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Analysis Of Serum Copper, Zinc And Iron Levels In Psoriasis And Psoriasis With Hyper Tension Patients

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Abstract:
As co-factors of metallo enzymes, copper (Cu), zinc (Zn) have a considerable effect on nearly all the metabolisms that takes place in organs of the body, including the skin. Iron(Fe) is a key element in the metabolism of almost all living organisms and is essential component of hundreds of proteins and enzymes. The purpose of this study was to evaluate copper, zinc & iron status in Psoriasis. We measured serum levels of copper and zinc in 35 cases of Psoriasis and 15 cases of Psoriasis with H.T., and 24 healthy controls by Direct colorimetric method using kits from Crest Bio-systems& serum iron level by manual method dipyridyl method (Ramsay, 1954, 1958). The serum levels of Cu were significantly higher in Psoriasis than in healthy controls, which may be due to copper stimulates the immune system to fight infections [(1 - 3)] and helps to neutralize 'free radicals' which can cause severe damage to cells[(4)]. The serum levels of zinc were significantly lower in Psoriasis than in the healthy controls. The most likely explanation of the depression of serum zinc in Psoriasis is zinc depletion secondary to loss of zinc through exfoliation [(5)]. The serum level of iron were significantly lower in psoriasis patients than in healthy controls which may be because of accelerated loss of iron from the hyperproliferation and desquamation of epidermal layer of skin[6].
The serum levels of zinc were further decreased in Psoriasis with H.T. patients and serum copper level were further increased in Psoriasis with H.T. patients as compared to controls which may be because trace elements regulate blood pressure& any imbalance of dietary intake ofthese elements such as (copper, zinc) will affect the blood pressure and lead tothe development of hypertension and vascular diseases [(7-8)].There is no change in the level of serum iron in psoriasis and psoriasis with H.T. patients.
The purpose of this study was to access the body status of trace elements i.e. copper, zinc and iron as a potential marker of the disease and may provide better targets for effective control of the disease.

Key words : *Serum copper , serum zinc , serum iron, psoriasis , psoriasis with H.T.*

1.Introduction

The effects of pathologic condition on the levels of serum zinc, copper and iron have been of interest to investigators for a no. of years. From time to time attempts have been made to determine these trace metal levels associated with diagnosis of interest, but most of these studies were limited in scope, often resulting in conflicting reports.

Cu, Znand Fe are important co-factors and modulators of many critical biologic functions in the states of health and diseases [9,10]. There has been an increased awareness that the levels of dietary intake of copper, zinc and iron may be marginal for patients with particular diseases or for entire population groups[11-13].Copper is necessary for growth development and maintenance of bone, connective tissue. Copper stimulates the immune system to fight infections, [2-3]. Copper also helps to neutralize 'free-radicals' which can cause severe damage to cells [4]. Some experts believe that elevated copper levels, especially when zinc levels are also low, may be a contributing factor in many medical conditions including hypertension, fatigue, muscle and joint pain, skin diseases & premenstrual syndrome [14].

Zinc is one of the important trace elements constituting less than 0.005% of total body weight and is related to health and disease[8]. In fact, congenital and acquired zinc deficiencies express as a variety of skin manifestations such as psoriasis like eruptions, blisters, loss of hair and onychopathy[10]. Zinc serves an essential role as a cofactor for more than 200 metalloenzymes.Zinc acts as integral components of Cu-Zn SOD, which is essential for thestrength and the integrity of the heart and blood vessels, so decreased amountof zinc will lead to decrease in the SOD activity which leads to impair heartfunctions [15].Decreased serum zinc levels have been reportedin number of cutaneous disorders by some investigators[16], while others have refuted these findings [16-17].

The total amount of iron in an adult body is 3-5 gm. About 70% of this occurs in the body as a constituent of haemoglobin. European food and safety authority (EFSA) has confirmed that iron helps in normal function of RBC and haemoglobin, immune systems and normal cell division[18]. So sufficient iron is critical to several immune functions, including the development and division of WBC and the generation of free radicals, which are used for killing infectious agents (eg. bacteria) [19]. So decreased serum iron level is reported in psoriasis by many investigators [6,20] may be because of accelerated loss of nutrients from the hyperproliferation and desquamation of epidermal layer of skin in psoriasis.

There are not many studies which relate these trace element levels with both groups of psoriasis from India, which prompted us to carry this study and which may become a better target for effective control of the disease.

2.Material & Method

The study was carried out at the Biochemistry & Dermatology Departmentof large hospital from July 2012 to December 2012. The material for the study consisted of 50 cases of different psoriatic disorders i.e. 35 patients of psoriasis & 15 patients of psoriasis with H.T., and 24 healthy controls.

