



Eight-week consumption of milk enriched with omega 3 fatty acids raises their blood concentrations yet does not affect lipids and cardiovascular disease risk factors in adult healthy volunteers



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ABSTRACT

Adequate concentrations of omega 3 fatty acids (FA) may be maintained by consuming foods naturally rich in or functional foods enriched with those essential FA. We assessed the effects of an 8-week consumption of milk enriched with 400 mg of omega 3 FA on blood lipid levels and selected cardiovascular risk factors in adult healthy volunteers. Participants ($n = 157$) were randomized to consume – for eight weeks – either 500 mL/day of 1% fat milk providing 150 mg of eicosapentaenoic (EPA), 150 mg of docosahexaenoic (DHA), and 100 mg of α -linolenic (ALA) acids or 500 mL/day of non-enriched 1% fat milk. At week 8, we observed significant increments of blood EPA and DHA in the intervention group and a decrease in controls. No significant between-group differences at week 8 were observed in the lipid profile and other surrogate makers of cardiovascular disease, with the exception of homocysteine, whose levels remained stable in the intervention group, but increased in the control group ($p < 0.001$). In conclusion, daily consumption of 500 mL of 1% fat milk enriched with omega-3 FA for eight weeks leads to higher blood levels of EPA and DHA, confirming that milk is an optimal matrix for the provision of important micronutrients.

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1. Introduction

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality in Western countries [1] and its incidence and development can be modulated by diet. Among the various cardioprotective food components, omega 3 fatty acids have been the subject of extensive investigation. Even though supplemental omega 3 fatty acids do not, apparently, provide protection from cardiovascular disease [2], their consumption via diet, i.e. marine products are consistently associated with better cardiovascular prognosis [3]. Indeed, adequate circulating concentrations of long-chain, namely eicosapentaenoic (EPA) and docosahexaenoic (DHA)

acids are directly associated with better cardiovascular health. Therefore, International scientific societies such as the ISSFAL (www.issfal.org) are suggesting the intake of >250 mg/day of EPA and DHA to maintain proper cardiovascular health. The medium-chain alpha-linolenic acid (ALA) is also essential and there is uncertainty regarding whether ALA has actions of its own in relation to the cardiovascular system and neural function [4,5]. Also, the rate of its elongation to EPA and DHA; in humans, appear to be minimal [6].

For the purpose of primary prevention of CVD in the general population, adequate circulating levels of omega 3 fatty acids may be maintained over a lifetime by consuming marine products or functional foods enriched with omega 3 fatty acids [7]. One suitable matrix for omega 3 provision is milk, because its fat is dispersed in micelles which efficiently increase the surface available for absorption of bioactive components in the gut [8,9].

The aim of this study was to evaluate the effects of the short-term administration of 500 mL/day of omega 3 fatty acids-enriched milk – providing 300 mg/day of EPA and DHA – on blood fatty acid and lipid profile and on circulating cardiovascular risk

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factors [homocysteine, thromboxane B₂ (TxB₂) and leukotriene B₄ (LTB₄)] in adult healthy volunteers.

2. Materials and methods

2.1. Study design

We performed a double-blind, randomized, placebo-controlled trial conducted at the Scientific Institute San Raffaele (Milan, Italy). The protocol was approved by the Ethics Committee of the Scientific Institute San Raffaele and all participants gave written informed consent prior to enrolment. The study flow is shown in Fig. 1.

2.2. Setting and participants

The study was advertised through an e-mail sent to the entire Institution's database. Study participants were healthy adult volunteers. Eligibility criteria were: age 30–65 years, general good health, a body mass index (BMI) from 18.5 to 30. Exclusion criteria were: pregnancy or breast-feeding, intolerance to lactose or cow's milk proteins, dyslipidemia, dysthyroidism, smoking ≥ 10 cigarette/day, eating fish more than once a week, using medications

affecting lipid levels (including drugs to treat dyslipidemia and heparin), intake of functional foods influencing lipid levels, and intake of omega 3 FA fatty acids as medications or food supplements during the six months preceding their enrolment in the study.

