Food Chemistry **33** (1989) 27–31

Processed Oil and Fat Products*

B. W. Nichols

Van Den Berghs & Jurgens Ltd, Sussex House, Burgess Hill,
West Sussex RH15 9AW, UK

ABSTRACT

In principle, the oil processor can produce a variety of fats and oils which would probably fulfil most definitions of natural. Similarly, it is possible to make products such as margarines and spreads using only natural ingredients and which could even be additive free. However, it would be difficult to justify, from the viewpoint of general food quality, the universal adoption of natural processes and additive-free products, especially in terms of wholesomeness and good nutrition.

INTRODUCTION

Manufacturers of foods which can make significant contributions to overall fat intake may consider several nutritional issues which could include:

(i) expert opinion and recommendations on dietary fat and health
(ii) consumer views on the effects on health of additives, and
(iii) consumer views on the relative merits of synthetic and natural materials.

In general, expert opinion on fat consumption emphasises the reduction in consumption of total fat; this is advised particularly for saturated fat, which may be partially substituted by unsaturated acids.

In practical terms these recommendations indicate the development of products lower in fat and/or having a fatty acid composition relatively higher in (poly)unsaturated acids. These changes need to be achieved without significant changes in the food qualities which consumers view as particularly important (Fig. 1).

* Contribution from the Royal Society of Chemistry Mason Conference, 6 September 1988, Oxford, UK.

Food Chemistry 0308-8146/89/$03·50

Taste
Texture
Appearance
Spreadability
Versatility in kitchen use
Cost
Keepability
Nutritional characteristics

Fig. 1. Consumer-perceived qualities of margarines and spreads.

RAW MATERIALS: OILS AND FATS

Some of the fats and oils commonly used in processed foods are given in Table 1. For economic, technical and nutritional reasons oils from seeds and, in some countries, from fish have achieved increasing importance in recent years. In general these preferred oils have relatively high levels of polyunsaturated acids and low levels of saturated acids.

MODIFICATION OF OILS AND FATS

With certain exceptions, natural oils and fats, as isolated from their parent tissues, do not provide the range of qualities which would permit their incorporation into a wide variety of processed foods (see Fig. 2).

TABLE 1
General Fatty Acid Composition of Natural Oils Commonly Used in Margarine and Spread Manufacture

Origin	*Fatty acid as % of total fat*		
	Saturated	*Monounsaturated*	*Polyunsaturated*
Vegetable oils			
Coconut	89	8	3
Palm kernel	82	16	2
Palm	48	44	8
Maize (Corn)	14	33	53
Soyabean	15	23	62
Rapeseed	7	59	34
Sunflower	11	21	68
Safflower	10	14	76
Animal oils			
Fish (e.g. Menhaden)	30	34	36
Butter	64	33	3
Beef	42	53	5

Colour
Smell
Taste
Solid fat content
Fatty acid composition

Fig. 2. Important characteristics of oils and fats used for processed foods.

COLOUR, TASTE AND SMELL

For most purposes oils should have a bland taste, be relatively odourless and have a consistent, fairly light colour. Colour can be controlled by using absorbents such as natural earths, whilst undesirable flavours and odours can usually be removed by steam stripping *in vacuo* at high temperatures.

MELTING POINT AND SOLIDS CONTENT

Arguably the most important characteristic of the component fat in a processed food is its hardness or plasticity over the range of temperatures within which the product is manufactured, used and eaten. This property is a reflection of the amount of solid fat present at different temperatures, known as the solids content profile. With the exception of certain frying applications, single natural oils do not possess the solids content profiles required for most high quality products. In particular most economically available oils have a lower than ideal saturated fat content, which in consequence produces an unsatisfactorily low solids content. Also, fatty acids with three or more double bonds, which frequently occur at varying concentrations in such oils, may, at certain levels, confer a degree of oxidative instability which might result in a product system developing unacceptable off-flavours. Methods which are available to modify the fat composition and solids content profile of fats and oils include hydrogenation, fractionation, interesterification and blending. Of these, *hydrogenation* is used most extensively, and involves the reaction of an oil or fat with hydrogen in the presence of a nickel catalyst. This process can be used both to increase the solids fat content and also to remove the more highly unsaturated polyunsaturated acids.

NUTRITIONAL QUALITY OF PROCESS FAT AND OILS

The processes normally used to remove unwanted flavours and colour from oils do not otherwise have a significant effect on the composition of the oil.

Fatty acid composition is little changed, and although the vitamin E (tocopherol) content may be reduced, sufficient remains to confer oxidative stability on the oil. The steam-stripping process has the additional advantage that it largely removes any pesticides which may be present in the crude oil.

Hydrogenation, which can produce profound changes in the fatty acid composition of oils, has received appreciative attention regarding its influence on nutritional value. The process does, of course, reduce levels of unsaturated acids, and increase those of saturated acids. From the point of view of heart disease prevention, therefore, this process cannot be regarded as a direct benefit. However, hydrogenation can be used to produce fats which, when mixed in minor quantities with highly unsaturated oils, produce blends relatively high in unsaturates and low in saturates but which, at the same time, have sufficient firmness to facilitate the formulation of palatable products of nutritionally improved fat content.

The hydrogenation process also generates isomers of unsaturated acids which do not occur naturally. A large number of toxicological studies, and epidemiological evidence, indicates that generally the products of hydrogenation do not represent a risk to health other than those referred to above in the context of heart disease. However, attention has been paid to the physiological function of the *trans* isomers produced during the hydrogenation process. It has been suggested that *trans* monounsaturated acids might behave similarly to saturated fats in respect to influencing serum cholesterol levels, but recent reviews of the evidence have concluded that such suggestions are not justified. There is certainly some evidence that *trans, trans* unsaturated fatty acids may interfere with the important functions of the essential fatty acids, and oil refiners generally control the hydrogenation process to minimise the production of these acids.

MARGARINE AND SPREADS

Margarine and spreads are water in oil emulsions containing 80% or less fat. In addition to oil and water this type of product contains a variety of minor components which are essential to provide the product quality expected by the consumer (Fig. 3).

Although it is possible, in principle, to make such products entirely from natural materials, and even using no additives, this seems hardly justified in terms of overall product quality and cost, although products based entirely on natural ingredients are marketed for consumers who attach particular importance to eating foods which contain no artificial ingredients. The commercial fate of such foods has been rather variable. The use of

Milk products
- Skimmed milk
- Whey
- Buttermilk
- Caseinates

Emulsifiers and stabilisers
- Mono- and diglycerides of fatty acids
- Lecithin
- Carrageenan
- Locust bean gum
- Gelatin

Colours
- Beta-carotene
- Annatto
- Curcumin

Antioxidants
- Tocopherols

Preservatives
- Potassium sorbate

Flavours

Salt

Vitamins A & D

Fig. 3. Some minor components used in UK margarines and spreads.

preservatives such as sorbic acid may be particularly important for those products of lower fat and salt content, which are recommended in current expert nutritional advice. In some countries sorbic acid is used even in margarines because of the absence of salt, which in these products acts as both preservative and flavour enhancer.

In the conventional low fat spreads currently marketed, half of the fat of margarine or butter is replaced by an aqueous phase containing milk protein stabilisers or other minor ingredients. Should the synthetic non-digestible fat replacers, such as those based on fatty esters of sucrose or ethylene oxide, prove to be both technically and toxicologically sound, then products based on them, such as spreads and frying media, might retain the qualities and performance characteristics of the full fat equivalents but when eaten will yield much reduced levels of fat energy.