Fasting blood samples (approx. 5ml) were collected in the morning between 9 and 11am in OPD. Blood samples were drawn by venipuncture into vacutainer tubes and the samples were immediately centrifuged and serum is separated from clotted blood. The serum obtained was kept in freeze at −20ºC until it was analysed every 3 months for serum copper and zinc. The metals zinc and copper were analysed by the direct colorimetric method using kits from Crest Biosystems. The colour reagent for copper was 3,5-DiBr-PAESA stain in acid solution. Copper is released from the ceruloplasmin protein and reduced; the cuprous ion forms a coloured complex with the stain and is measured photometrically at 582nm. The zinc ions of the sample produce a red coloured complex with 2-(5-Brom-2-pridylazo)-5-[-N-propyle-N-(3-sulfopropyl) amino]-phenol in alkaline solution, and the colour intensity was measured at 560nm. The normal reference values for the instruments were 80–155 µg/dl for copper and 68–115 µg/dl for zinc.

Iron level is analysed by manual dipyridyl method (Ramsay, 1954,1958). Ferrous iron gives a pink colour with 2'.2'-dipyridyl. A solution of dipyridyl in acetic acid is added to serum followed by a reducing agent. Proteins are removed by heating in boiling water and then centrifuging or filtering and the colour intensity was measured at 520nm in colorimeter. The normal reference value of iron for the instrument were 60-170 µgm/dl.

2.1.Statistical Analysis

Data were analysed using the one way analysis of variance (ANOVA) followed by Tukey's test to assess differences of continuous variable between two or more groups.

Pearson's r coefficient was used to assess the correlation between two continuous variables. Statistical significance was assigned for p values less than 0.05.

3.Result

Out of 50 patients. 34 (68%) were males and 16 (32%)females. 8 (16%) were in second decade of life, 14 (28%)in third decade, 14(28%) in fourth decade. 7 (14.7%) infifth decade and 7 (14.7%) above 50 years of age. 24healthy controls belonged to same socio economic statusand in whom cutaneous/systemic disease processes werecarefully excluded clinically and by relevant laboratory investigations.Normal serum copper level range from 80-140µ gm/dl in males and 80-155 µ gm/dl in females.Normal Serum zinc level range from 60-140 µgm/dl. Normal serum iron level range from 60-170 µgm/dl.

Cutaneous Disorder	No. of cases	Serum copper level (µgm/100 ml)			P value
		Minimum	Maximum	Mean with SD	
Controls	24	76	145	110.04±37.12	
Psoriasis	35	90	186	136.62±26.66	<0.05
Psoriasis with H.T.	15	102	190	135.33±27.80	<0.05

Table 1 : Serum copper level in controls, psoriasis & psoriasis with H.T.

Cutaneous Disorder	No. of cases	Serum zinc level (µgm/100 ml)			P value
		Minimum	Maximum	Mean with SD	
Controls	24	58	147	105.3±30.1	
Psoriasis	35	35	139	93.3±25.9	<0.05
Psoriasis with H.T.	15	26	102	71.5±21.5	<0.001

Table 2 : Serum zinc level in controls, psoriasis & psoriasis with H.T.

Cutaneous Disorder	No. of cases	Serum iron level (µgm/100 ml)			P value
		Mini mum	Maxi mum	Mean with SD	
Controls	24	64	110	86.95±11.1	
Psoriasis	35	50	102	70.8±12.3	<0.05
Psoriasis with H.T.	15	54	90	71.2±10.5	<0.05

Table 3 : Serum iron level in controls, psoriasis & psoriasis with H.T.

Serum copper levels in psoriatic patients (Table 1) and psoriasis with H.T. patients is statistically significantly higher ($p < 0.05$) than that in the controls, but there is no significant difference between the two groups of patients.

Serum zinc levels in psoriatic patients (Table2) which was statistically significantly lower ($p < 0.05$) thanthat in controls and in psoriasis with H.T. patients it is very statistically significantly lower ($p < 0.001$) than that in the controls, and there is statistically significant difference between the two groups of patients.

Serum iron level in psoriasis and psoriasis with H.T. patients (Table 3) is statistically significantly lower ($p < 0.05$) than that is controls but there is no significant difference between two group of patients.

Percentage of skin surface involved by Psoriasis	**No. of cases**	**Mean serum copper level (µgm/dl)**	**Mean serum zinc level (µgm/dl)**	**Mean serum iron level (µgm/dl)**
<10	6	108	113	92
11-20	7	110	108	88
21-30	9	102	82	74
31-40	7	112	74	70
>40	6	98	68	68

Table 4 :Percentage of skin surface involvement and serum copper, zinc& ironlevel in cases of Psoriasis

Percentage of skin surface involved by Psoriasis	**No. Of cases**	**Mean serum copper level (µgm/100 ml)**	**Mean serum zinc level (µgm/100 ml)**	**Mean serum iron level (µgm/100 ml)**
<10	1	120	94	90
11-20	1	112	86	88
21-30	9	124	72	86
31-40	4	110	61	74

Table 5 :Percentage of skin surface involvement and serum copper, zinc and iron level in cases of Psoriasis with H.T.

