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THE FATTY ACID COMPOSITION OF THE TRIGLYCERIDES OF THE PAKISTANI CORIANDRUM SATIVUM OF THE FAMILY UMBELLIFERAE

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Abstract. The fatty acid composition of the Pakistani coriander has been studied for the first time. The seed contains oil whose composition as determined by GLC and degradative studies is palmitic (10%), oleic (36.3%), petroselinic (37%) and linoleic acids (16.6%).

Coriandrum sativum (coriander, dhanya) belongs to the Umbelliferae family. It is an annual plant with a rise of about 2 ft and pointed leaflets.[1] Its fruits being sweet and aromatic[2] are largely used for flavouring in medicines, cookery and a source of hair oil.

It is cultivated in Pakistan at Hazara, Abbottabad, Khyber Agency, Gilgit Agency, Rawalpindi, Quetta (Baluchistan). The quantity of coriander cultivated in Pakistan, at present stand at 944 tons/annum.[3] The yield of oil in the coriander fruit and seed as claimed by the previous workers was 20.6% and 21% respectively.[4,5]

The investigation on the composition of the cultivated species of *Coriandrum sativum* was reported as palmitic (9.7%), oleic (37.8%), petroselinic (38.5%) and .linoleic (14%) acid.[6,7,8] However, the fatty acid composition of the Pakistani coriander has been carried out for the first time. In the present investigation the coriander seed contain 11% fatty oil consisting of the usual acids of the family Umbelliferae which were separated on 16.7% $AgNO_3$ impregnated thin layer chromatogram into three fractions. The second fraction, consisting of mono unsaturated esters of fatty acids was oxidised by the modified Von Rudloff's oxidation method[9] to liberate mono- and dicarboxylic acids. These were methylated and separated on a thin layer chromatogram. The gas liquid chromatography of methylated monocarboxylic acids was accomplished to determine the presence of dodecanoic and nonanoic acid which reflect upon the presence of petroselinic and oleic acids having double bond positions at $\triangle^6$ and $\triangle^9$ respectively.

Materials and Methods

Extraction and Characterisation of the Oil. The crushed seed (100 g) was exhaustively extracted in soxhlet apparatus with distilled hexane. The extract was dried over anhydrous sodium sulphate and filtered. The solvent was distilled off under nitrogen and final traces being removed under vacuum. The yellowish green oil (11 g) having a typical smell of coriander was obtained. This was stored under nitrogen.

Physicochemical characteristics of the oil as refractive index by Abbe's refractometer at 20° specific gravity by the density bottle method and colour by tintometer method using a cell of 1 cm width were determined respectively. The different chemical values as saponification, acid and idodine were also determined and are given in (Table 1).

Methylation of Liberated Fatty Acids. The fatty acids (4.488 g) were liberated[10] by treating the soap, resulting from the saponification of the oil (5.10 g) by 0.5N alcoholic potassium hydroxide with 2N sulphuric acid. The liberated acids were converted to methyl esters[11] by methanol in the presence of conc sulphuric acid.

Chromatography. Methyl esters (2.40 g) were purified by using Kiesel gel (0.2-0.5 mesh) (50 g) in a glass column of dia (2.5 cm) and diethyl ether in hexane 300 ml (7%), 300 ml (10%) and 600 ml (15%) respectively.

Table 1. Physico chemical Characteristics of the Coriander seed oil.

Moisture	8.77%
Ash	9.02%
Oil	11%
Refractive index at 20°	1.4653
Specific gravity at 20°	0.910
Colour by tintometer using a cell of 1 cm width.	18.2 units of yellow and 9.6 of red and 6.0 of blue scale of Lovibond tintometer.
Saponification value	199
Acid value	4.13
Iodine value	97.79

The esters (280 mg) were separated into saturated, mono- and diunsaturated fractions weighing (30 mg), 200 mg and 50 mg respectively on a 16.7% silver nitrate impregnated thin layer chromatogram.[12]

The three fractions of methyl esters were identified on a gas liquid chromatogram (Phase separation, GLC 2 F Model) by using a column (9 ft × 1/8 inch) of diethylene glycol succinate (20%) on gas chrome Z (80-100 mesh) at 200°

Modified Von Ruhdloff's Oxidation.[9] The second fraction (16 mg) of monounsaturated fatty acid esters was oxidised in t-butanol (4 cm^3) and the stock oxidant solution (8 cm^3). The material, after extraction was methylated and separated into mono and difunctional methyl esters on a thin layer chromatogram. The monofunctional methyl esters, that is, nonanoate and dodecanoate were analysed on the above mentioned gas liquid chromatogram at 125° and 150° respectively.

Results and Discussion

The oil was extracted by a soxhlet using hexane as a solvent. The solvent was removed and the yield calculated on the weight basis of the oil was (11%) which is a low percentage as compared to the work of C. Argon[4] and Chernoyarova.[13] The low percentage of the coriander seed oil may be due to the climatic condition of the country. The oil as such was qualitatively checked upon a thin layer chromatogram using diethyl ether : hexane (1:9) solvent system which mostly recommends the presence of triglycerides which was also confirmed by IR characteristics. So the thin layer chromatography[7] and the spectrophotometry of the oil suggest to proceed further for saponification and methylation of the liberated acids from triglycerides.

Column chromatography was applied to get a large quantity of pure methyl esters (2.038 g out of 2.40 g) by using 7% diethyl ether in hexane. The purity of methyl esters was also checked up by thin layer chromatography and IR spectrophotometry.

TABLE 2. THE R_f VALUE OF KNOWN METHYL ESTERS OF ACID ON SILVER NITRATE SILICA GEL CHROMATOGRAM USN G SOLVENT SYSTEM DIETHLYL ETHER: HEXANE 1:9 (v/v).

Me Esters	R_f
Palmitic acid	0.71
Oleic acid	0.59
Linoleic acid	0.43

TABLE 3. FATIY ACID COMPOSITION OF CORIANDER SEED OIL.

Me Esters	Percentage
Palmitic acid	10%
Oleic acid	36.3%
Petroselinic acid	37.1%
Linoleic acid	16.6%

The iodine value shows the total unsaturation of the acids without giving an indication about the percentage of unsaturated acids. Therefore, the pure methyl esters were separated on 16.7% silver nitrate impregnated thin layer chromatogram. The R_f value of the sample was compared against standard of methylated octadecanoic acid, octadecenoic acid and octadecadienoic acid (Table 2). The quantitative separation of the methylated acids show fraction 1 (10%). Fraction II (73.4%) and fraction III (16.6%) which have been characterised on GLC as hexadecanoic acid, octadecenoic and octadecadienoic acid respectively. In the light of the previous work, the fraction II was oxidised, extracted methylated and separated on TLC by using 10% ether-hexane, (1 : 9) solvent system. The monobasic dodecanoic and nonanoic acids were determined by GLC which reflected upon the presence of the positional isomers, i.e. petroselinic (37.1%) and oleic acid (36.3%) having double bonds at $\triangle^6$ and $\triangle^9$ respectively. The quantitative determination of these acids (Table 3) agreed closely with the results of the previous workers.[8] However, the composition of coriander seed oil has shown to be related to phylogenetic factors, i.e. petroselinic acid is found in seeds of all plants belonging to family Umbelliferae. The work on the coriander seed oil has been reported by previous workers, but in view of the shortage of the edible oil in Pakistan, it was decided to examine the fatty acid composition of Pakistani coriander seed oil in the hope of adding another source of unsaturated fatty acids required for edible purposes.

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