to biochemical processes in the body and are involved in immunological and inflammatory reactions such as keratinization and melanin formation.[7]

1. COPPER

Copper is widely distributed in biological tissues, where it occurs largely in the form of organic complexes, many of which are metalloproteins and functions as enzymes. They are involved in utilization of oxygen during cell respiration and energy utilization. The involvement of copper in a

variety of key oxidative and synthetic processes may well imply that mild deficiency has generalized rather than diagnostically specific events. A common characteristic of enzymes containing copper is their ability of using elemental oxygen as a substrate for oxidation and hydroxylation. Most copper metalloenzymes are oxidases, hydroxylases and superoxide dismutase and are involved in metabolic reactions, angiogenesis, oxygen transport and antioxidant protection physiological functions related to copper are based on the biochemical functions of one or more copper metalloenzymes.[8]

2. ZINC

Zinc participates in the synthesis and degradation of carbohydrates, lipids, proteins and nucleic acids. Its involvement in fundamental activities probably accounts for the essentiality of zinc in all forms of life. Zinc is a co-factor for DNA- and RNA polymerases required for protein synthesis in involved skin. Zinc and copper are important cofactors and modulators of many critical biological functions in many dermatological diseases including psoriasis.[9] Zinc and copper are an integral part of as many as 40 metalloenzymes, including alkaline phosphatase and superoxide dismutase, and changes in their serum levels may reflect in changes in the activity of these enzymes.

3. MAGNESIUM

Magnesium is an essential mineral, being found in all organs of your body. It is involved in the activation of several enzymes and in the regulation of calcium and other nutrients. All human tissues contain small amounts of this mineral. The adult human body contains about 25 grams of this mineral. Most of this magnesium is present in the bones in combination with phosphate and carbonate. About one-fifty of the total magnesium in the body is present in the soft tissues, where it is mainly bound to protein. The dietary recommendation (RDA) for magnesium is 400 to 420 mg daily for adult men and 310 to 320 mg daily for adult women. Mechanisms of magnesium action are anti-inflammation, antioxidant, and modulation of cell growth properties. The production of reactive oxygen species is usually increased in the vasculature of psoriasis patients, and the involvement of magnesium could occur through the reduction of inflammation and oxidative stress. Additionally, deficiency of this mineral has been previously related to oxidative stress, proinflammatory state and endothelial dysfunction. Mg has antioxidant properties. There are a number of studies on the serum level of trace elements in psoriasis with controversial findings.[10,11]

The present study was planned to investigate the possible involvement of oxidative stress-antioxidant status and the levels of trace elements in psoriatic patients.

MATERIALS AND METHODS

A case- control study was carried out at Owaisi Hospital and Research Centre (OHRC), Hyderabad. The study was carried out for a period of 1 year from June 2016-June 2017.A total of 50 cases diagnosed for psoriasis were undertaken during the study period in the test group. 50 healthy individuals with no skin disease were taken as control group. The cases were taken from the department of Dermatology. Blood samples were collected and analyzed in the department of Biochemistry, Owaisi Hospital and Research Centre (OHRC).All patients attending the dermatology out-patient department in the Owaisi Hospital and Research Centre (OHRC), who were diagnosed with psoriasis were included in the study. Both male and female patients within the age group of 18-65 years were included. Controls: 50 individuals without history of any kind of skin disease were selected who included both males and females in the age group of 18 to 65 years.

Patients with history of other skin diseases, chronic diseases like hypertension, diabetes, chronic smokers and alcoholics. Psoriatic patients receiving any systemic treatment for at least 4 weeks or

photochemotherapy within 3 months before enrolment. Patients who did not give voluntary informed consent for reviewing. Patients less than 18 years and more than 55 years. All these patients were excluded from the study.

Approval of the institutional ethics committee was obtained before starting the study.

