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Plastic Surgery

Effect of Manufactured Fat Emulsion Infusion on Protein Loss in Burn Patients (Randomized Controlled Study)

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ABSTRACT

Background: Burn injury management requires a lot of time and resources. Most patients need lengthy hospital stays.

Aim of the study: To determine the impact of manufactured fat emulsion on protein loss in burn patients.

Patients and Methods: This Randomized controlled study included 20 patients of 20% up to 40% of TBSA that were hospitalized to department of plastic and reconstructive surgery, Al-Azhar University hospital, which was prospectively be simple into two groups. Group (A) were subjected manufactured fat emulsion IV infusion. Group (B) controlled. The study duration ranged from 6-12 months. The patient administrates 1-1.5g /per kg of intralipid (20%) from post burn day 4. venous blood samples were taken for testing total protein, albumin, total cholesterol and triglyceride and 24 hours' urinary creatinine on post burn days 1st, 7th ,14th, 21st, 30th respectively.

Result: There is a substantial reduction in total protein, plasma albumin and urinary creatinine from 1st day to 21days among group A and group B. However, there is a slight change in cholesterol and triglycerides without statistically significant difference. at 1st day and 7th day, total protein, plasma albumin, cholesterol and triglycerides were comparable in both groups without statistically significant difference. At 14th day total protein was substantially greater in group A compared to group B. At 21st and 30th day total protein, plasma albumin was significant higher in group A compared to group B.

Conclusion: The intralipid 20 percent IV infusion is a useful energy source to reduce albumin loss in severely burnt individuals.

Keywords: *Assessment; Biomarkers; Burn nutrition; Hyper metabolism; Parenteral nutrition.*

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INTRODUCTION

The hypermetabolic reaction to severe burns greatly affects the weight of the burn patient. In spite of the fact that the process behind hyper metabolism is not completely known, it is characterized by a higher rate of whole-body oxygen consumption and a resting energy expenditure that is over 10% above average.[1]

A cascade of proinflammatory cytokines, acute-phase proteins, and catabolic hormones are linked to hypermetabolism following burn. These in turn cause an elevation in body temperature, hyperactive circulation, hyperglycemia, and inhibit protein synthesis, which is correlated with a higher level of muscle catabolism.[2]

It has been suggested that the degradation of skeletal muscle may act as a source of nitrogen to aid in the burn patient's gluconeogenesis and wound healing. Up to a year following burn, there may be a considerable reduction in muscle mass, weight, and strength because of this loss of muscle protein.[3]

Despite rigorous feeding, burned individuals continue to catabolize protein throughout the first week after a burn. This causes a loss of lean body mass and significant muscular wasting, which reduces strength and prevents a patient from recovering completely. It also affects immunity and wound healing.[4]

To lessen or avoid the catabolic response to injury and sepsis, generally three kinds of therapy have been investigated in recent years: 1) nutritive, 2) hormonal, and 3) pharmacologic. Few research

directly looked at muscle protein turnover; instead, several studies measured whole-body nitrogen balance and plasma protein concentrations to determine the metabolic effects of different therapies. Although protein turnover in other organs and tissues may contribute to whole-body nitrogen balance, changes in whole-body protein balance, at least in part, reflect changes in muscle protein balance.

Prior studies have looked at the impact of changes in protein metabolism as well as the role of fat, which is a necessary food to avoid an essential fatty acid deficit but is only advised in small doses. [5]

This study aims to compare the outcome of manufactured fat emulsion on protein consumption in burn patients between the patient who received it and the patient who didn't with measurement clinical and laboratory out com of both group.

PATIENTS AND METHODS

A prospective, randomized trial was carried out with Institutional Review Board approval to determine the impact of manufactured fat emulsion infusion on protein loss in burn patients with 20–40% body surface area burns who were hospitalized to the plastic and reconstructive surgery department at Al-Azhar University hospital, which was prospectively be simple Randomized control trails into two groups: Group (A) will be subjected manufactured fat emulsion iv infusion. By dose of 1.0-1.5 g/kg/day and Group (B) controlled without manufactured fat emulsion iv infusion.

