

## **Comparison of Nutritional Regimens on Serum Proteins and Trace Elements Along With Haemoglobin and Body Weight in Burned Children**

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### **Abstract**

The study was conducted on a total of 33 children of 3-14 years of age having more than 20 percent burn. They were randomly divided into two groups and effect of two nutritional diets were compared on serum total proteins, albumin, globulins, Zn and Cu. Haemoglobin and body weight were also compared. In overall, more than 50 percent children died those admitted with greater than 20 percent body surface burn. Higher numbers (60%) of deaths occurred in group advised vegetable + milk rich diet. In overall, serum total proteins decreased in higher number of patients ( $P<0.05$ ) advised vegetable + milk rich, while decrease in albumin was in higher number of patients ( $P<0.01$ ) advised pulses + egg rich diet. Test of no association revealed that decrease in serum total proteins in patient advised vegetable + milk-rich diet was mainly due to decrease in albumin ( $P<0.01$ ), while in patients advised pulses + egg-rich diet was due to decrease in both albumin ( $P<0.05$ ) and globulins ( $P<0.01$ ). In overall, serum copper decreased in relatively higher number of patients while both diets had similar effect. Serum Zn levels increased or remained same in relatively higher number of patients advised vegetable + milk rich diet, while it decreased in significantly higher number of patients ( $P<0.005$ ) advised pulses + egg rich diet. However, the decrease in haemoglobin was in relatively higher number of patients advised pulses + egg rich diet, while it was otherwise in patients advised vegetable + milk rich diet.

**Key words:** Burn wound, children, diets, serum proteins, trace elements.

### **Introduction**

Burn wounds are serious threat to patients inflict them as massive tissue damage occurs by burn and the products thus formed are toxins, those cause liver damage and are life threatening (Moroney, 1964). Weight changes in burn patients do occur and negative nitrogen balance in burn patients has been related to protein loss through the full thickness burn wound in first three postburn days (Waxman *et al.*, 1987). In the severely burned patients, inadequate protein feeding and increased rate of protein catabolism and protein depletion causes weight loss (Belcher and Ellis, 1991). In children with 20-30 percent deep infected burn, supplemental parental nutrition of protein, carbohydrates, trace elements (Zn, Fe), vitamins and electrolytes (K, Ca, P and Mg) provide optimum nutritional support (Derganc, 1979). Bailey *et al.* (1982) successfully supported burn patient with high caloric, high quality protein diet containing eggs, rice and milk. It has been reported that special diets are essential for preventing weight loss, promoting wound healing, in successful skin grafting and preventing the complications of acute postburn malnutrition (Curreri and Luterman, 1978). It has been recommended that as albumin facilitates fluid retention in intravascular space, should be reserved in severely burned patients (Carsin, 1997). Adequate nutrition in the severely burned child often determines the morbidity and mortality (Solomon, 1981). With a caloric intake of 175 kcal/kg/day and the best metabolic and nutritional results were obtained with diets containing 20 to 30% of calories as protein and providing a caloric intake that paralleled the measured energy expenditure (Dominioni *et al.*, 1985).

Trace elements are also affected in burn patients and disturbance in maximum intensity of Cu and Zn appears after two days of injury (Lafargue *et al.*, 1976). The exudative Cu and Zn losses during the first week postburn, contribute to increased nutrient requirements (Berger *et al.*, 1992). Zn and Cu deficiency reported to occur in more than 20% burn in children (Fochon, 1981). The role of nutrition is of significant importance in the treatment of burn wound and very limited local data is available. The present study was therefore, designed to compare the effect of two nutritional diets on serum proteins, trace elements, haemoglobin and body weight in children having more than 20% burn wound.

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## Materials and Methods

The study was conducted on children admitted with more than 20 percent burn in Nishtar Ward, Allied Hospital, Faisalabad. A total of 33 children of 3-14 years of age were randomly selected for the study. Blood samples of about 5 ml were collected from these children with the help of a disposable syringe. Blood samples after collection were allowed to clot for separation of serum which was then collected and stored at -20 °C for further studies. One ml of blood was placed in a test tube containing anticoagulant for determination of haemoglobin. Body weight of each patient was recorded at week interval for three weeks.

