CHEMICAL PROPERTIES OF RAPESEED OIL

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ABSTRACT

As part of a study of edible oil purity criteria, 134 authentic samples of low-erucic-acid rapeseed oil (LEAR) and 12 samples of high-erucic-acid rapeseed oil (HEAR) from 13 geographically different harvest regions were analysed. The results were used to revise and update the Codex Alimentarius rapeseed oil specifications. Fatty acid, sterol, tocopherol and triglyceride compositions were measured. The LEAR contained 24 named varieties.

INTRODUCTION

The Leatherhead Food RA has been investigating the authenticity of commercially available vegetable oils for the last decade. The results of these studies have proved extremely useful for establishing the authenticity of samples, for nutritional purposes and as an aid to establishing the components of a fat blend. The Food RA has developed a computerised database, which has proved useful for these purposes.

In the case of rapeseed, plant breeding programmes have led to the development of new varieties. Whilst plant breeders produced low-erucic strains in the 1970s, further work was carried out in the 1980s to reduce levels of glucosinolate. Varieties with higher yields of seed per acre and higher oil content of the seed are also being investigated.

Most of the work involved accurate determination of purity criteria by modern techniques. The study included determination of the oil content, fatty acid profile, composition of fatty acids at the triglyceride 2-position, triglyceride carbon number, sterol and tocopherol concentrations, often of named varieties from numerous origins.

EXPERIMENTAL

Sample preparation and oil extraction

Authentic commercial rapeseed samples were obtained from traders, seed breeders and agricultural suppliers. On arrival in the laboratory, the samples were manually cleaned to remove admixture and extracted with petroleum spirit.

Fatty acid profiles

The fatty acid composition of rapeseed oil has been studied in considerable depth, mainly to monitor changes in agriculture varieties over the past 10 years. There has been a progressive shift from single-zero low-erucic-acid strains to the double-zero crops, which are also low in glucosinolate.

TABLE 1. Fatty acid composition ranges of high and low-erucic-acid rapeseed oil samples

Fatty acid	HEAR 1982-1986 crops[1]	LEAR 1982-1986 crops[1]	LEAR 1986-88 crops[2]
C12:0	ND - 0.1	-	-
C14:0	0.1	0.1 - 0.2	ND - 0.1
C16:0	2.0 - 5.1	3.4 - 6.0	3.3 - 5.3
C16:1	0.2 - 0.5	0.1 - 0.6	0.1 - 0.3
C17:0	ND	ND	ND - 0.3
C17:1	ND	ND	ND - 0.3
C18:0	0.7 - 1.3	1.1 - 2.5	1.3 - 2.1
C18:1	9.6 - 49.8	52.0 - 65.7	53.9 - 66.9
C18:2	13.0 - 22.9	16.9 - 24.8	16.1 - 24.7
C18:3	7.0 - 12.7	6.4 - 14.1	8.0 - 13.6
C20:0	0.2 - 1.0	0.2 - 0.8	0.4 - 0.8
C20:1	2.6 - 11.3	0.1 - 3.4	0.9 - 3.0
C20:2	Tr - 1.1	Tr	ND - 0.1
C22:0	0.3 - 1.2	Tr - 0.5	0.2 - 0.5
C22:1	6.5 - 51.6	Tr - 4.7	ND - 2.7
C22:2	ND - 2.0	Tr	ND
C24:0	ND	ND - 0.2	ND - 0.2
C24:1	ND	ND - 0.4	ND - 0.3
Iodine value	105.2 - 117.5	104.5 - 123.8	110.2 - 125.9

Tr = Trace
ND = Not detected
1 Turrell & Whitehead, 1990
2 Downes et al., 1990

The results for HEAR are given in Table I. The high-erucic-acid rapeseed oils are defined by Codex as those that have more than 5% erucic acid in their fatty acid composition. Countries sampled were Sweden, Hungary, East Germany, India and China. Samples from Sweden and Holland containing 9.8% and 6.5% erucic acid, respectively, may have been the result of agricultural reversion, from farm-retained seed. Samples from East Germany and China contained 26.0 and 26.1%, respectively, and may be more properly described as 'intermediate' rather than high-erucic varieties. The samples containing 44.4-51.6% erucic acid may be properly described as high-erucic.

However, as the main interest in rapeseed oil is for food use, it is mostly LEAR that is produced commercially in the western world. Even so, HEAR is still being produced in some regions for industrial purposes, e.g. as a feedstock for high-quality lubricant oil. In China, India and Pakistan, HEAR is still produced for food use.

In general, the different varieties of LEAR all have similar fatty acid compositions, except that the linolenic (18:3) level has crept up progressively from the 8-10% norm in former years to 14% in some of the newer rapeseed varieties. This may in due course lead to an inferior oxidative and/or flavour stability, unless these high-linolenic-acid varieties can be discouraged by the trade. On the whole, rapeseed oil contains 52-65% oleic acid and 17-25% linoleic acid.

Iodine values were calculated from the fatty acid composition and are given in Table 1. In general, the HEAR varieties would be expected to have lower IVs than the LEAR varieties, since trierucin has a lower IV than trioleine. This is not reflected in this work, mainly because of the small number of HEAR varieties evaluated and the presence of varieties containing little more than 5% erucic acid.

Other methods of analysis

The composition of rapeseed oil has been studied extensively at the Leatherhead Food RA. The oil content, fatty acid composition at the triglyceride 2-position, triglyceride carbon number, triglyceride composition by HPLC, sterols and tocopherol compositions have also been examined as part of this study (Downes, 1983; Jordan & Muddeman, 1989; King et al., 1985; Turrell et al., 1988).

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Note: These reports are available to Leatherhead Food RA Members only.