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NOTE

Oil Content and Fatty Acid Compositions of Some Oil Sources

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The oil yields of seed used in this study ranged between 27.1 to 39.8 % of the dry weight. Results showed that the oils of safflower 1 seeds used in this study had higher linoleic acid content (78.06 %) than those of other linoleic acid contents. On the other hand, oleic acid contents of seed oils varied between 14.21 % (safflower 1) to 67.79 % (rape 2). Results showed that the oils of canola 4, rape 1, rape 2, canola 3 and canola 5 oils had higher oleic acid (61.40-67.79 %). As a result, the present study showed that the seeds are to be a potential source of valuable oil which might be used for edible and other industrial applications.

Key Words: Seeds, Rape, Canola, Sufflower, Oil content, Fatty acids, GC.

Oilseed rape species used to produce canola oil and meal are from the *Brassica* genus in the Cruciferae family. A number of useful farm crops that are extensively grown as cash crops, fodder and industrial crops belong to the *Brassica* family[1,2]. Rape seed (*Brassica napus* L.) is the most important oil seed crop of the temperate climates and it takes the second place for the world supply of vegetable oil[3]. Virgin rapeseed oil is a high acceptance level by the consumer, due to its careful processing, natural compositions and typical taste and smell[4]. The only crucifer oils important in commerce are rape seed and mustard seed oils, which are used primarily as edible oils but also to some extent in a number of industrial applications[5]. The aim of current study is to determine the oil content and fatty acid compositions of rape, canola and safflower seeds harvested from several locations.

Oil-bearing materials (rape, canola and safflower) were collected from plants growing in Konya province in Turkey in October 2010. Samples were transported to the laboratory in polypropylene bags and held at room temperature. They were cleaned in an air screen cleaner to remove all foreign matter such as dust, dirt and chaff as well as immature and broken seeds were discarded as well. Seeds were dried to a constant weight at room temperature for analysis. Prior to chemical analysis, samples were ground to pass a 0.5 mm screen. The ground samples were then packed in new plastic bags and stored in a desiccator until analysis.

The oil contents of seeds were analyzed according to AOAC[6] methods. The oil was extracted with diethyl ether (50 ºC) in a Soxhlet apparatus. The extract was evaporated in vacuum. The lipid extract was collected in a flask. The extracted lipid was weighed to determine the oil content and stored under nitrogen at 4 ºC for further analyses.

Determination of fatty acids: Fatty acid composition for seed samples were determined using a modified fatty acid methyl ester method as described by Wang and Zhao[7]. The oil was extracted three times for 2 g air-dried seed sample by homogenization with petrolium ether. The oil samples (50-100 mg) was converted to its fatty acid methyl esters (FAME). The methyl esters esters of the fatty acids (1 µL) were analyzed in a gas chromotography (Shimadzu GC-2010) equipped with a flame ionizing detector (FID), a fused silica capillary column (60 m × 0.25 mm i.d.; film thickness 0.20 mikrometere). It was operated under the following conditions: oven temperature program. 90 ºC for 7 min. Raised to 240 ºC at a rate 5 ºC/min and than kept at 240 ºC for 15 min); injector and detector temperatures, 260 and 260 ºC; respectively, carrier gas: nitrogen at flow rate of 1.51 mL/min; split ratio. 1/50 µL/min.

A standard fatty acid methyl ester mixture (Sigma Chemical Co.) was used to identify sample peaks. Commercial mixtures of fatty acid methyl esters were used as reference data for the relative retention times[6]. Quantitative analyses of the fatty acids were performed using the heptadecanoic acid methyl ester as

TABLE-2
FATTY ACID COMPOSITIONS OF RAPE, CANOLA AND SAFFLOWER SEEDS (%)

