

## ROLE OF ANTIOXIDANT TRACE ELEMENTS IN THERMAL BURNS

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**ABSTRACT:** Burn injury is a medical problem as well as a social burden on the national health service. In developing countries. After major burns patients can develop nutritional deficiencies including trace element (TE) deficiencies various complications, such as delayed wound healing, influence the clinical course of such patients. In this study we estimated copper (cu), Zinc (zn), selenium in serum and glutathione peroxidase levels in 20 patients and 20 controls. Trace element levels decreased. Significantly ( $p < 0.05$ ) in burn patients (cases) compared to controls. Whereas glutathione peroxidase activity increased in cases. Based on the critical role of plasma Zn and Cu rate in wound healing and their relationship in decreasing the burn injury by estimating the this we can take start with early trace element supplementation for better wound healing.

**Key words:** Trace elements, wound healing, Glutathione peroxidase (GxPx)

### INTRODUCTION

Burns involving >20% of the body surface result in extensive inflammatory, endocrine, metabolic and immune changes. Tissue repair and wound closure may last for weeks after burn injury, and closure usually requires extensive surgery and skin grafting (sheridanRL et al., 2003). Various complications that are exacerbated or favored by nutritional deficiencies (Berger MM, Cavadini Solomkin JS et al., 1992) can occur, such as infections, delayed wound healing, and muscle wasting (Herndon DN et al) infections remain a leading causing of death after major burns. (Herndon DN, Peck MD, Wikinson RA et al., 2001)

Burns injury changes metabolic and immune responses. The immune system is depressed overall (Soomkin JS, 1990). Some of these changes can be related to alterations in trace elements metabolism. Trace elements, especially zinc (zn) and copper (cu) have important roles in human growth, development and immune function (Walker CF et al., 2004). Wound healing is a major issue in burns and delayed healing with graft failure is a serious problem. Trace elements directly affect most metabolic pathways, copper is essential for wound repair, indeed lysyl oxidases are extracellular copper enzymes that initiate the cross linkage of collagen and elastin and their activated decline with inadequate copper status (Jonas J, Rucker RB, berger MM, et al., 1993) zinc is required for most anabolic pathways and deficiency has negative effect on wound healing in non burn conditions

### MATERIAL AND METHODS

The present study was carried out in Burns unit in the department of plastic surgery, Narayana Medical College and Hospital Nellore. Study protocol was approved by ethical committee of Narayana Medical College and Hospital Nellore. The study groups include 40 subjects this includes patients as well as healthy controls. Patients total 20 patients with different types of burn injuries admitted in burn ward in plastic surgery department of Narayana Medical College and Hospital Nellore. Controls are 20 healthy people

Selenium, Zinc, copper was measured by using atomic absorption spectrometry, were measured by HPLC and erythrocyte glutathione peroxidase levels was determined by the RANSEL method. Catalase activities were measured by Marklund and Marklund method.

**RESULTS**

The study was conducted on a total number of 40 subjects (cases=20) (thermal burn patients) controls n=20 (healthy subjects).

**Statistical analysis**

Data analysis was done using SPSS version 11.0. Study variables were expressed in terms of mean  $\pm$  standard deviation (S.D). Variability across the study groups for each of the variable was assessed using nonparametric test Mann whitney's test. The p value  $<0.05$  was considered as significant.

Within a study group relation between two variables was assessed using pearson's correlation test with p value  $<0.05$  as significant limit.

The mean and S.D of all parameters were calculated. The parameters include serum selenium, zinc, copper, catalase, glutathione peroxidase in thermal burns patients. (Tables-1 to 5).

**Table 1. The serum copper levels in cases and controls**

	Mean (mg/dl)	Std
<b>Cu</b>		
Cases	83.72	24.94
Controls	88.16	24.72

There is significant decrease in serum copper levels in cases (burn patients) when compared to controls.

