

Invited commentary

Monounsaturated fatty acids in parenteral nutrition; evaluation of risks and benefits

For a number of years, lipid emulsions have been used in the nutritional support of surgical and critically ill patients, with the aim of supplying substrates to meet energy demands and providing building blocks for wound healing and tissue repair. Traditionally, these emulsions have been based on soyabean oil, which is rich in the *n*-6 PUFA linoleic acid (18:2*n*-6). More recently, the impact of manipulation of the fatty acid composition of lipid emulsions in nutritional support has been investigated.

The basis for the use of emulsions containing lipids other than the traditional soyabean oil is that, owing to its high content of linoleic acid, soyabean oil might promote the generation of arachidonic acid-derived eicosanoids and exaggerate the inflammatory responses seen in clinical situations involving stress or trauma. Whether this phenomenon does in fact occur *in vivo* and whether it affects clinical outcome have not been unequivocally demonstrated. Nevertheless, interventions aiming to ameliorate the systemic inflammatory response syndrome (SIRS), which is associated with sepsis and multiple organ failure, have focused on the replacement of some of the *n*-6 PUFA with other fatty acids, including *n*-3 PUFA and MUFA. There is particular interest in the effects of these alternative emulsions on immune and inflammatory responses, as well as clinical outcome, since hyperinflammation and compromised cell-mediated immunity can coincide in patients with a poor prognosis (Tschakowsky *et al.* 2002).

There is a growing literature on the use of *n*-3 PUFA in a variety of acute and chronic inflammatory settings, including parenteral and enteral delivery to surgical and critically ill patients (see Calder, 2004, for a review). There may be some clinical benefit in these situations, although they do not always appear to correlate with improvements in immune and inflammatory markers (Furst & Kuhn, 2000). On the other hand, there are relatively few available published data on the impact of MUFA in parenteral nutrition. Proponents of emulsions containing olive oil suggest that it offers an immunologically neutral alternative to soyabean oil for use in parenteral nutrition, with the potential benefit of some mild anti-inflammatory effects. This is based on a lack of effect of olive oil on a range of immune parameters in healthy human subjects (Yaqoob, 1998, 2004; Yaqoob *et al.* 1998).

Several animal studies have examined the effects of an olive oil-based emulsion (ClinOleic; Baxter, Maurepas, France) on immune function. Granato *et al.* (2000) compared the effects of ClinOleic with two soyabean oil-based emulsions (Intralipid (Fresenius Kabi, Upsala, Sweden) and Ivelip (Baxter)) on a number of functions of human peripheral blood mononuclear cells *in vitro*. Both Intralipid and Ivelip suppressed lymphocyte proliferation and IL-2

production, whereas ClinOleic had no effect, which could be interpreted as suggesting that olive oil-based emulsions offer a neutral alternative to soyabean oil-based emulsions with respect to their effects on immune function. A similar hypothesis was adopted in a study in which rats were subjected to total parenteral nutrition (TPN) in the form of ClinOleic or Ivelip for 6 d; in this study, there were no significant differences in spleen lymphocyte proliferation, although the response tended to be greater in the ClinOleic group, and the expression of the IL-2 receptor was significantly higher after TPN with ClinOleic (Moussa *et al.* 2000).

The neutral nature of olive oil-containing emulsions was also demonstrated in a study by Garnacho-Montero *et al.* (2002), in which rats received saline, a soyabean oil-based emulsion, a medium-chain triacylglycerol (MCT)/soyabean oil emulsion or an olive oil-containing emulsion prior to challenge with *Escherichia coli*. Both the soyabean oil- and MCT-containing emulsions diminished bacterial clearance, whereas the olive oil-containing emulsion did not. Survival rates were not, however, significantly different between groups (Garnacho-Montero *et al.* 2002). Nevertheless, the effect of olive oil is potentially important, since an impairment of phagocytosis and bacterial clearance is an undesirable outcome commonly associated with the use of intravenous lipid emulsions (Waitzberg *et al.* 2002).

In this issue, Vahedi *et al.* (2005) compare the effects of soyabean oil- versus olive oil-based emulsions in home parenteral nutrition for patients with stable intestinal failure. The authors report that there were no adverse effects on liver function or any other routine laboratory measurements. The main results presented in the paper show, not surprisingly, that oleic acid and linoleic acid were elevated in plasma lipids in the ClinOleic and Ivelip groups, respectively. However, the olive oil-based emulsion also increased the levels of γ -linolenic acid, for reasons that are unclear. The same effect was observed in lymphocyte membranes, although no immunological parameters were assessed. The study has some limitations, chiefly that it was small in size and that the Ivelip group had a lower feed intake than the ClinOleic group.

Two other recent studies have examined the efficacy and safety of ClinOleic in individuals on home parenteral nutrition. In the first study, there were no differences between ClinOleic and a soyabean oil-based emulsion with respect to complications, line infections or unplanned admissions to hospital over a 6-month period (Thomas-Gibson *et al.* 2004). In the second, there were no effects of ClinOleic on a range of clinical or inflammatory markers over 3 months (Reimund *et al.* 2005). Although both studies were also very small, the available evidence is consistent

in demonstrating that whereas olive oil-based emulsions do not offer any specific added benefits in parenteral nutrition, they appear to be immunologically neutral and do not produce any adverse effects.

Parenteral feeding is not without inherent risks, although a combination of experience and technical and clinical evolution over the past few decades has substantially reduced these risks (Griffiths, 2004). From the clinician's point of view, it is important to be able to evaluate whether using parenteral nutrition, in whatever form, increases the risk to the patient without any added benefit (Griffiths, 2004). The studies described above suggest that ClinOleic does not increase the risk of complications in patients with chronic intestinal failure on home parenteral nutrition but, at the same time, does not provide any added benefits. The studies do not provide insight into other clinical settings, for example critically ill patients, in whom the potential risks of complications are comparatively greater. This remains an area of interest for future work.

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