

Effect of Cutaneous Application of Sunflower-Seed Oil on Serum Triglyceride and Cholesterol Levels in Preterm Infants

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Abstract

Intravenous lipid solution (intralipid) provides essential substances for optimizing growth in premature infants, but has potential side effects. We investigated the effects of dermal application of sunflower-seed oil (SFSO) as a substitute for intralipid in preterm infants. This study comprised of 20 preterm infants, unable to be fed enterally divided into case and control groups of equal numbers. SFSO was rubbed over the whole skin (1 gr/kg, three times daily) in case group only. Serum triglyceride and cholesterol levels were measured in both groups initially, and on the third and seventh day. The initial mean of serum triglyceride (TG) levels in the case and control groups were 42.6 ± 15.5 mg/dl and 45.2 ± 14.0 mg/dl respectively. TG level had a steady state increase at three (47%) and seven (80%) days of cutaneous application of SFSO in the case group, whereas, it decreased steadily in the control group. The respective initial mean cholesterol levels in the study and control groups were 94.6 and 102.5 mg/dl which did not significantly change during the course of the study in both groups. This study is indicating that although, deficiency of essential fatty acids or their related clinical complications were not observed in either group, application of SFSO steadily improved the level of triglyceride in preterm infants. Therefore, dermal application of sunflower-seed oil is a non-invasive and economic way, and it appears to be a suitable non-complicated alternative for intralipid.

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Keywords • Premature infant • sunflower-seed-oil • intralipid • hyperalimentation

Introduction

Normal growth of infants is dependent upon an adequate supply of essential fatty acids.¹ Thus, intravenous hyperalimentation is of special importance, particularly in nutritional management of the orally deprived and sick neonates.² Intralipid as a low-volume, high-caloric part of alimentation furnishes suitable setting for growth enhancement and body metabolism in preterm infants.^{1,3} On the other hand, supplying the sick premature infants with intralipid solution may lead to unfavorable metabolic consequences such as abnormal increase in serum glyceride, septicemia,² increased risk of coagulase, negative staphylococcal bacteremia or fungal infections^{4,5} cholestasis⁶, hypoxia and acidemia.² The aim of the study was to rub sunflower-seed oil (SFSO) on the skin of

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preterm infants as a substitute for intralipid administration and to evaluate the effect of SFSO on serum triglyceride and cholesterol levels.

Patients and Methods

This cross-sectional prospective study was conducted in the Neonatal Intensive Care Units of Nemazee Hospital of Shiraz University of Medical Science. The board of the Pediatric Department and the Committee of the Research Proposals approved the study design and informed consents were obtained from the parents.

The study is conducted on preterm infants of less than 37-weeks-gestation that could not be fed enterally either by mouth or gavage, and were receiving fat-free total hyperalimentation. They were randomly divided into case and control groups of equal numbers. In the case group SFSO was rubbed (one gr/kg three times daily) over their whole skin, except for face and head, for seven days, whereas, only routine procedures were performed in the control group. The SFSO was obtained from Iran Oil Product Company with the composition of linoleic acid (61.5%), linolenic acid (1.2%), oleic acid (21.5%), stearic acid (7.3%), and palmitic acid (8.5%).

Before the commencement, a blood sample was taken from each patient and its serum triglyceride (TG) and cholesterol (CH) levels were measured using enzymatic end-point technique and their results were considered as pre-treated values for both groups. The corresponding samples were taken in both groups on the third and seventh days after the start of the study in control group and administration of oil in case group. During the course of the study both groups were closely observed for possible developing clinical complications of essential fatty acid deficiency such as generalized scaling, bleeding and skin rashes. Statistical analyses are performed using non-parametric Mann-Whitney U-test and $P < 0.05$ is considered as statistically significant.

Results

The levels of TG and CH of both groups are presented in Table 1. The pretreated level of TG in both case and control groups were 42.6 ± 15.6 and 45.2 ± 14.0 mg/dl respectively. The serum TG level in both groups exceeded 100mg/dl. After administration of SFSO there was a steady rise in the level of TG, 47% at day-three and 80% at day-seven. But in the control group there was a steady decrease in the level of TG, 28% in day-three and 38% in day-seven respectively. Comparison of the values of CH of both groups indicated that

there were no statistical or clinical differences between their values before or during day-three and day-seven of the two groups (Table 1).

Table 1: Mean \pm SD of triglyceride and cholesterol levels in preterm infants of case (n=10) and control (n=10) groups

	Pretreated	Day-3	Day-7
Triglyceride (mg/dl)			
Control	45.2 \pm 14.0	32.6 \pm 11.6	27.7 \pm 9.9
Case	42.6 \pm 15.6	62.7 \pm 20.8	79.9 \pm 21.2
Cholesterol (mg/dl)			
Control	102.5 \pm 35.5	118.8 \pm 27.	125.9 \pm 27.7
Case	94.6 \pm 32.5	130.7 \pm 26.8	133.3 \pm 27.1

Clinical observation revealed that during the study period mild gastrointestinal hemorrhage was found in five neonates, two in the case and three in the control groups, and generalized skin scaling in four neonates of control group. No skin rashes were observed among the neonates of either group.

Discussion

Cutaneous application of SFSO has been suggested as a safe procedure for prevention of hypolipidemia and avoiding intralipid complications.⁷ SFSO with high levels of polyunsaturated fatty acids (69%), and 0.2 mg/ml of fatty acid methyl esters, can provide adequate linoleic acid for maintaining immune response in neonates.⁸ Moreover, prophylactic treatment of preterm infants with SFSO is shown to be highly effective in reducing the incidence of nosocomial infections.^{4,9-11} This method has also been used for compensation of depleted essential fatty acids such as linoleic and arachidonic acids in deficient patients.^{3,7}

In our study, seven day cutaneous application of SFSO on preterm infants had an escalating trend on the level of serum triglyceride levels. This application, by preventing the declining pattern of serum TG level seen in the control group, clearly had meaningful results in favor of the usefulness of SFSO as a substitute for intralipid. Therefore, it seems that rubbing SFSO on the skin, not only corrected the depleted level of triglyceride in preterm infants, but also enabled them to maintain the level of serum TG close to normal range without being forced to have oral feeding or intralipid. Moreover, since in the case group the level of TG did not surpass the upper normal limit of TG, routine measurements of serum TG may not be necessary, as it is crucial in those receiving intralipid.

Cutaneous application of SFSO, because it is cholesterol-free, did not alter the level of serum cholesterol in our preterm infants of case group (Table 1), which is similar to the results of Bohles et al.³ The controversy regarding cholesterol

administration to those neonates treated only with dermal SFISO merits further investigations.

Correction of the skin dryness and scaling by dermal application of enriched linoleic acid SFISO has been observed even in those infants receiving intralipid.⁷ Linoleic acid, due to its immediate skin absorption, is said to directly incorporate into the circulating lipoproteins.⁷ In preterm infants due to immaturity the skin barrier is temporarily but critically compromised,⁹ hence the use of SFISO as a skin barrier-enhancing product have shown to improve the skin condition.^{9,12,13} In our study generalized skin scaling was observed only in four preterm infants of the control group probably due to depletion of essential fatty acids. However, as is concluded by other investigators,¹⁴ no skin rashes or other dermal side effects attributable to the use of SFISO were observed among the neonates of our study group.

For correction of fatty acid depletion in premature infants, cutaneous application of SFISO is non-invasive and more economic. The simplicity of the topical administration of sunflower-seed oil suggests that this method could be vastly used, particularly in developing countries.

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