Patient with Age range from 18 to 50 years old with all types of burn with burned body surface area from 20% up to 40% ware included in research

On the other hand, patients were excluded if the Age was more than 50 years old or less than 18 years' old and Patients with (renal diseases, hepatic diseases, and immunosuppressive diseases) and Allergy.

All patients were investigated by Total Plasma protein, Plasma albumin, Serum cholesterol, Serum triglycerides, 24 hours' urinary creatinine at 1st, 7th ,14th, 21st and 30th day.

Body mass index and Lean body mass were measured to all patients.

Statistical Analysis: Utilizing SPSS 24.0 for Windows, all data were gathered, tabulated, and statistically examined (SPSS Inc., Chicago, IL, USA). Using the Shapiro Walk test, the distribution of the data was examined for normality. Frequencies and relative percentages were employed to depict qualitative data. According to what is stated, the difference between qualitative variables was determined utilizing the chi-square test ($\chi 2$) and Fisher exact. For parametric and non-parametric data, respectively, the mean ± SD (standard deviation) were used to describe quantitative data. To determine the variance between quantitative variables in two groups for parametric and non-parametric variables, respectively, Independent T test and Mann Whitney test were utilized.

Every statistical comparison used a two-tailed significance test. Level of P-value ≤ 0.05 denotes a substantial change, p <0.001 denotes a very substantial variation, and P> 0.05 denotes no difference**.**

RESULTS

10 cases underwent fat emulsion iv infusion after burn, started by day 4 and continued for 3 weeks (group A). while the other 10 patients did not receive the fat emulsion (group B). The mean age of the patient in Group A were 39.15 ± 8.49 three of them were males and seven were females, while in group B were 40.36 ± 9.62 four of them were males and six were females.

As regard body mass index, body weight and lean body mass there was no stastical variation between two groups.

Total protein (g/dl) Plasma albumin (g/dl) Cholesterol (mg/triglycerides (mg/dl) Urinary and Creatinine (mg/day) were measured in the 1st ,7th, 14th, 21st and 30th day and we found that on the 1st day there is no stastical difference between two groups while the cholesterol level was slightly decreased at the 7th day at group B, but on 14th day total protein was substantially greater in group A compared to group B. Meanwhile, plasma albumin, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference. At 21stand 30th days total protein, plasma albumin was significant higher in group A compared to group B Meanwhile, cholesterol and triglycerides were comparable in both groups without statistically significant difference.

Variables		Group A (n=10)	Group B (n=10)	t / χ^2	P
Age (years) Mean± SD		39.15 ± 8.49	40.36 ± 9.62	.298	.769
Sex	Male	3 (30%)	4 (40%)	.220	.639
	Female	7 (70%)	6 (60%)		

Table 1: Demographic characteristics between studied group

Regarding age and sex, we didn't find any substantial differences between the two study groups.

Variables	Group A (n=10)	Group B (n=10)	T	P
Weight (kg) Mean± SD	81.8 ± 10.79	83.45 ± 7.2	.378	.710
BMI (kg/m^2) Mean± SD	25.91 ± 2.68	26.25 ± 3.57	.241	.812
Lean body mass (kg/m^2) Mean± SD	55.42 ± 7.35	58.3 ± 7.91	.843	.410

Table 2: Clinical characteristics between studied groups

we didn't find any substantial differences between the two study groups regarding weight,BMI and lean body mass.

Variables	Group A (n=10)		Group B (n=10)		χ2	P
	N	%	N	%		
Smoking	2	20%	3	30%	.267	.606
DM	1	10%	2	20%	.392	.531
HTN	2	20%	2	20%	--	1

Table 3: Comorbidities distribution among the two studied groups

There no substantial differences between the researched groups.

