Effects of diet on body weight, haemoglobin, serum proteins and trace elements in burned children

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ORIGINAL ARTICLE

EFFECTS OF DIET ON BODY WEIGHT, HAEMOGLOBIN, SERUM PROTEINS AND TRACE ELEMENTS IN BURNED CHILDREN

M. Tariq Javed, Zahid Mahmood Nagra,* Nighat Bhatti,** Zakia Bashir** and Nusrat Shabbir**

ABSTRACT

Objective: To compare the effect of two diets on serum proteins, trace elements, haemoglobin and body weight in burned children.

Design: Comparative analytical study.

Place and Duration of Study: The study was conducted on burned children admitted in Nishtar Ward, Allied Hospital, Faisalabad for seven months, from February to August 2002.

Materials and Methods: The study was conducted on 61 children of 3-14 years of age. Of these, 27 children were randomly selected and advised diet 1 (vegetables and milk-rich diet), while 34 children were randomly selected and advised diet 2 (pulses and egg-rich diet). Serum proteins and haemoglobin were determined spectrophotometrically, trace elements by atomic absorption spectrophotometric methods and body weight by weighing machine. The data obtained was analyzed statistically on SAS 6.12.

Results: During the study, 30 percent children died. Relatively higher deaths occurred in children advised vegetables + milk-rich diet. The increase in body weight was noted in 25 % children. Of these, significant number was in those advised pulses + eggs rich diet ($p<0.01$). The haemoglobin, total proteins, albumin, globulins, copper and zinc showed no change. Haemoglobin ($p<0.01$) and serum total proteins ($p<0.05$) increased in significantly higher percentage of children advised diet 2. Decrease in serum globulins and no change from initial values were comparable in two diets, while the increase was in relatively higher percentage of children advised diet 2. The decrease in serum copper was almost in same percentage of children advised two diets. It was maintained in relatively higher percentage of children advised diet 1. However, the increase in serum copper was in significantly ($p<0.05$) higher percentage of children advised diet 2. Serum zinc maintenance was in significantly ($p<0.001$) higher percentage of children advised rich diet 2.

Conclusion: Better effect of pulses and eggs rich diet in burned children was seen on the basis of parameters studied. However, the role of vegetables and milk in burned children has not been ruled out altogether.

KEY WORDS: *Diet, Burn injury. Serum total proteins. Albumin. Globulins. Copper. Zinc. Haemoglobin. Body weight.*

INTRODUCTION

Burn wounds cause massive tissue damage. The products thus formed are toxins and are life-threatening.[1] Weight changes and negative nitrogen balance in burnt patients have been related to protein loss through the full thickness burn wound in first three post-burn days.[2] In the severely burnt patients, inadequate protein feeding and increased rate of protein catabolism and protein depletion causes weight loss.[3] In patients with 20-30 percent deep infected burns, supplemental parenterl nutrition of protein, carbohydrates, trace elements (Zn, Fe), vitamins and electrolytes (K, Ca, P and Mg) provides optimum nutritional support.[4] Burnt patients have been successfully supported with high caloric, high quality protein diet containing eggs, rice and milk.[5] Special diets are essential for preventing weight loss, promoting wound healing, in successful skin grafting and preventing the complications of acute post-burn malnutrition.[6] As albumin facilitates fluid retention in intravascular space, it should be used in severely burnt patients only.[7] Adequate nutrition in the severely burnt children often determines the morbidity and mortality.[8] A high eggs diet (35 eggs/day) was found valuable and safe addition in the management of severe burned patients[9] with a caloric intake of 175 kcal/kg/day. The best metabolic and nutritional results have been obtained with diets containing 20 to 30% of calories as protein and providing a caloric intake that parallelled the measured energy expenditure.[10]

Trace elements are also affected in burned patients. Disturbance in maximum intensity of Cu and Zn levels appears after two days of injury due to exudation in more than 20% of burned patients.[11-13] Zn is needed for protein and DNA synthesis and for cell division.[14] Serum zinc concentration is reported to decrease immediately after burns, then gradually increases and approaches to normal on 15 post-burn day.[15] By establishing nutritional goals and monitoring daily weight, caloric counts, protein intake and biochemical parameters, the chances of survival have been reported to increase.[16]

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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 effects of two nutritional diets on serum proteins, trace elements, haemoglobin and body weight in children inflicted with burn injury.