Serum biochemical studies included total proteins, albumin, globulins, zinc and copper. Serum total proteins were determined by the Biuret method as described by Oser (1976). The serum albumin was determined following the method of Varley *et al.* (1980). Globulin was estimated by subtracting albumin from total protein. Serum zinc was determined by atomic absorption spectrophotometer method (z - 8200 polarized Zeeman) at 239 nm wavelength described by Mukherjee (1988). Serum copper was determined similar to serum zinc by using atomic absorption spectrophotometer at 324.8 nm wavelength. Hb was estimated by acid haematic method as described by Benjamin (1978) using Sahli=s apparatus. The effect of two nutritional diets were compared with reference to parameters under study by analysing data on personal computer by using Fisher=s Chi Square test and test of no association to determine association between various parameters by using SAS 6.12 computer software package (SAS, 1996).

## Results

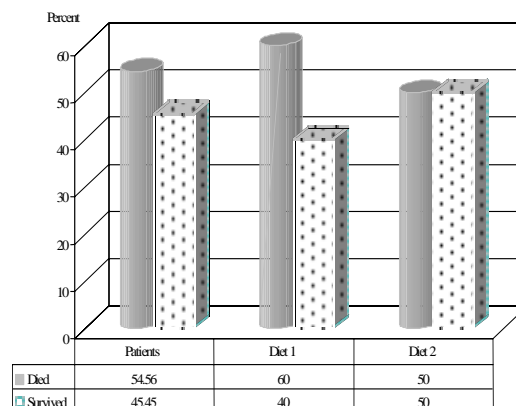
### Patients died/survived

In overall, more than 50 percent children died those admitted with greater than 20 percent body surface burn (Table and Fig. 1). Among the dead, half of the patients died during first week, while rest of them died after 3<sup>rd</sup> week. Higher percentage (60%) of deaths occurred in group advised vegetable + milk rich diet, while it was 50 percent in those advised pulses + egg rich diet (Table and Fig. 1).

### Serum proteins

In overall, serum total proteins significantly decreased in higher number of patients ( $P<0.05$ ) at the end of the third week from the admission values (Table 2). Serum total proteins decreased in significantly higher number of patients ( $P<0.05$ ) advised vegetable + milk rich while the difference was non-significant in those advised pulses + egg rich diet.

Table and Fig 1: Percentage of patients died or survived in different diets.



In overall, serum albumin increased in relatively higher number of patients at the end of the third week from admission value. The increase was in comparably higher number of patients advised pulses + egg rich diet while it was otherwise in those advised vegetable + milk rich diet (Table 2).

In overall, serum globulins decreased in significantly higher number of patients ( $P<0.01$ ) at the end of the third week than admission values. The decrease was in relatively greater number of patients advised vegetable + pulses, while it decreased in significantly higher number of patients ( $P<0.01$ ) advised pulses + egg rich diet (Table 2).

Test of no association revealed that decrease in serum total proteins in patient advised vegetable + milk-rich diet was mainly due to decrease in albumin ( $P<0.01$ ; Chi Sq. 5.63), while in patients advised pulses + egg-rich diet was due to decrease in both albumin ( $P<0.05$ ; Chi Sq. 3.636) and globulin ( $P<0.01$ ; Chi Sq. 6.340).

Table 2: Percentage of patients showing increase or decrease in serum total proteins, albumin and globulins advised two nutritional diets.

