

Olive oil in food spreads

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La hidrogenación química de los ácidos grasos insaturados es una reacción que se utiliza con frecuencia en la industria alimentaria. El proceso implica el movimiento de los dobles enlaces en la cadena hidrocarbonada de los ácidos grasos, y la aparición de isómeros posicionales y geométricos (ácidos grasos *trans*). La ingesta inadecuada de alimentos que pueden contener cantidades significativas de ácidos grasos *trans* se asocia con el aumento en sangre de colesterol total y LDL, y la disminución de HDL, entre otros efectos. Por lo tanto, el uso de aceite de oliva en la preparación de grasas para untar constituye un importante avance en el desarrollo comercial de nuevos alimentos saludables con una imagen positiva para el consumidor.

PALABRAS-CLAVE: Aceite de oliva; Hidrogenación; Ácidos grasos *trans*; Ácidos grasos monoinsaturados; Grasa para untar; Dieta Mediterránea.

SUMMARY

Olive oil in food spreads.

Chemical hydrogenation of unsaturated fatty acids is a commonly applied reaction to food industries. The process may imply the movement of double bonds in their positions on the fatty acid carbon chain, producing positional and geometrical isomers (*trans* fatty acids). Through hydrogenation, unsaturated oils are converted to margarines and vegetable shortenings. The presence of *trans* fatty acids in foods is undesirable, as *trans* fatty acids raise the plasma levels of total and low-density lipoproteins (LDL), while decrease the plasma level of high-density lipoproteins (HDL), among other effects. The use of olive oil to prepare fat spread opens new insights into the commercial development of healthy novel foods with a positive image in terms of consumer appeal.

KEY-WORDS: Olive oil; Hydrogenation; Trans fatty acids; Monounsaturated fatty acids; Fat spread; Mediterranean diet.

1. A SHORT OVERVIEW

Food spreads such as margarine and butter are commonplace in the kitchen. They are used in the home and in the industry for cooking, baking

sandwiches and numerous food products. In recent years, attention has been directed to producing healthier food spreads, in the form of reduced fat alternatives to the existing products.

Margarines contain a water phase and an oil phase, which are emulsified. They are generally in the form of a water-in-oil emulsion. The taste of margarines and food spreads is due mostly to water-soluble flavors, oil soluble flavors and salt included in the water phase. Margarine type compounds contain at least 80% of fat by weight.

In general, fats containing a majority of saturated fatty acids (SFA) are solid at room temperature, and those containing mostly unsaturated fatty acids are usually liquid at room temperature and are called oils. Most naturally occurring dietary unsaturated fatty acids in vegetable oils or polyunsaturated fatty acids (PUFA) of fish oils are of the *cis* configuration.

Chemical hydrogenation is the process of adding hydrogen atoms to unsaturated sites on the carbon chains of fatty acids, thereby reducing the number of double bonds. The reaction is applied to food industries as partial hydrogenation, by heating vegetable oils (fish oils occasionally) in the presence of metal catalyst and hydrogen. The process of partial hydrogenation accompanied by thermal isomerization, represents incomplete saturation of the double bonds, in which some double bonds remain but may move in their positions on the carbon chain, and produces several geometrical and positional isomers.

Hydrogenation heightens the melting point of fats, which makes it possible to convert fats in liquid form to semi-solids and solids that are useful in many dietary products, increasing shelf life and the flavor stability of unsaturated fatty acids. Cottonseed oil was first hydrogenated in 1911 in the United States to produce vegetable shortening. The partial hydrogenation process became more popular in the 1930's with the development of margarine (IFIC, 1998). Through hydrogenation, oils such as soybean, safflower, and cottonseed oil, which are rich in unsaturated fatty acids, are converted to margarines and vegetable shortenings (Federal register, 1999).

Thus, *trans* fatty acids are produced artificially and commercially today. They are present in variable amounts in a wide range of foods, including most foods made with partially hydrogenated oils such as baked goods and fried foods, and some margarine products.