Materials and Methods

The study was conducted on children admitted in Nishtar Ward, Allied Hospital, Faisalabad, having body surface burns. A total of 61 children of 3-14 years of age were randomly selected for the study. Of these, 27 children were randomly selected and advised diet 1 (vegetables + milk rich diet), while 34 children were randomly selected and advised diet 2 (pulses + eggs rich diet), both diets had daily calories of 2000-2500 /day (Table I). Children included in the two groups had similar degree of burns. Blood samples of about 5 ml were for biochemical analysis and determination of haemoglobin. Body weight of each patient was recorded at weekly intervals for three weeks.

Table I: Diet chart for burned patients including diet 1 and 2.

Time	**Diet 1 (meat + vegetables + milk-rich diet)**
6.00 AM	1 glass buffalo/cow milk + 1 boiled egg
8.00 AM	1 egg + 1 slice bread + 1 glass buffalo/cow milk
10.00 AM	milk shake (banana/apple + milk)
12.00 AM	potatoes + beef/mutton + 1/2 chapati + vegetables salad + custard
4.00 PM	1 glass buffalo/cow milk
6.00 PM	1 kabab +1 banana
8.00 PM	chicken + mixed vegetables + 1/2 chapati + custard
10.00 PM	1 glass buffalo/cow milk
	Diet 2 (meat + pulses + eggs-rich diet)
6.00 AM	1 glass buffalo/cow milk + 2 boiled eggs
8.00 AM	2 eggs + 1 slice bread
10.00 AM	tea + 1 egg
12.00 AM	chicken + pulses + 1/2 chapati + custard
4.00 PM	2 eggs (boiled)
6.00 PM	1 beef kabab
8.00 PM	beef/mutton + pulses + 2 chapati + custard
10.00 PM	tea + 1 tsp. honey

Serum biochemical studies included total proteins, albumin, globulins, zinc and copper. Serum total proteins were determined by Biuret method[17] and albumin by bromocresol green dye binding method.[18] Globulins were estimated by subtracting albumin from total proteins value. Serum zinc was determined by atomic absorption spectrophotometer method (Z - 8200 polarized Zeeman) at 239 nm wavelength.[19] Serum copper was determined similar to serum zinc by using atomic absorption spectrophotometer at 324.8 nm wavelength. Hb was determined by spectrophotometric method using Drabkins solution.[20]

The effects of two nutritional diets were compared. The data was analyzed using chi-square test and test of no association to determine association between various parameters, on SAS 6.12 computer software package.[21]

Results

Approximately 30% children died. They were admitted with more than 20% body surface burn. Among them, half of the children died during first week of admission, while rest of them died after 3rd week of admission. Relatively higher deaths occurred in children advised diet 1 compared with those advised diet 2 (Table II).

Table II: Percentage of patients died or survived in different diet groups.

	Children	Diet 1	Diet 2
Died	29.5	33.3	26.5
Survived	70.5	66.7	73.5
Significant at	(p<0.001)		(p<0.01)

Note: The significant level is shown where the difference was significant in a column and/or in a row.

The data on serum total proteins, albumin and globulins is given in Table III. The data showed increase in serum total proteins was in significantly ($p<0.05$) higher percentage of children advised diet 2 compared with those advised diet 1. However, albumin increased in significantly ($p<0.01$) higher percentage of children advised diet 1. While data on serum globulins revealed statistically non-significant difference between diets.

Table III: Percentage of children showing increase or decrease in serum proteins and trace elements advised two nutritional diets.

Parameter/diets	Increase	Decrease	No change
Total protein			
Children	21.2	44.2	34.6
Diet 1	9.5	61.9	28.6
Diet 2	29	32.3	38.7
Significant at	(p<0.05)		
Albumin			
Children	34.6	40.4	25
Diet 1	42.9	38.1	19
Diet 2	29	41.9	29
Significant at	(p<0.01)		
Globulins			
Children	34.6	42.3	23.1
Diet 1	19	52.4	28.6
Diet 2	45.2	35.5	19.4
Copper			
Children	26.9	26.9	46.2
Diet 1	14.3	28.6	57.1
Diet 2	35.5	25.8	38.7
Significant at	(p<0.05)		
Zinc			
Children	15.4	21.2	63.5
Diet 1	33.3	9.5	57.1
Diet 2	3.2	29	67.7
Significant at	(p<0.001)		

Note: The significant level is shown where the difference was significant in a column and/or in a row.