The following parameters were estimated in all subjects:

a. Zn, Mg, Cu are determined by colorimetry.

b. Total anti-oxidant activity in plasma by ferric reducing anti-oxidant power (FRAP ASSAY)

All the analytes estimated are subjected to standard quality control (QC) guidelines. External Assurance Quality scheme (EQAS) is under CMC Vellore. Internal Quality control is run twice daily.

Statistical Analysis

Student's 't' test (independent, two-tailed) was used for significance of study parameters on a continuous scale between two groups. Pearson's correlation was used to find out the strength of linear relationship between study variables. p-value of 0.05 or less as statistically significant.

RESULTS

There was no statistical difference in patient's demographics between the two groups. Mean age was 43.76±10.080. 50 individuals of the age group of 18-55 years without any history of any skin disease or chronic diseases like hypertension, diabetes and obesity were taken as control group in this study Mean age was 38.96 ± 11.178. Serum FRAP Assay, Copper, Magnesium and Zinc were estimated in both the groups. The results obtained are tabulated below. This data was subjected to descriptive analysis to find out the mean, standard deviation, standard error of the mean and p value. The differences between the two groups are done by means of students unpaired "t" test for independent mean values.

Table 1: showing statistical analysis of serum FRAP Assay in psoriasis patients and controls.

	Serum FRAP Assay (µmol/ml)	
	Psoriasis	**Controls**
Mean	1.18	1.20
Standard Deviation	0.438	0.404
P – value	0.813 *NS	

*NS = Not Significant

It is seen from the table 1 that Serum FRAP Assay in psoriasis patients is in the range of 1.18±0.43. Serum FRAP Assay in controls is in the range of 1.20±0.4. It is evident from the table that serum FRAP Assay is decreased in psoriasis patients than in controls.

Table 2: Showing Statistical analysis of Serum Copper levels in Controls and Psoriasis patients:

	Serum Copper (µg/dl)	
	Psoriasis	**Controls**
Mean	122.58	69.76
Standard Deviation	8.187	11.449
P – value	0.000 *HS	

*HS= Highly Significant

It is seen from the table 2 that serum copper levels in psoriasis patients are in the range of 122.58±8.18. Serum copper levels in controls are in the range of 69.76±11.44. It is evident from the table that serum copper levels are increased in psoriasis patients than in controls. This increase is highly significant. ($p<0.001$)

Table 3: Showing statistical analysis of Serum Zinc in psoriasis and controls

	Serum Zinc	
	Psoriasis	**Controls**
Mean	71.06	148.34
Standard Deviation	8.858	15.370
P- Value	0.000 *HS	

*HS= Highly Significant

It is seen from the table 3 that Serum zinc levels in psoriasis patients are in the range of 71.06±8.85. Serum zinc levels in controls are in the range of 148.34±15.370. It is evident from the table that serum zinc levels are decreased in psoriasis patients than in controls. This decrease is highly significant. ($p<0.001$)

Table 4: Showing Statistical analysis of serum magnesium in psoriasis and controls

	Serum Magnesium (mg/dl)	
	Psoriasis	**Controls**
Mean	1.28	2.04
Standard Deviation	0.454	0.198
P- Value	0.000 *HS	

*HS =Highly Significant

It is evident from the table 4 that serum magnesium levels are decreased in psoriasis patients than in controls. This decrease is highly significant. ($p<0.001$)

DISCUSSION

Although there have been extensive studies on the roles of serum lipids, oxidants and antioxidants levels in psoriasis, their importance in the etiology or in the enhancement of the disease remains controversial (Jyothi et al., 2011).[12] There is no comprehensive study on the levels of trace elements, oxidants and anti-oxidants defense mechanism and correlation in between them. Studying the levels of trace elements in psoriatic patients gives an idea about the molecular basis of psoriasis and cytokine etiology. This approach seems reasonable because copper and zinc are known to be among the constituents of the skin and to play essential roles in maintenance of its function in association with the enzyme systems activated by trace elements. A deficit of those elements may result in decrease of antioxidant enzyme activity and increase in oxidative cell damage.[13] Trace elements and their compounds have been used since ancient times for their therapeutic as well as cosmetic effects on the skin[14,15]. We measured some of the trace elements in order to illuminate the possible role of trace metals in the pathogenesis of psoriasis.