	Patients	Diet 1	Diet 2
<b>Total proteins</b>			
Increase	29.17	33.33	26.67
Decrease	70.83	66.67	73.33
<b>Albumin</b>			
Increase	54.17	44.44	60.00
Decrease	45.83	55.55	40.00
<b>Globulins</b>			
Increase	25.00	44.45	13.33
Decrease	75.00	55.55	86.67

Total Protein: In patients column decrease was significant at  $P<0.05$  (Chi sq. 4.167), in diet 1 column non-significant difference, in diet 2 column significant difference at  $P<0.05$  (Chi sq. 3.267), however data showed non-significant difference between diets in each row

Albumin: Data showed non-significant difference in each column

(patients, diet 1, diet 2) as well as between diets in each row. Globulins: In patients column decrease was significant at  $P < 0.01$  (Chi sq. 6.000), in diet 1 column non-significant difference, in diet 2 column significant difference at  $P < 0.005$  (Chi sq. 8.067), however data showed non-significant difference between diets in each row.

**Serum copper and zinc**

In overall, serum copper decreased in relatively higher number of patients at the end of the third week from admission values. However, both diets had similar effect on the serum copper levels in patients under study and in both cases the decrease in serum copper levels was observed in patients even after three weeks of treatment (Table 3).

In overall, serum zinc decreased in significantly higher number of patients ( $P < 0.001$ ) under study. Similarly, serum Zn levels increased or remained same in relatively higher number of patients from admission levels those advised vegetable + milk rich diet, while it decreased in significantly higher number of patients ( $P < 0.005$ ) those advised pulses + egg rich diet (Table 3).

Test of no association revealed that in patients advised pulses + egg-rich diet, decrease in serum zinc accompanied decrease in serum copper in significant number of patients ( $P < 0.05$ ; Chi Sq. 4.615), while it was non-significant in those advised vegetable + milk-rich diet.

**Table 3: Percentage of patients showing increase or decrease in serum copper and zinc concentration advised two nutritional diets.**

	Patients	Diet 1	Diet 2
<b>Copper</b>			
Increase	33.33	33.33	33.33
Decrease	66.67	66.67	66.67
<b>Zinc</b>			
Increase	25.00	44.44	13.33
Decrease	70.83	44.44	86.67
No Change	4.17	11.11	00.00

Copper: Data showed non-significant difference in each column (patients, diet 1, diet 2) as well as between diets in each row. Zinc: In Patients column decrease was significant at  $P < 0.001$  (Chi sq. 16.750), in diet 1 column non-significant difference, in diet 2 column significant difference at  $P < 0.005$  (Chi sq. 8.067), however data showed non-significant difference between diets in each row.

**Body weight and haemoglobin**

In overall, body weight decreased in significantly higher number of patients ( $P < 0.001$ ) at the end of the third week of treatment (Table 4). Although body weight decreased in significant number of patients advised both diets, i.e., vegetable + milk-rich ( $P < 0.01$ ) and pulses + egg-rich ( $P < 0.05$ ), however, decrease in weight was in comparably lower number of patients advised pulses + egg-rich diet. In overall, Hb increased in half the patients under study.

However, the decrease was in relatively higher number of patients those advised pulses + egg rich diet, while it was otherwise in patients those advised vegetable + milk rich diet (Table 4).

**Table 4: Percentage of patients showing increase or decrease in body weight and haemoglobin concentration advised two nutritional diets.**

	Patients	Diet 1	Diet 2
<b>Body weight</b>			
Increase	25.00	11.11	33.33
Decrease	66.67	77.78	60.00
No change	8.33	11.11	6.67
<b>Haemoglobin</b>			
Increase	50.00	33.33	60.00
Decrease	50.00	66.67	40.00

Body weight: In Patients column decrease was significant at  $P < 0.002$  (Chi sq. 13.000), in diet 1 column significant difference at  $P < 0.01$  (Chi sq. 8.000) and in diet 2 column significant difference at  $P < 0.05$  (Chi sq. 6.400), however data showed non-significant difference between diets in each row.

Haemoglobin: Data showed non-significant difference in each column (patients, diet 1, diet 2) as well as between diets in each row.

