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## STUDIES ON THE LIPID CLASSES OF *FERULA ASSAFOETIDA* L. (HING) SEED OIL

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*Ferula assafoetida* L. seed oil (3.02%) was examined for the fatty acid composition. The oil was fractionated by TLC into lipid classes; "neutral lipids (78.37%) and "polar lipids (21.63%)". Further analysis of the "neutral" lipids revealed the presence of hydrocarbons (3.76%), Wax esters (3.05%) triglycerides (36.58%), free fatty acids (12.89%), 1:3-diglycerides (9.27%), 1:2-diglycerides (7.91%), 2-mono-glycerides (2.76%) and 1-monoglycerides (2.15%), the fatty acid composition of the whole oil and its fractions was determined by GC. All the lipids classes except triglycerides, free acids and 1:3-glycerides showed a fairly large amount of an odd numbered fatty acid (C<sub>17:0</sub>).

**Key words:** Lipid classes, *Ferula assafoetida*, Seed oil.

### Introduction

*Ferula assafoetida* L. locally called 'Hing' belongs to the genus *Ferula* of the plant family Umbelliferae. This genus consists of about 140 species which are widespread mostly from the Mediterranean region to the central Asia [1]. Only 15 species have been identified in Pakistan [2]. These species are: *Ferula assafoetida*, *F. baluchistanica*, *F. communis*, *F. costata*, *F. hindukushensis*, *F. kokanica*, *F. lehmanii*, *F. kokanica*, *F. microlobe*, *F. narthex*, *F. oopoda*, *F. ovina*, *F. reppiea*, *F. rubicaulis* and *F. stewartiana*.

*Ferula assafoetida* is native to Afghanistan and Iran and its young cabbage-like raw tops are consumed as salad by the local population. The plant exudes a gum that finds wide applications in the flavouring of different kinds of food products and also as medicine [3]. It also has numberable medicinal attributes and is recommended in pharmaceutical preparations as a local stimulant to the mucous membrane of the alimentary canal [4].

The occurrence of an essential oil as well as of a fixed oil in the seeds is well documented [5]. The essential oils from the seeds of certain species of the genus *Ferula* have already been studied [6], and a recent report describes the presence of palmitic, oleic, petroselinic and linoleic acids as the constituents of the fixed oils of some *Ferula* species [7].

As a general and continuous interest in the evaluation of seed oils from local resources, the present report describes the seed oil of *Ferula assafoetida*-L. The oil was fractionated by thin layer chromatography into various lipid classes. The fatty acid composition of the oil as a whole and of these lipid classes was determined by gas chromatography. The oil was found rather rich in unsaturated acids (83.73%), comprising mainly oleic and lin-oleic acid. Except for the wax esters and 1:2-diglycerides fractions, which had a higher percentage of saturated acids, all the other lipid classes also showed the same

trend, being composed mainly of unsaturated fatty acids. However, the presence of an unidentified fatty acid in the whole oil, wax esters, 1:3-diglycerides, 1:2-diglycerides, 1:monoglycerides and polar lipids fractions (2.17%, 4.19%, 2:11%, 1.58, 3.16% and 4.62% respectively) was also observed.

### Material and Methods

*Ferula assafoetida* L. seeds were collected from wild growing plants in Quetta region of Baluchistan. The essential oil from the seeds about 4 months old) was removed by steam distillation of the crushed seeds. The volatile oil free seeds were taken out and dried at low temperature and under vacuum. The fatty oil was extracted with Chloroform-methanol solvent system in a Soxhlet apparatus and the solvent was distilled off on a rotary evaporator. The non-lipids were removed from the residual oil by the use of a sodium chloride solution [8].

The oil was fractionated into lipid classes by the use of thin layer chromatography [10]. Aliquots of the oil (100 mg) were streaked on 20 x 20 cm. glass plates coated with 0.5 mm silica gel G. Plates were developed in hexane/diethyl ether/acetic acid (80:20:2, v/v/v) and the resulting bands were made visible under UV lamp by spraying with 2,7-dichlorofluorescein in methanol. Lipid classes were identified by comparison of their R<sub>f</sub> with that of standards. The bands made visible under UV light were marked and then scrapped from the plates.

The methyl esters of the whole oil and each fraction except that of the hydrocarbon fraction were prepared by the use of boron-trifluoride solution in methanol [9]. The methyl esters were analyzed for the respective fatty acid composition by GC on a Pye-Unicam 204 Series apparatus equipped with a FID and a glass column (4 mm x 1.5 m) packed with 10% diethylene glycol succinate on diatomite CAW. The temperature of the column was 200° and nitrogen was used as a carrier

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gas. The peaks were recorded on a Philips recorder PM-8251 and were identified by comparison of their retention times with those of the standard methyl esters. Percent peak areas have been quoted as fatty acids composition by percent weight.