Zinc is considered as an antioxidant because the extracellular enzyme superoxide dismutase is zinc- dependent and it plays a vital role in the protection against free radical damage.[28] Studying the level of trace elements in psoriatic patients gives an idea about the molecular basis of psoriasis and cytokine etiology. In our study, serum zinc level was found to be diminished in a considerable percentage of psoriatic patients. Similar results to our study were found in many studies[16-17] Zinc has important roles in bone formation, cell mediated immunity, generalized host defense, and a wide variety of factors related to tissue growth. Zinc provides structural integrity to the enzyme and/ or participates directly in catalysis. This explains that zinc is used in rapid turnover of the skin and loss of zinc occurs through exfoliation. And zinc deficiency may be the original cause of psoriasis. Some studies noted that psoriatic lesions retain a high content of zinc compared with the uninvolved skin, suggesting an imbalance in zinc distribution between serum and psoriatic lesions[16,17]. In fact zinc is a co-factor for DNA- and RNA polymerases required for protein synthesis in affected skin. Lowered level of serum protein or albumin which results from peeling off of a large quantity of scales from the body surface, may be also attributable to decreasing zinc level. Alternative possibility is that disturbances of zinc status might actually be causative in producing psoriasis. The possibility that altered zinc status might contribute to the pathology of psoriasis is worth considering in view of the finding that lesions of psoriasis are associated with systemic zinc deficiency in humans.

Contradictory to this, some authors found increase level of serum zinc & in some studies the serum zinc was equal in patients and control subjects. Basavaraj et al, found decreased Zn concentrations in both mild and severe psoriasis patients consistent with some studies and increased Cu concentrations in both mild and severe psoriasis groups[18]. Bhatnagar et al[19], in their study on active and remissive phases of psoriasis, reported an increase in serum Zn and reduced Cu levels. Overall, it seems that Cu/Zn is a more effective parameter rather than either Zn or Cu level alone, although it had no correlation with the severity of psoriasis in our study.

In the present study, we observed that Mg was significantly lower in patients in comparison with controls. Basavaraj et

al, reported higher levels of Mg in the serum samples of both mild and severe psoriasis group.[19] Suworow reported that magnesium deficiency was the focus of skin damage in psoriasis.[20] Interestingly, Schempp et al, demonstrated that magnesium ions specifically inhibited the antigen presenting capacity of Langerhans cells and that they might contribute to the efficacy of Dead Sea water in the treatment of inflammatory skin disorders.[21] None of the elements were correlated to psoriasis chronicity. Interestingly, decreased serum Mg levels in patients with SLE has been reported in a study,[22] which is similar to our finding, and may show some similarities in metabolic alterations in these inflammatory disorders. The mechanisms by which these alterations occur in certain inflammatory conditions can be explained due to the deficiency of magnesium.

Regarding the serum copper level in the present study, a statistically significant increase was demonstrated in patients as compared to healthy control. These results are in accordance with the results given by Tasaki et al. (1993)[23] and Basavaraj. et al. (2009),[18] who found a significant increase in the serum Cu level of both mild and severe psoriasis patients. There are other reports too stating that the serum copper level is high in psoriasis.[24,25] Copper is present in the serum in at least two fractions: (1) a transport fraction (approximately 5%) loosely bound t albumin; and (2) ceruloplasmin (approximately 95%) firmly bound to globulin. The elevation of serum Copper in psoriasis maybe ascribed to an increase in both fractions, especially an increase in ceruloplasmin, a Copper-binding protein, in response to inflammation.

