

Rapeseed Oil as a source of essential fatty acids

T. SEPPÄNEN-LAAKSO (1), I. LAAKSO (1), H. VANHANEN (2) and J. VIKARI (3).

(1) Department of Pharmacy, University of Helsinki, Fabianinkatu 35, SF-00170 Helsinki

(2) Second Department of Medicine, University of Helsinki,

(3) Department of Medicine, University of Turku, Finland.

The cholesterol-lowering properties of rapeseed oil have been primarily attributed to its main constituent monoenoic oleic acid (OA, C18:1n-9), whereas antithrombotic effects are rather considered to be due to the essential linoleic (LA, C18:2n-6) and α -linolenic acids (α -LLA, C18:3n-3). In western diets rapeseed oil is especially valuable due to its very low amounts of saturated fatty acids (SaFA) (< 6%, Fig. 1b).

Population studies suggest that a high SaFA and a low LA intake is associated with a high incidence of coronary heart diseases (1,2). A low level of polyunsaturated fatty acids (PUFA) in serum phospholipids (PL) is also presumed to be a risk factor (3). The traditional Finnish diet is exceptionally rich in SaFA and poor in PUFA. For example, fatty acid compositions of adipose tissue have shown that the proportion of LA is for about half and that of stearic acid twice as high as those in Italian population (2).

We have studied the effects of rapeseed oil and rapeseed oil-containing margarine on the fatty acid composition of plasma PL and serum lipids in butter users ($n = 43$) (4,5). Butter on bread was replaced by substitute fats constituting the only change made to the diet. Substitution, which accounted for about 8% of total energy and 21% of total fat, lasted for 6 weeks. The use of rapeseed oil was reflected as dose-dependent changes in the proportion of total plasma α -LLA.

Fig. 1a. Fatty acids in butter.

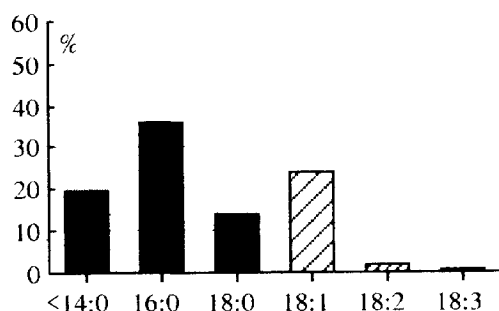
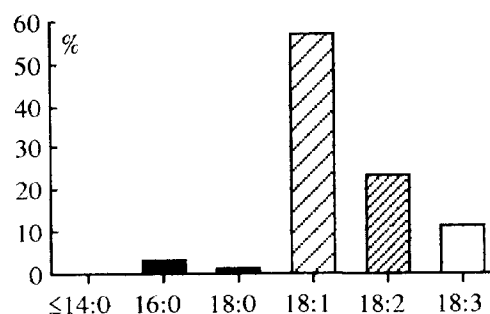


Fig. 1b. Fatty acids in rapeseed oil.



When compared to rapeseed oil butter contains more than 10-fold amounts of SaFA ($\approx 70\%$) but 1/16th part of essential fatty acids only (Figs. 1a-b). The linoleic / stearic acid ratio in butter is about 0.1 and in rapeseed oil 16. Substitute margarine consisted of 21% SaFA, 31% OA, 28% LA and 3% α -LLA (5).

Replacement of butter with rapeseed oil resulted in a significant reduction in PL SaFA (** $p < 0.001$) and considerable utilisation of essential fatty acids derived from rapeseed oil (Fig. 2) (4,5). The increase in n-3 PUFA (including eicosapentaenoic acid, EPA) at 3 weeks clearly indicated further metabolism of α -LLA. A significant increase in LA and in other n-6 PUFA appeared at 6 weeks at the expense of OA. These results suggest that the proportion of essential fatty acids in rapeseed oil is high enough to cause a significant competitive effect and a preferential incorporation of PUFA in plasma PL. As expected, no increase in n-3 PUFA was observed during margarine substitution due to the low content of α -LLA ($\approx 3\%$).

Fig. 2. Changes in the fatty acid composition of plasma PL when butter was replaced by rapeseed oil (at 3 and 6 weeks, N = 20).

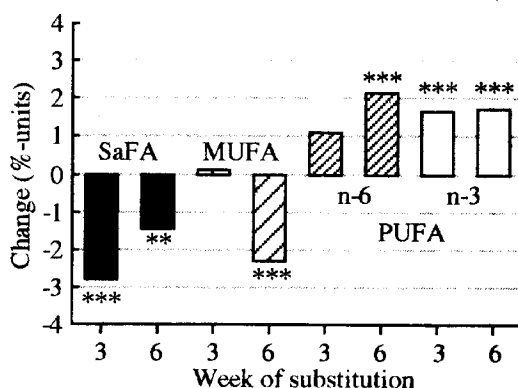
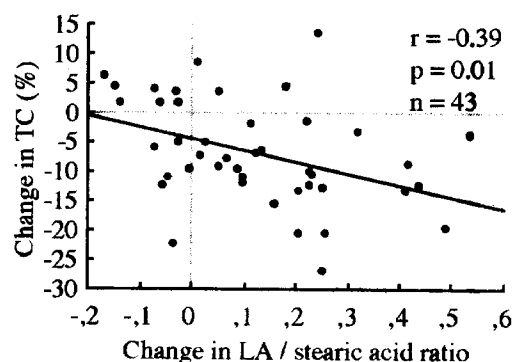


Fig. 3. Relationships between changes in PL linoleic / stearic acid ratio and serum total cholesterol levels.



Despite the high proportion of OA in substitute fats no associations with serum lipids were found. On the contrary, the increase in PL linoleic / stearic acid ratio correlated inversely with the decrease in total cholesterol (TC) in both substitution groups (combined in Fig. 4) (5). It is also important to note that the rise in α -LLA was also associated with the fall in TC during rapeseed oil diet.

Our results suggest that

- rapeseed oil is primarily a source of essential fatty acids rather than that of monoenes in the diet of butter users.
- rapeseed oil is able to bring about significant competitive effects of essential fatty acids through α -linolenic and linoleic acids.
- the increases in linoleic and α -linolenic acid levels in plasma phospholipids are closely related with the decrease in serum total cholesterol levels.

References

1. Miettinen, T., Naukkarinen, V., Huttunen, J. K., Mattila, S. and Kumlin, T.: *Br Med J*, 285, 993, 1982.
2. Logan, R.L., Thomson, M., Riemersma, R.A., Oliver, M.F., Olsson, A.G. and others: *Lancet*, i, 949, 1978.
3. Riemersma, R.A., Wood, D.A., Butler, S., Elton, R.A., Oliver, M. and others: *Br Med J*, 292, 1423, 1986.
4. Seppänen-Laakso, T., Vanhanen, H., Laakso, I., Kohtamäki, H. and Viikari, J.: *Br J Nutr*, 68, 1992 (in press).
5. Seppänen-Laakso, T., Laakso, I., Vanhanen, H. and Viikari, J.: *Proceedings of the 8th Int. Rapeseed Conference*, 9-11th June, Saskatoon, Canada, 1618, 1991.