Table 4 & 5 shows that serum level of copper is not changed with the increase in the % of skin surface involvement [22-23]. But serum level of zinc is decreased may be because of zinc depletion secondary to loss of zinc through exfoliation [21-22] and serum iron level is decreased may be because of accelerated loss of iron from the hyperproliferation and desquamation of epidermal layer of skin[6,23] and due to decreased hematocrit.

4.Discussion

Throughout this study we have focused on the role of Cu, Zn& Fe in psoriasis and psoriasis with H.T. patients. The data presented in this study have shown a significant increase in the serum copper level in psoriasis patients as compared to healthy controls which is in accord with the findings of other investigators.

There are several reports stating that the serum Cu level is exceedingly high in psoriasis[12,16]. Copper is present in the serum in atleast two fractions: (1) a transport fraction (approx. 5%) loosely bound to albumin; and (2) ceruloplasmin (approx. 95%) firmly bound to globulin. The elevation of serum Cu level in psoriasis may be ascribed to an increase in both fractions, esp. an increase in ceruloplasmin, a copper binding protein, in response to inflammation. Hinks[16]and colleagues demonstrated that serum copper and ceruloplasmin levels were significantly increased in psoriasis.

There is found a significant increase in the serum copper level in psoriasis with H.T. as compared to controls which is in accord with the findings of Earl S. Ford[24] and D.A.Olatunbosun[25]. Elevated serum copper concentrations may be related to coronary heart disease in at least 2 ways. Oxidation and free radical formation are 2 components of Atherogenesis. Copper oxidises LDL cholesterol increasing its atherogenicity[19]. Alternatively, copper may be a risk marker for inflammation rather than a risk factor for coronary heart disease directly involved in the pathogenesis of atherosclerosis [26].

There was a slight tendency for the serum copper levels to rise with the extent of psoriatic skin surface involvement but it is not statistically significant. It would thus appear that the elevated serum copper levels in psoriasis and psoriasis with H.T. are not simply a reflection of the extent of skin surface involvement. We have found a significant reduction in the serum zinc level in psoriasis patients as compared to healthy controls. This is in agreement with the findings of Greaves and Boyde[27] and Morgan et al [21].

The present study also showed a marked low level of Zn in psoriasis. The most likely explanation of the depression of serum Zn in psoriasis is zinc depletion secondary to loss of zinc through exfoliation [(22).] Voorhees et al [(28)] noted that psoriatic lesions retain a high content of Zn compared with the uninvolved skin, suggesting an imbalance in Zn distribution between serum and psoriatic lesions. In fact, Zn is a co-factor of the DNA and RNA polymerases required for protein synthesis in involved skin. Lowered levels of serum protein of albumen, which results from peeling off of a large quantity of scales from the body surface, may be also attributable to decreasing Zn level.

There has been found a significant reduction in the serum Zn level in psoriasis with H.T. patients as compared to controls which may be because in arterial H.T. the levels of Zn in serum lymphocytes decreases while increases in the heart, kidney, liver and spleen. These changes result in loss of Zn homeostasis that leads to various degrees of deficiency, not entirely compensated by nutritional factor or increased absorption in GIT [(29).]

There was found a tendency for serum Zn level to decrease with the extent of psoriatic skin surface area involvement which is in accord with the findings of McMillan and Row [(22)] but Hinks et al [(30)] did not demonstrate such an effect in psoriasis.

There is found a significant decrease in serum iron level in psoriasis patients which is in accord with the findings of Prystowsky JH[(6)], Graves M.W. [(12)], Smith S.A. [(13)]&Basavaraj KH[(20)]. Decreased serum iron concentration may be due to accelerated loss of nutrients from the hyperproliferation and desquamation of the epidermal layer of the skin in psoriasis[(6)]. Iron is an important requirement of cell division and decreased utilization of iron by the proliferating cells may also result in reduced level of Fe psoriasis.

There is no significant change in iron level in both the groups of patients which shows that decreased iron level is not a cardiovascular risk factor [(31-32)].

In conclusion our study shows that serum Cu level were significantly high in psoriasis and psoriasis with H.T. patients and serum Zn & Fe level were found to be significantly low in psoriasis and psoriasis with H.T. patientstherefore these biomarkers monitoring may be useful in prevention of the progress of disease towards complications.

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