1st day	Group A (n=10)	Group B (n=10)	T	P
Total protein (g/dl) Mean± SD	6.37 ± 0.583	6.12 ± 0.427	.183	.857
Plasma albumin (g/dl) Mean± SD	4.25 ± 0.521	4.31 ± 0.503	.262	.796
Cholesterol (mg/dl) Mean± SD	319.88 ± 72.34	301.64 ± 64.73	.594	.560
Triglycerides (mg/dl) Mean± SD	113.48 ± 52.6	124.7 ± 44.16	.517	.612
Urinary Creatinine (mg/day) Mean± SD	1354.7 ± 336.2	1321.25 ± 349.8	.218	.830

Table 4: Laboratory parameters at 1st day between the two studied groups

1st day total protein, plasma albumin, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference.

7th day	**Group A (n=10)**	**Group B (n=10)**	**T**	**P**
Total protein (g/dl) Mean± SD	5.84 ± 0.604	5.62 ± 0.527	.868	.397
Plasma albumin (g/dl) Mean± SD	3.33 ± 0.514	3.17 ± 0.498	.708	.489
Cholesterol (mg/dl) Mean± SD	295.24 ± 98.38	309.17 ± 69.53	.366	.719
Triglycerides (mg/dl) Mean± SD	108.96 ± 71.26	99.2 ± 48.21	.359	.724
Urinary Creatinine (mg/day) Mean± SD	964.57 ± 213.6	905.65 ± 227.9	.597	.558

Table 5: Laboratory parameters at 7th day between the two studied groups

7th day total protein, plasma albumin, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference.

14th day	**Group A (n=10)**	**Group B (n=10)**	**T**	**P**
Total protein (g/dl) Mean± SD	4.91 ± 0.470	4.32 ± 0.581	**2.5**	**.022**
Plasma albumin (g/dl) Mean± SD	2.87 ± 0.664	2.31 ± 0.688	1.92	.071
Cholesterol (mg/dl) Mean± SD	271.54 ± 78.44	251.33 ± 86.42	.548	.591
Triglycerides (mg/dl) Mean± SD	95.47 ± 49.92	85.75 ± 37.13	.494	.627
Urinary Creatinine (mg/day) Mean± SD	682.33 ± 182.48	638.51 ± 197.1	.516	.612

Table 6: Laboratory parameters at 14th day between the two studied groups

14th day total protein was substantially greater in group A compared to group B. Meanwhile, plasma albumin, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference.

21st day	***Group A (n=10)***	***Group B (n=10)***	**T**	**P**
Total protein *(g/dl) Mean± SD*	4.68 ± 0.516	4.15 ± 0.502	**2.33**	**.032**
Plasma albumin *(g/dl) Mean± SD*	2.82 ± 0.835	2.19 ± 0.314	**2.33**	**.038**
Cholesterol *(mg/dl) Mean± SD*	241.36 ± 65.18	233.51 ± 74.63	.251	.805
Triglycerides *(mg/dl) Mean± SD*	81.29 ± 30.85	79.68 ± 28.42	.121	.904
Urinary Creatinine *(mg/day) Mean± SD*	479.24 ± 144.21	516.47 ± 153.8	.558	.583

Table 7: Laboratory parameters at 21 days between the two studied groups

21st day total protein and plasma albumin was substantially greater in group A compared to group B. Meanwhile, urinary creatinine, cholesterol, and

triglycerides were comparable in both groups without statistically significant difference.

30th day	*Group A (n=10)*	*Group B (n=10)*	T	P
Total protein (g/dl) Mean± SD	**4.72 ± 0.622**	**4.23 ± 0.594**	**2.26**	**.037**
Plasma albumin (g/dl) Mean± SD	**2.7 ± 0.751**	**2.21 ± 0.479**	**2.13**	**.048**
Cholesterol (mg/dl) Mean± SD	**225.31 ± 59.56**	**213.62 ± 62.19**	**.429**	**.673**
Triglycerides (mg/dl) Mean± SD	**80.34 ± 29.64**	**78.53 ± 28.56**	**.139**	**.891**
Urinary Creatinine (mg/day) Mean± SD	**412.54 ± 131.62**	**487.36 ± 148.27**	**1.19**	**.248**

Table 8: Laboratory parameters at 30th day between the two studied groups.

30th day total protein and plasma albumin were substantially greater in group A compared to group B. Meanwhile, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference.