**Table 2: Serum Zinc levels in cases and controls**

	Mean (mg/dl)	Std
<b>Zn</b>		
Cases	69.29	15.67
Controls	74.91	18.41

There is significant decrease in serum zinc levels in burn patients p value  $<0.001$

**Table 3: Serum Selenium levels in cases and controls**

	Mean (mg/dl)	Std
<b>Se</b>		
Cases	74.28	30.76
Controls	78.18	29.01

There is significant decrease in serum Selenium levels in burn patients p value  $<0.001$ .

**Table 4: Glutathione Peroxidase levels in cases and controls.**

	Mean (mg/dl)	Std
<b>GSHPx</b>		
Cases	73.4	27.6
Controls	54.3	11.3

There is significant increase in serum glutathione peroxidase levels in burn patients p value  $<0.001$ .

**Table 5: Catalase levels in cases and controls**

	Mean (mg/dl)	Std
<b>Catalase</b>		
Cases	306.50	87.45
Controls	198.2	35.56

There is significant increase in serum catalase levels in burn patients p value  $<0.001$ .

**DISCUSSION**

The trace elements play important role for antioxidant defence inflammatory process and wound healing in burn injuries (Boosalis MG, Selmanpakoglu An, Faunce De, et al.,1986) infectious complications are the main cause of death in patients with burn(Murphy KD.,2003 ). Wound healing is a major issue in burns and delayed healing with graft failure is a serious problem. Trace elements directly affect most metabolic pathways, copper is essential for wound repair indeed lysyl oxidases are extracellular copper enzymes that initiats the cross linkage of collagen and elastin and their activities decline with inadequate copper status. (Berger et al., 1995)

Burn injury is associated with enhanced systemic inflammatory reaction. There are several reasons for loss of plasma zinc and copper levels in burn injuries. First of all the greatest loss of zinc and copper levels is through the wound exudated the body distribution profile of these trace elements is changed following the burn injury and it is possibly due to contribution of zinc and copper in the inflammatory process.

According to carrg, Willinson et al., 1999 showed in a study that copper has levels reduced in burn patients. Berger and chiolera observed that the positive relationship between burn area and amount of zinc and copper excretion through the urine (Sandrec, et al., 2004).

Peck MD et al (Perk MD Weber JM., 1998) showed that zn serum levels decreased with six hours of burn injury to 20% and remained significantly lower on day one in plasma of rats and it was continued on day three and then returned near control levels. The decrease of serum zn concentration was associated with accumulation zn in the liver (Berger MM.,1995).

Micronutrient deficiencies are frequent after makjor burns (21). These patients suffer acute trace element depletion as the result of extensive exudative losses (Berger MM, et al., 1994) copper, selenium and zinc are particularly depleted, all of which are involved in wound healing and in various aspects of immune defenses. Locally wound healing requires a coordinated activation and local penetration on of various cell types coming from the circulation and surrounding tissues. The simultaneous presence of numerous nutrients is required (Peck MD., 1998) amino acids, vitamins, trace elements (mainly copper, manganese, selenium and zinc) and anabolic factors. Adequate antioxidant defense is also required. Trace element especially selenium which is essential for the activity of glutathione peroxidase (GSHPX), belong to the bodys first line of antioxidant defense in both the intra and extra cellular compartments (Meyer NA., 1994). The activities of erythrocytes glutathione peroxidase and catalase in burned patients was significantly ( $p<0.001$ ) increased when compared to controls.

This indicates following burn injury there is a marked elevation of oxidative markers malondialdehyde to cope up this oxidative stress include by burn serum antioxidant enzymes catalase, glutathione peroxidase levels were increased.

Increased catalase activity is of thermal injury that initiate the free radical generation it is demonstrated that increased  $H_2O_2$  scavenging activity by catalases.

**CONCLUSION**

Burn injury is associated with increased free radical generation. This free radical scavenges the enzymatic antioxidants like glutathione peroxidase, superoxide dismutase. These are metalloenzymes and dependent on trace elements like copper, zinc, selenium.

Therefore trace element supplements were associated with early normalization of the low plasma trace element concentration these changes were associated with a significantly improved clinical course (better graft take, fewer infectious complications).

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ISSN : 0976-4550

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