Serum copper and ceruloplasmin levels were significantly increased in psoriasis. Hinks et.al reported that serum copper and ceruloplasmin levels were significantly increased in psoriasis.[26] It is not known, however, whether psoriasis accelerates the release of synthesized protein (ceruloplasmin) into the blood serum or whether the synthesizing capacity is enhanced, or both. Copper is required for a number of functions, including bone formation, proper cardiac function, connective tissue development, myelination of the spinal cord, keratinization, myelination of the spinal cord and tissue pigmentation. The function of copper in metalloenzymes involves electron transfer and enzymatic binding of molecular oxygen. Superoxide dismutase is extremely important and well-studied copper metalloenzyme. Another copper dependent enzyme, lysyl oxidase, is important in the biosynthesis of connective tissues. Its deficit probably accounts for the lesions of copper deficiency that affect bone and connective tissues. Its activity in the liver was related to collagen synthesis during hepatic fibrosis[27].

The role of zinc and copper in skin disease has been widely investigated, particularly with regard to psoriasis. Serum copper has been reported as increased in patients with psoriasis, whilst measurement of plasma zinc resulted in conflicting data, both reduced and normal levels being reported. The reason for the conflict in serum zinc levels in psoriasis patients may be due to failure to take into account the extent of skin involvement, and a relationship between surface involvement and serum zinc levels. But Hinks et al[26] did not demonstrate such an effect in psoriasis.

CONCLUSION

He results of this study suggest zinc and copper may have a role in etiology of psoriasis as they influence the levels of antioxidant enzyme superoxide dismutase. These levels reflect that these abnormalities are caused by either the disease process or due to the pathogenesis of psoriasis into motion. This needs to be investigated further by large-scale studies. Furthermore, these simple indices may be useful in the clinics for oxidative stress assessment, thus obviating the need for expensive biomarkers which can be restricted to research settings. This study aims at highlighting the possible role of trace metals copper and zinc in the etio-pathogenesis of psoriasis and also

provides a proposed interplay of factors involved in the pathogenesis of psoriasis.