Many years of epidemiological research have shown that populations consuming diets high in SFA have relatively high levels of serum cholesterol and carry a high prevalence of coronary heart disease (as shown earlier by Keys, 1980; Kromhout and Lezenne, 1984; Caggiula and Mustad, 1997; and reviewed in issue 3). Based on the evidence of these studies, it is generally accepted that high levels of serum cholesterol, particularly low-density lipoprotein (LDL) cholesterol, promote the development of atherosclerosis and predispose to coronary heart disease. The concept has become widely accepted that lowering LDL cholesterol by virtually any safe means will reduce the risk of coronary heart disease (Gould *et al.*, 1998).

One study in 1990 demonstrated that *trans* fatty acids raised total and LDL cholesterol while lowering high-density lipoprotein (HDL) cholesterol (Mensink and Katan, 1990). As a result, the net effect of *trans* fatty acids on the ratio of LDL to HDL cholesterol was approximately double that of the SFA. These adverse effects of *trans* fatty acids have been confirmed by subsequent metabolic studies.

Strong epidemiological evidence relating dietary factors to the risk of coronary heart disease has been provided by large prospective studies. Those studies assessed the intake of *trans* fatty acids using detailed food-frequency questionnaires whose results were validated by comparison with the composition of adipose tissue or food diaries. Each of these studies reported high relative risk of coronary heart disease associated with the intake of *trans* fatty acids (Willet *et al.*, 1993; Ascherio *et al.*, 1996; Pietinen *et al.*, 1997; Oomen *et al.*, 2001).

Butter has been probed to produce a small, but significant rise in the total serum cholesterol and LDL cholesterol, relative to other fats. Enrichment of butter with either olive oil (50/50) or sunflower oil (50/50) failed to reduce serum lipid levels below habitual diet values. Hard margarine, containing 29% *trans* fatty acids, caused a decrease in apolipoprotein A-I and B levels, but did not change total serum cholesterol or LDL cholesterol levels, relative to habitual diet values. The data indicated that *trans* fatty acids are not metabolically equivalent to the natural *cis* isomers and that they can affect the serum lipid profile adversely (Wood *et al.*, 1993). Therefore, an olive based fat spread could help, not only to reduce LDL cholesterol, but also not to raise the ratio of LDL/HDL cholesterol as the *trans* fatty acids do.

The first commercial development of a spread made from a combination of butterfat and vegetable

oil was a product named Bregott, in Sweden forty years ago. It contains around 65% milk fat and 15% soybean oil. The manufacturing technique is the same as butter. The cream is pasteurized followed by cooling, and oil is mixed in the churn or the oil is continuously injected before churning in a continuous butter machine. One of the first companies in Europe with a fat spread containing olive oil was Benecol®.

In terms of product competition, the yellow fat market is dominated overall by soft margarines, followed by butters, with dairy, polyunsaturated spreads and low fat spreads following in approximate order of market share. The source oils for these products are mainly dairy and vegetable. A more recent introduction has been the application of olive oil as a major source fat in this respect, but still with a much smaller market share than other oils.

Olive oil and products based on it, which are high in monounsaturated fatty acids (MUFA), are promoted as part of the Mediterranean diet which is currently viewed as making a favorable dietary contribution. Thus, in this respect, olive oil in the diet can be recommended, and has a positive image in terms of consumer appeal. There is also a possible negative image for a wider consumer market in the northern countries because its use as medicinal form for many decades, and its consumption is very low compared with southern European countries.

Traditionally in the Mediterranean diet, the oil is consumed in the pure form, either as a basting or frying aid. Although the most common use of olive oil is in as such, in the liquid form, it is acknowledged that a more pleasant way to consume the oil is in the form of a spread. There are also some indications that presentation of a healthy image for a food product may not *per se* ensure consumer acceptance. Consumer attitudes to this new source oil used in spread form and its associated sensory appeal and image has been explored and the selection and acceptance of a new food product depends on many factors which include the foods sensory properties and the information imparted to the consumer (Bower and Saadat, 1998).

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