DISCUSSION

A reaction to severe burns nearly always affects every organ system. The pathophysiological response to severe burns is characterized by inflammation, hypermetabolism, muscular atrophy, and insulin resistance. It is also known that alterations in metabolism persist for many years after damage.[6]

Due to increased vascular permeability in burn wounds, which causes exudation with significant protein loss via the burn wound and an acute stage response of plasma synthesis of proteins in the liver that occurs with even a very small proportion of burn skin (0.8 percent), albumin levels in burn patients can also be significantly reduced, falling to about 80% of normal albumin and prealbumin levels. In addition, significant burn patients who initially have decreased blood albumin levels have a higher fatality rate.[7]

Nutritional assistance is particularly crucial and difficult for burn patients since severe burns result in major metabolic disturbances. Burn damage results in an extended period of persistent hypermetabolism and accelerated catabolism, which accelerates the loss of muscle mass and induces cachexia. Burn patients may have double the usual metabolic rates, and when these needs are not met, organ dysfunction, decreased wound healing, and infection susceptibility result. To properly care for these individuals, dietary requirements must be assessed and met.[8]

Intralipid therapy is becoming more popular as a therapeutic option for a wide variety of problems. A treatment for local anesthetic calcium channel blockers, psychiatric drugs, glyphosate surfactant herbicide toxicities, and even cocaine overdose has been described as intravenous lipid emulsion (ILE) in human literature. [9]

According to the results of the current investigation, there was no substantial variation in the two study groups' ages, comorbidities, weights, BMIs, or amounts of lean body mass. There was no substantial variation between the groups under study.

Our findings were supported by the research of **Juang et al., 2007**[10] as they showed that no substantial differences in comorbidities or baseline nutritional parameters were observed between groups.

As regard clinical outcome the patient who receive fat emulsion show slightly improvement of general condition than control group Our results were supported by **Edmunds et al., 2014**[11]**.** In this study a total of 451 of critically ill patients were divided in to multiple group 70 (15.5%) in the lipid-free group, 223 (49.5%) in

the soybean oil group, 65 (14.4%) in the medium-chain triglyceride group,

74 (16.4%) in the olive oil group, and 19 (4.9%) in the fish oil group. the net result of this study the patient who receive lipid product showing a faster time to ICU discharge, had a shorter time to termination of mechanical ventilation and improve general condition A compared to lipid free group.

Early enteral feeding has also been proven to promote wound healing, reduce the chance of developing Curling ulcers, and shorten stays in critical care units in people. Parenteral and enteral nutrition are often given in a continuous manner. This is done for parenteral nutrition (PN), but the rationale for continuous feeding is less evident for enteral nutrition (EN). To make sure the patient can tolerate this regimen, enteral feeding is started continuously at a modest volume and slowly increased to the desired amount. Even when the patient has no problems with tolerance, a continuous regimen is often maintained. Continuous enteral feeding is probably a remnant from parenteral regimens, albeit the data are few and neither schedule has been proved to be preferable. Further investigation is required to evaluate if intermittent eating after burn could be advantageous. Normal physiology operates with intermittent meals, typically throughout the day.[12]

The current study showed that 1st day total protein, plasma albumin, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference. 7th day total protein, plasma albumin, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference. 14th day total protein was substantially greater in group A compared to group B. Meanwhile, plasma albumin, urinary creatinine, cholesterol, and triglycerides were comparable in both groups without statistically significant difference. At 21st and 30th day total protein, plasma albumin was substantially

greater in group A compared to group B Meanwhile, cholesterol and triglycerides were comparable in both groups without statistically significant difference. This means After a period of accumulation, the application of fat emulsion can reduce plasma albumin consumption. This result is important for alleviating hypoalbuminemia, preventing infection. Our findings were supported by the research of **Rong et al., [13]** as they examined how intralipid affected how much protein severely burnt patients consumed. Sixty-seven patients without surgery who had severe burns were split into two groups: the intralipid group (which received 20 percent intralipid in 500 ml once a day starting on post-burn day 4) and the non-intralipid therapy group (the control group). On post-burn days 1, 7, and 14, venous blood samples from these individuals were taken for the evaluation of total protein, albumin, total cholesterol, and triglyceride.