Canola seeds	Palmitic	Oleic	Linoleic	Stearic	α-Linolenic	Linolenic
Canola 1	4.27 ± 0.3*	21.77 ± 1.2	63.15 ±1.1	0.67 ± 0.03	1.66 ± 0.03	9.12 ± 0.11
Canola 2	5.00 ± 0.7	19.22 ± 1.3	69.56 ± 1.4	0.94 ± 0.07	1.61 ± 0.02	4.58 ± 0.04
Canola 3	4.41 ± 0.2	65.31 ± 3.4	20.01 ± 0.6	1.26 ± 0.01	1.70 ± 0.11	8.54 ±* 0.12
Canola 4	4.44 ± 0.1	63.11 ± 2.3	20.74 ± 0.7	1.68 ± 0.02	1.75 ± 0.12	9.93 ± 1.02
Canola 5	11.46 ± 1.1	61.40 ± 1.7	18.67 ± 0.7	1.74 ± 0.03	1.30 ± 0.09	7.15 ± 0.34
Canola 6	5.08 ± 0.5	67.76 ± 1.9	18.80 ± 0.9	1.33 ± 0.03	1.59 ± 0.01	6.66 ± 0.23
Rape seeds						
Rape 1	4.92 ± 0.3	66.16 ± 2.1	20.98 ± 0.3	0.93 ± 0.01	1.45 ± 0.03	6.46 ± *.16
Rape 2	5.05 ± 0.2	67.79 ± 2.6	20.51 ± 1.1	0.87 ± 0.01	1.43 ± 0.05	5.20 ± 0.03
Rape 3	4.68 ± 0.6	22.54 ± 1.9	65.66 ± 1.6	1.87 ± 0.02	1.25 ± 0.04	5.85 ± 0.07
Safflower seeds						
Safflower 1	6.57 ± 0.6	14.21 ± 0.6	78.06 ± 2.1	1.13 ± 0.01	4.35 ± 0.12	4.67 ± 0.03
Safflower 2	6.17 ± 0.7	15.00 ± 0.3	77.05 ± 2.3	1.23 ± 0.01	6.15 ± 0.13	5.01 ± 0.06

*mean ± standard deviation

internal standard. The results are mean values of three replicates.

Statistical: All determinations were conducted in triplicate. Data is expressed as mean ± S.D. The means were compared by using the one-way and multivariate analysis of variance (ANOVA) followed by Duncan's multiple range tests. The differences between individual means were deemed to be significant at $p < 0.05$.

The total oil contents of seed and kernels are given in Table-1. The oil content of seeds ranged from 27.1 % to 39.8 % of the dry weight. The oil contents of seeds changed among the different species. Canola 1 had the highest oil content (39.8 %), followed canola 3 (37.1 %), canola 4 (36.4 %), rape 3 (35.8 %) and safflower 1 (34.1 %). Generally, the oil contents of rape were found high compared with canola oils. Similar results (43.20-48.00 %) were obtained by Mikolajczak *et al.*[5] and Gül *et al.*[3]. The highest oil content (40.7 %) was also recorded in RBN-03255 (*B. napus*), while the lowest oil content (less than 36 %) was measured in genotypes RBN-03060 (*B. napus*) and RBJ-99026 (*B. juncea*)[2].

TABLE-1
OIL CONTENTS OF RAPE, CANOLA AND SAFFLOWER SEEDS (n:3)

Canola seeds	Concentrations (%)
Canola 1	39.8 ± 1.3*
Canola 2	30.1 ± 2.1
Canola 3	37.1 ± 1.7
Canola 4	36.4 ± 2.3
Canola 5	32.8 ± 2.1
Canola 6	32.7 ± 3.4
Rape seeds	
Rape 1	27.1 ± 3.2
Rape 2	33.4 ± 2.6
Rape 3	35.8 ± 2.7
Safflower seeds	
Safflower 1	34.1 ± 1.9
Safflower 2	32.3 ± 2.8

*mean ± standard deviation

In comparison with literature, it may be different values for almost all oil parameters. Differences among the values of seed oil content can be probably due to growing, climatic, environmental conditions and analytical conditions and locaties.

The fatty acid compositions of samples were determined and compared with literature values (Table-2). Results showed that the oils of safflower 1 seeds used in this study had higher linoleic acid content (78.06 %) than those of other linoleic acid contents. On the other hand, oleic acid contents of seed oils varied between 14.21 % [safflower 1 to 67.79 % (rape 2)]. Results showed that the oils of canola 6, rape 1, rape 2, canola 3 and canola 5 oils had higher oleic (61.40-67.79 %). Table-2 reveals that the major components of fatty acids are linoleic and oleic acids. Nutritionally unfavourable is the high content of saturated fatty acids, consisting of palmitic acid, which amounted to between 4.27 % (canola 1) and 11.46 % (canola 5). Linolenic acid contents of seed oils changed at the level between 4.58 % (canola 2) to 9.93 % (canola 4). In addition, α-linolenic values of samples ranged between 1.25 (rape 3) to 6.15 % (safflower 2). Oleic acid contents of canola seed oils were generally found high compared with rape seed oils. But, it was found to have a seed oil with a fatty acid composition similar to those of canola oil. It was composed mainly of oleic acid and linoleic acids in addition to stearic and palmitic acid. Tsevegsuren *et al.*[9] established 12.0-60.0 % oleic, to 22 % linoleic and 8.4-11.9 % linolenic acids in some rapeseed cultivars in Mongolia. Gül *et al.*[3] determined 56.92-65.71 % oleic acid and 9.55-11.97 % linolenic acid in winter rapeseed grown in Çanakkale province in Turkey. Przybylski and Mag[1] reported that canola oil contained 3.6 % palmitic, 1.5 % stearic, 61.6 % oleic, 21.7 % linoleic and 9.6 % linolenic acids.

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