REFERENCES

1. Griffiths CE, Barker JN. Psoriasis. In: Burns T, Breathnach S, Cox N, Griffiths C, editors. Rooks Textbook of Dermatology. 8th ed. UK: Blackwell Publishing Ltd; 2010. pp. 1.
2. Bowcock AM, Krueger JG. Getting under the skin: the immunogenetics of psoriasis. Nat Rev Immunol. 2005; 5(9):699-711.
3. Krueger G, Ellis CN. Psoriasis-recent advances in understanding its pathogenesis and treatment. J Am Acad Dermatol. 2005;53(1 Suppl 1): S94-100.
4. Gelfand JM, Stern RS, Nijsten T, Feldman SR, Thomas J, Kist J et al. The prevalence of psoriasis in African Americans: results from a population-based study. J Am Acad Dermatol. 2005 Jan; 52(1):23-6.
5. Barker JN. Pathogenesis of psoriasis. J Dermatol. 1998 Dec; 25(12):778–81.
6. Varley H, Gowenleck AH, Bell M. Practical Clinical biochemistry. London: Williams Heinemans Medical Book Ltd.; 1980.
7. Bock M, Schmidt A, Bruckner T, Diepgen TL. Occupational skin disease in the construction industry. Br J Dermatol. 2003;149(6):1165-71.
8. Jelka Vukelic, Aleksandra Kapamadzija, Djordje Petrovic, Zorica Grujic, Aleksandra Novakov-Mikic, Vesna Kopitovic, Arthur Bjelica. Variations of serum copper values Arh celok Lek, 140 (1-2):4246, 2012.
9. Kadam DP, Suryakar AN, Ankush RD, Kadam CY, Deshpande KH. Role of oxidative stress in various stages of psoriasis. Indian J Clin Biochem. 2010 Oct; 25(4):388-92.
10. Voorhees JJ, Chakrabarti SG, Botero F, Miedler L, Harrell ER. Zinc therapy and distribution in psoriasis. Arch Dermatol. 1969 Dec; 100(6):669-73.
11. Jyothi RS, Govindswamy KS, Gurupadappa K. Psoriasis: an oxidative stress condition. J Clin Diagn Res. 2011; 5:252–3.
12. Ghosh A, Mukhopadhyay S, Kar M. Role of free reactive iron in psoriasis. Indian J Dermatol Venereol Leprol. 2008; 74(3):277-8.
13. Afridi HI, Kazi TG, Jamali MK, Kazi GH, Shar GQ. The status of trace and toxic elements in biological samples (Scalp Hair) of skin disease patients and normal human subjects. Turk J Med Sci. 2006; 36:223-30.
14. Adriano DC. Trace elements in terrestrial environments: biogeochemistry, bioavailability, and risks of metals. 2nd ed. New York: Springer; 2001. pp. 866.
15. Alwasiti, Estabraq ARK, Al-Rubayee, Wasan T, Al-Tammimy, Sami M: Serum Copper, Zinc and Oxidative Stress in Patients with Psoriasis. Iraqi J Med Scienc. 2011; 9:137.
16. Arora PN, Dhillon KS, Rajan SR, Sayal SK, Das AL. Serum zinc levels in cutaneous disorders. Med J Armed Forces India. 2002; 58(4):304-6.
17. Basavaraj KH, Darshan MS, Shanmugavelu P, Rashmi R, Mhatre AY, Dhanabal SP et al. Study on the levels of trace elements in mild and severe psoriasis. Clin Chim Acta. 2009; 405(1-2):66-70.
18. Bhatnagar M, Bapna A, Khare A. Serum proteins, trace metals and phosphatases in psoriasis. Indian J Dermatol Venereol Leprol. 1994; 60:18.
19. Suworow AP. Regulation of peptide hydrolase activity in psoriasis. Dermatol Monatsschr. 1990;176(7):393-7.
20. Schempp CM, Dittmar HC, Hummler D, et al. Magnesium ions inhibit the antigen-presenting function of human epidermal Langerhans cells in vivo and in vitro. Involvement of ATPase, HLA-DR, B7 molecules, and cytokines. J Invest Dermatol. 2000; 115(4):680-6.
21. Yilmaz A, Sari RA, Gundogdu M, Kose N, Dag E. Trace elements and some extracellular antioxidant proteins levels in serum of patients with systemic lupus erythematosus. Clin Rheumatol. 2005; 24(4):331-5.
22. Tasaki M, Hanada K, Hashimoto I. Analyses of serum copper and zinc levels and copper/zinc ratios in skin diseases. J Dermatol. 1993; 20(1):21-4.

23. Twomey PJ, Wierzbicki AS, Reynolds TM, Viljoen A. The copper/caeruloplasmin ratio in routine clinical practice in different laboratories. J Clin Pathol. 2009; 62(1):60–3.
24. Doğan P, Soyuer U, Tanrikulu G. Superoxide dismutase and myeloperoxidase activity in polymorphonuclear leukocytes, and serum ceruloplasmin and copper levels, in psoriasis. Br J Dermatol. 1989; 120(2): 23944.
25. Hinks LJ, Young S, Clayton B. Trace element status in eczema and psoriasis. Clin Exp Dermatol. 1987; 12(2):93-.
26. Cousins RJ. Absorption, Transport and Hepatic metabolism of copper and zinc: Special reference to metallothionein and ceruloplasmin: Physiol Rew 1985; 65: 238-309.

How to cite this article: Mohammed S, Faizan i Asrar Nazki, Mohammed S et.al. Study of the levels of trace elements (Cu, Mg, Zn) in psoriasis patients: a case control study. International Journal of Research and Review. 2020; 7(10): 311-317.

******