2.3. Randomization and Interventions

Allocation ratio to treatment groups was 1:1. We used the PEPI software to select random permuted blocks of size 20 [17]. Allocation information was sealed in sequentially numbered opaque envelopes prepared by a biostatistician not involved in the trial. Participants in the intervention group were asked to drink – during eight weeks – 500 mL/day of 1% fat milk enriched with fish oil, containing 400 mg of omega 3 fatty acids (150 mg each of EPA and DHA and 100 mg of alpha linolenic acid); vitamins C, E, B6, and B12; and folic acid. Participants in the control group were asked to drink – during eight weeks – 500 mL/day of 1% fat milk not enriched with fish oil. The two types of milk used in this study were packed in white 500 mL Tetrapack™ containers labelled either “milk A” or “milk B” by Parmalat (Collecchio, PR, Italy). The composition of the two types of milk used in this study is reported in Table 1.

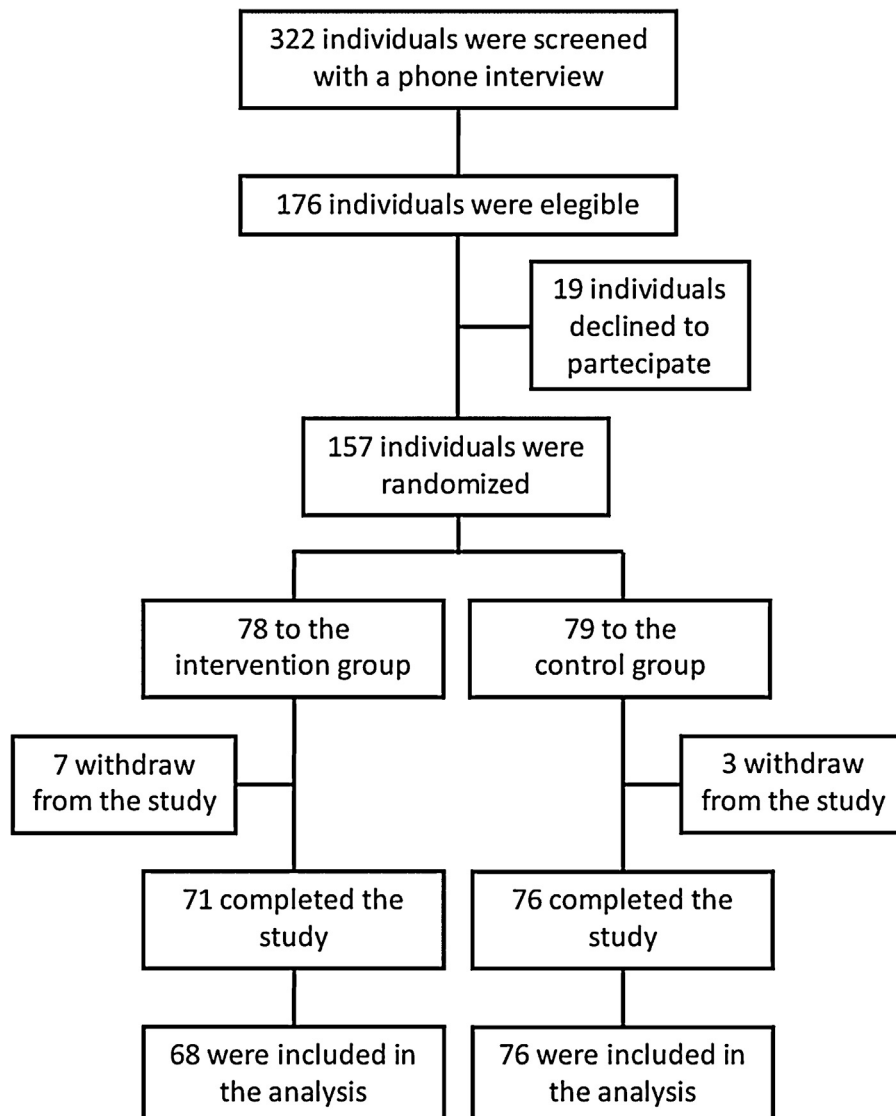


Fig. 1. Study flow.

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