**Discussion**

Burn wound is one of the important issue in our society. Children mostly suffered moist burns, while women from dry burn. Burn results in protein depletion, weight loss, metabolic changes and increased daily energy expenditure (Thomas, 1962). During the study it was observed that at the time of admission, burnt children were unable to eat properly but started proper food consumption after about one week of admission. In severely burnt patients, the metabolic energy expenditure (MEE) is twice the normal resting metabolic rate (Cunningham *et al.*, 1990). To meet the loss, diet rich in nutrients, particularly the protein is needed to save the life and reduce the consequences to minimum. To the same effect, diet based on daily intakes of 5eggs/10kg of body weight, incorporated into milkshakes were most effective in severely burned patients (Kaufman *et al.*, 1986).

The results of the present study revealed that children can not tolerate more than 20 percent of total body surface burn as more than 50 percent patients died during three weeks of study, of which about half the deaths were during first week of inflicting burn wound. Infants and elders tolerate burns less efficiently as compared with young adults. It appears that diet was secondary, while other factors might have played crucial role in the death of the burnt children, although death in group advised pulses + egg rich diet were relatively low compared with those advised vegetable + milk rich diet. Previous studies have also shown that protein and more importantly egg rich diet

is important in saving the life in burn patients (Kaufman *et al.*, 1986). Measurement of serum protein concentration to monitor adequacy of nutritional support seems an unwarranted expense in patients with thermal injury (Carslon *et al.*, 1991). It was concluded by Boosalis *et al.* (1989) that visceral protein may reflect severity of injury and prognosis in critically ill hospitalised patients, but they often had not accurately reflected nutritional status. Similarly, Prelack *et al.* (1997) reported that high energy intakes with a minimum of 3g of protein/kg support adequate wound healing. Present studies on serum protein suggested that the loss was greater and continued for more than three weeks as levels of serum total proteins and fractions remained lower after three weeks in significant number of patients. The results showed that diet containing pulses + eggs contributed in raising the serum albumin, while globulins and total proteins were comparably better in patients of group on vegetable + milk rich diet. However, it was also observed that decrease in serum total protein in patients on vegetable + milk-rich diet was mainly due to albumin loss and the diet might have contributed in relative maintenance of globulins. While decrease in serum total protein in patients on pulses + egg-rich diet was due to decrease in both albumin and globulins. It has been reported that egg rich, milk based formula with vitamins and mineral supplementation provided over a 60% of daily caloric requirements and proved effective in promoting wound healing (Baily *et al.*, 1982). It has been suggested that nutritional interventions high in protein, vitamins and fatty acids improved net protein balance after thermal injury (Klinik *et al.*, 2001). The diet containing albumin as a major constituent has been suggested to be safe and valuable addition in the management of severely burned patients (Hirshowitz *et al.*, 1975).

Apart from caloric and protein requirements in burned patients, it is generally accepted that trace elements requirement increases with caloric and protein needs, because in burn injury Cu and Zn decreases due to losses of these elements through urine and wound (Shippee *et al.*, 1987). Decrease occurs in about two days (Lafargue *et al.*, 1976) and become normal in about 15 days postburn (Cai, 1989). Present study with reference to serum copper and zinc also showed decrease in levels in significant number of patients even after three weeks of treatment. It was however, observed that both diets had similar effect on serum copper levels. However, serum Zn rose to normal or increased in relatively higher percentage of patients those were on vegetable + milk rich compared with pulses + egg rich diet. Further that there was found significant association between copper and zinc in patients on pulses + egg-rich diet.

Although body weight decreased and remained lower in significant number of patients, however, patients on pulses + egg rich diet had relatively better body weights

and similar was the effect on haemoglobin levels compared with patients on vegetable + milk rich diet. Negative nitrogen balance that occurs in burn patients has been related to protein loss to the full thickness burn wound in 1<sup>st</sup> three-postburn days (Waxman *et al.*, 1987). In the severely burned patients inadequate protein feeding and increased rate of protein catabolism and protein depletion causes weight loss (Belcher and Ellis, 1991).

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