### Results and Discussion

The fatty oil content of *Ferula assafoetida* seeds was 3.02%. The oil was fractionated into lipid classes by thin layer chromatography to give neutral lipids (78.37%) and polar lipids (21.63%). Neutral lipids were further fractionated into eight fractions, which were identified by comparison of their  $R_f$  values with those of standard materials. These identified fractions were hydrocarbons, wax-esters, triglycerides, free fatty acids, 1:3-diglycerides, 1:2-diglycerides, 2-monoglycerides and 1-monoglycerides.

Triglycerides were the predominant fraction amounting to 36.58% of the total lipids whereas 1-monoglycerides were the minor component (2.15%) of the neutral lipids (Table 1). The total lipids and the fractions except the hydrocarbon fraction were analysed for their fatty acid composition (Table 2).

The oil of *Ferula assafoetida* can be classed as an oleic-linoleic rich oil. All the lipid fractions including trigly-

TABLE 1. PERCENTAGE OF LIPID FRACTIONS OF *FERULA ASSAFOETIDA* SEED OIL

Lipid fraction	Percentage
Neutral	78.37
Polar	21.63
Hydrocarbons	3.76
Wax esters	3.05
Triglycerides	36.58
Free fatty acids	12.89
1:3-diglycerides	9.27
1:2-diglycerides	7.97
2-monoglycerides	2.76
1-monoglycerides	2.15

TABLE 2. FATTY ACID COMPOSITION OF *FERULA ASSAFOETIDA* SEED OIL AND THE FRACTIONS

Fractions	C <sub>10:0</sub>	C <sub>12:0</sub>	C <sub>14:0</sub>	Unidenti- fied	C <sub>16:0</sub>	C <sub>16:1</sub>	C <sub>17:0</sub>	C <sub>18:0</sub>	C <sub>18:1</sub>	C <sub>18:2</sub>	C <sub>20:0</sub>	C <sub>18:3</sub>
Whole oil	Traces	0.72	3.14	2.17	8.44	0.48	0.60	0.96	67.90	24.15	0.24	1.20
Wax esters	6.71	6.37	6.04	4.19	23.49	1.34	1.68	6.54	31.88	8.05	1.68	2.08
Triglycerides	3.48	4.35	3.04	—	13.04	2.17	—	10.00	54.35	9.59	—	—
Free fatty acids	—	5.55	2.08	—	9.72	2.08	—	4.17	62.50	13.89	—	—
1-3-diglycerides	—	4.21	7.37	2.11	21.05	0.84	—	10.53	42.10	10.53	0.21	1.05
1:2-diglycerides	—	9.51	8.72	1.58	25.36	1.27	0.79	15.85	28.53	6.66	1.10	0.63
2-monoglycerides	—	11.63	12.21	—	14.53	11.63	2.91	4.65	37.79	4.65	—	—
1-monoglycerides	—	11.7	9.49	3.16	25.32	7.91	2.24	1.26	31.64	6.69	—	0.95
Polar lipids	—	2.34	1.40	4.62	16.78	2.35	1.79	12.23	45.25	11.35	1.13	0.76

cerides, 1,3-diglycerides, 2-monoglyceride, 1-monoglycerides and free fatty acids showed high percentage of unsaturated fatty acids except that of wax ester and 1:2-diglyceride fractions which showed a high percentage of saturated fatty acids (Table 3).

TABLE 3. PERCENTAGE OF SATURATED, UNASATURATED AND UNIDENTIFIED FATTY ACIDS OF *FERULA ASSAFOETIDA* SEED AND ITS FRACTIONS

Fractions	Saturated fatty acids %	Unsaturated fatty acids %	Unidentified fatty acids %
Whole oil	14.0	83.73	2.17
Wax esters	52.51	43.29	4.19
Triglycerides	33.91	66.08	—
Free fatty acids	21.52	78.47	—
1:3-diglycerides	43.37	54.52	2.11
1:2-diglycerides	61.33	37.09	1.58
2:monoglycerides	45.93	54.07	—
1:monoglycerides	49.38	47.46	3.16
Polar Lipids	35.67	59.71	4.62

The predominant saturated fatty acid was palmitic, and oleic and linoleic acids were the major fatty acids in the unsaturated class. The oleic acid peak could not be further resolved on gas chromatography, although it has been reported that the oils from *Ferula* species contain high percentage of petroselinic acid (cis-6-octadecenoic acid), which is an isomer of oleic acid (cis-9-octadecenoic acid). The other fatty acids found were capric, lauric, myristic, palmitoleic, stearic, arachidic and linolenic acids. The presence of these acids has been confirmed by GC analysis using authentic samples of these acids. The unidentified acid could be an unsaturated C<sub>14</sub> fatty acids.

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