The minimum serum proteins at hospital admission in patients advised diet 1 and 2 were 2.95 and 2.74 (total proteins, g/100 ml), 1.69 and 1.19 (albumin, g/100 ml) and 0.34, 0.19 (globulins, g/100 ml), respectively. The maximum corresponding values were 7.72 and 7.51; 5.66 and 5.84 and 4.49 and 5.73 respectively. The minimum serum proteins during the last week of observation in patients advised diet 1 and 2 were 3.92 and 2.93 (total proteins); 3.18 and 2.25 (albumin) and 0.03 and 0.01 (globulins), respectively. The maximum corresponding values during the last week were 7.28 and 7.84; 6.35 and 4.95 and 2.27 and 3.70, respectively. The overall mean ± SE (standard error of mean) of total proteins, albumin and globulins in patients advised diet 1 and 2 at admission were 5.49±0.29, 5.31±0.18; 3.70±0.20, 3.54±0.19 and 1.78±0.22, 1.74±0.17, respec-

tively while the same values at the last week of study were 5.28 ± 0.21, 5.39 ± 0.25; 4.06 ± 0.17, 3.54 ± 0.19 and 1.18 ± 0.14, 1.81 ± 0.20, respectively.

The data on serum copper and zinc is given in Table III. The increase in serum copper was in significantly ($p<0.05$) higher percentage of children advised diet 2. No change in serum zinc from initial values was seen in significantly ($p<0.001$) higher percentage of children. In children advised diet 2, the increase in serum zinc was in less percentage of children ($p<0.001$) but serum zinc was maintained to their admission value in higher percentage of children ($p<0.001$).

The minimum serum copper and zinc at hospital admission in patients advised diet 1 and 2 were 1.25 and 0.86 (copper; mg/1000 ml) and 1.01 and 0.72 (zinc; mg/1000 ml), respectively. The maximum corresponding values were 3.05 and 2.49 and 3.85 and 2.39, respectively. The minimum serum copper and zinc during the last week of observation in patients advised diet 1 and 2 were 1.21 and 0.71 (copper) and 0.80 and 0.77 (zinc), respectively. The maximum corresponding values in the last week were 2.79 and 2.51 and 2.22 and 2.74, respectively. The overall mean ± SE (standard error of mean) of copper and zinc in patients advised diet 1 and 2 at admission were 1.96 ± 0.09, 1.78 ± 0.07 and 1.48 ± 0.11, 1.34 ± 0.07, respectively while the same values at the last week of study were 2.01 ± 0.10, 1.64 ± 0.08 and 1.42 ± 0.09, 1.36 ± 0.08, respectively.

The data on body weight and haemoglobin is given in Table IV. Overall body weight decreased ($p<0.01$) in higher percentage of children. Among the latter it increased in significantly ($p<0.01$) higher percentage of children advised diet 2. Comparative effects of diets on haemoglobin levels revealed significant difference in increase in haemoglobin as it increased in higher ($p<0.01$) percentage of children advised diet 2.

Table IV: Percentage of children showing merge in body weight and haemoglobin concentration.

Parameter/Diets	Increase	Decrease	No change	Significant at
Body weight				
Children	25	51.9	23.1	($p<0.01$)
Diet 1	9.5	66.7	23.8	($p<0.005$)
Diet 2	35.5	41.9	22.6	
Significant at	($p<0.01$)			
Haemoglobin				
Children	34.6	28.8	36.5	
Diet 1	19	33.3	47.6	
Diet 2	45.2	25.38	29	
Significant at	($p<0.01$)			

Note: The significant level is shown where the difference was significant in a column and/or in a row.