On the first post-burn day, both groups' levels of total protein, albumin, total cholesterol, and triglycerides were within the normal range. On day 7, only the albumin level decreased in both groups, however by similar amounts (32+/- 4.83 vs. 31+/-5.04 g/L, $P<0.05$). On the 14th post-burn day, both groups' levels of total protein, albumin, total cholesterol, and triglycerides were lower than the normal range, although the intralipid therapy group lost more albumin than the control group (28+/-6.46 vs 23+/-7.03 g/L, $P<0.01$). In severely burnt individuals, intralipid (20 percent) offers an effective energy supply to reduce albumin loss. In the short-term parenteral nutrition of critically ill patients with septic and trauma, a concentrated fat emulsion (Intralipid 30 percent) with a phospholipid/triglyceride ratio of 0.04 was tested for clinical tolerance and metabolic effects and compared with Intralipid 20 percent (phospholipid/triglyceride ratio of 0.06).[13]

CONCLUSION

In order to reduce albumin loss in severely burnt patients, manufactured fat emulsion is an excellent energy supply. Further research with a bigger sample size and a wider geographic scope will strengthen this assertion. Also, measurement of prealbumin as albumin in the nutritional assessment need to done. The cost-benefit and cost-effectiveness of nutritional support for burn patients need to be better understood via large multicenter trials.

Conflict of interest : none

REFERENCES

1. Porter C, Tompkins RG, Finnerty CC, , et al. The metabolic stress response to burn trauma: current understanding and therapies. *Lancet*.; 2016,388.10052:1417–26.

2. Hart DW, Wolf SE, Herndon DN, et al. Energyexpenditure and caloric balance after burn: increased feeding leads to fat rather than lean mass accretion. *Ann Surg*.; 2002,235.1:152–6

3. Gore DC, Chinkes DL, Wolf SE, S et al. Quantification of protein metabolism in vivo for skin, wound, and muscle in severe burn patients. *J Parenter Enter Nutr ;* 2006,30.4.331–8.

4. Hart DW, Wolf SE and Chinkes DL. Determinants of skeletal muscle catabolism after severe burn. *Ann Surg* ;2000, 232: 455–65.

5. Ferrando, A. A., Stuart, C. A., Sheffield-Moore, M., et al. Inactivity amplifies the catabolic response of skeletal muscle to cortisol. *The Journal of Clinical Endocrinology & Metabolism*, 1999, 84.10: 3515-21.

6. Fagan, SP., Bilodeau, ML., and Goverman, J. Burn intensive care. *Surg Clin North Am*; 2014.94:765–79.

7. Guillory, A. N., Porter, C., Suman, O. E., et al. Modulation of the hypermetabolic response after burn injury. *Total burn care;* 2018, 301-6.

8. Clark, A., Imran, J., Madni, T., & Wolf, S. E. Nutrition and metabolism in burn patients. *Burns & trauma* , 2017,5.500-501.

9. Eldor, J., & Eldor, L. Intralipid use in Trauma. *SF J Emer Med*,2017, 1.1.

10. Juang, P., Fish, D. N., Jung, R., et al. Enteral glutamine supplementation in critically ill patients with burn injuries: a retrospective case control evaluation. Pharmacotherapy: *The Journal of Human Pharmacology and Drug Therapy*, 2007, 27.1: 11-9.10

11. Edmunds, C. E., Brody, R. A., Parrott, J. S.,.et al. The effects of different IV fat emulsions on clinical outcomes in critically ill patients. *Critical care medicine* ,2014, 42.5: 1168-77.

12. McClave SA, Taylor BE, Martindale RG, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN). JPEN. *Journal of parenteral and enteral nutrition*, 2016, 40.2: 159-211.

13. Rong, X. Z., Zhang, T., Li, Q. H., et al. Effect of intralipid for ameliorating protein loss in severe burned patients. Nan Fang yi ke da xue xue bao= *Journal of Southern Medical University*, 2006, 26.4: 500-501