The minimum body weight (kg) and haemoglobin (g/dl) at hospital admission in patients advised diet 1 and 2 were 12.0 and 10.0 (body weight) and 7.80 and 7.00 (haemoglobin), respectively. The maximum corresponding values were 30.0 and 32.0 and, 12.80 and 12.80, respectively. The minimum body weight and haemoglobin at the last week of observation in patients advised diet 1 and 2 were 10.5 and 8.0 (body weight) and, 7.00 and 7.90 (haemoglobin), respectively. The maximum corresponding values in the last week were 26.0 and 32.0 and, 12.80 and 13.00, respectively. The overall mean ± SE (standard error of mean) of body weight and haemoglobin in patients advised diet 1 and 2 at admission were 17.41 ± 0.83, 16.41 ± 0.82 and 10.73 ± 0.29, 9.94 ± 0.30, respectively while the same values at the last week of study were 16.14 ± 0.96, 16.14 ± 1.11 and 10.13 ± 0.43, 10.64 ± 0.28, respectively.

Discussion

Children mostly suffered moist burns due mainly to accidents in the kitchen or like places. Burns result in protein depletion, weight loss, metabolic changes and increased daily energy expenditure.[22] 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.[23] 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 5 eggs/10kg of body weight, incorporated into milkshakes were most effective in severely burned patients.[24] The results of the present study revealed that children can not tolerate more than 20 percent of total body surface burn as 30 percent children died during three weeks of study. Of these, approximately half the deaths were during first week of infliction of burn wound, though all had greater than 20 percent body surface burn. It is generally believed that infants and elders tolerate burns less efficiently as compared with young adults. It may aspire that diet was secondary, while other factors might have played crucial role in the death of the burnt children. The frequency of death in group advised diet 2 was relatively low compared with those advised diet 1. Previous studies have also shown that protein and more importantly eggs-rich diet is important in saving the life in burned patients.[24] Measurement of serum protein concentration to monitor adequacy of nutritional support seems an unwarranted expense in patients with thermal injury.[25] Visceral proteins may reflect severity of injury and prognosis in critically ill hospitalised patients, but they often had not accurately reflected nutritional status.[26] Similarly, it has been reported that high energy intakes with a minimum of 3 g of protein/kg support adequate wound healing.[27] Present studies on serum proteins 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 2 contributed in raising the serum total proteins and globulins. Surprisingly, both diets had almost similar effect on serum albumin levels. Test of no association revealed significant ($p<0.01$) association between protein and globulins in patients advised diet 2. There was no association ($p<0.05$) between albumin and globulins suggesting contribution of globulins in raising serum total proteins in children advised diet 2. These results in children advised diets 1 were non-significant, though similar effect was observed as in children advised diet 2. This suggests that globulins appeared to be relatively high in blood while the albumin loss was greater. It not compensated adequately as loss and utilization continued even upto three weeks of treatment/injury. However, it has been suggested that nutritional interventions high in protein, vitamins and fatty acids improved net protein balance after thermal injury.[28] This does not seem to occur upto three weeks post-burn in children under local conditions. The diet containing albumin as a major constituent has been suggested to be safe and valuable addition in the management of severely burned patients.[9]

Apart from caloric and protein requirements in burnt patients, it is generally accepted that requirement of trace elements increases with caloric and protein needs, because in burn injury Cu and Zn decreases due to losses of these elements through urine and wound.[29] Decrease occurs in about two days[11] and becomes normal in about 15 days post-burn.[15] Present study with reference to serum copper and zinc also showed decrease in levels in considerable number of patients even after three weeks of treatment/injury. It was, however, observed that both diets had almost similar effect on raising or maintaining serum copper levels. However, serum Zn became normal or increased in relatively higher percentage of those patients who were on vegetables and milk-rich diets compared with pulses and eggs rich diet. This indicates a probable role of vegetables in raising serum zinc levels.

The body weight decreased and remained so in significant number of patients. However, patients on diet 2 had relatively better body weights. Similar was the effect on haemoglobin levels compared with patients on vegetables and milk-rich diet. Negative nitrogen balance that occurs in burn patients has been related to protein loss to the full thickness burn wound in first three-post-burn days.[2] It has been reported that in the severely burned patients inadequate protein feeding and increased rates of protein catabolism and protein depletion causes weight loss.[3] Findings of the present study also suggested positive contribution of protein rich diet on body weight and haemoglobin, the former in particular.

Conclusion

It is concluded from the present study that pulses and eggs rich diet had better affect in burned children on the basis of parameters studied. However, the role of vegetables and milk in burned children has not been ruled out altogether.

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