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THE FATTY ACID OF INDIGENOUS RESOURCES FOR POSSIBLE INDUSTRIAL APPLICATIONS

Part VII. Investigation of the Species of Cucurbitaceae Family

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Seed oils from the members of *Cucurbitaceae* available for use as vegetables and fruits in Pakistan, have been analysed for their fatty acid composition. They have been shown to contain excellent contents of monoene (10-35%) and diene (30-68%) acids in their glycerides. One member *(Mamordica charantia),* however, contains triene acid (46.7%) in its seed oil.

INTRODUCTION

Members of the plant family, *Cucurbitaceae,* are found throughout Pakistan in every type of climate. The plants are cultivated mostly in the plains and the arid or semi-arid areas. They can also grow in sandy, saline or water logged soils. These plants yield common kitchen vegetables and deliciously flavoured fruits. Some of the plants are reported for their medicinal values and yield specific drugs[1].

Species of cucurbita, whether grown for fruits or vegetables, contain seeds rich in oil as well as proteins. Traditionally the seeds find usage in diverse medicinal concoctions and have never been considered as a source of oil in Pakistan. In continuation of earlier studies aimed at screening indigenous sources, seed oils from species of cucurbitaceae used either as vegetables or fruits have now been examined[2-7]. The seeds of the cultivated varieties of *Cucurbita, Cucumis, Citrullus, Luffa* and *bitter gourd* were procured from the Agriculture Institute, Faisalabad. By cultivating varieties and species with high seed contents in the fruits, it is possible to obtain quality oil from this crop. It has been observed that oleic and linoleic acids are the major component fatty acids of oils from different species. *Mamordica charantia* (karela or bitter gourd, seed oil however, contains elaeostearic acid, while traces of linolenic acid have been detected in the seed oils of some of the members of Cucurbitaceae.

EXPERIMENTAL

The seeds were obtained from crops grown at the Agriculture Research Institute, Faisalabad. In each case the oil was extracted from the clean, ripe and dried seeds by hexane (b.p. 60-68°c). The species and varieties of Cucurbitaceae seeds, their oil percentages and the characteristics of the oils are presented in Table 1.

The fatty acids of the oils were obtained by saponification with alcoholic potassium hydroxide (0.5N) solutions. The non-saponifiable matter was extracted with ether after removing alcohol from the saponified oils. The soap solutions were then decomposed by the addition of sulphuric acid (2N). The liberated fatty acids were extracted with ether and dried over anhydrous sodium sulphate and kept under nitrogen atmosphere.

The methyl esters of the fatty acids of individual oils were separately prepared as reported previously[2]. The identity and the percentage of the component fatty acids was worked out from the retention times and peak areas of the methyl esters when examined by gas chromatography under the following conditions:

Glass column (1.5 m x 4 mm) packed with diethyleneglycol succinate (DEGS 10%), injector port, 220°, flame ionisation detector, 220°, column oven, 220°, flow rate (N_2), 40 ml/min; (H_2) 40 ml/min. air, 550 ml/min.

The fatty acid composition, so determined, is given in Table 2.

DISCUSSION

The seed oils of various members of Cucurbitaceae have been examined by several workers in different countries[8]. In the majority of the cases these evaluations were carried out by classical techniques prior to the intro-

Physico-chemical characteristics of some Cucurbitaceae seed oils

S. No.	Name		Oil%	Refractive Index	Saponification value	Iodinae value
	Botanical	Common				
1.	*Benincasa hispida*	Paitha	23.9	1.4773	188.5	158.8
2.	*Cucurbita moschata*	Halva Kaddu	33.3	1.4723	194.0	118.0
3.	*Cucurbita pepo*	Ghia Kaddu	24.5	1.4763	192.5	128.0
4.	*Citrullus fistulosus*	Tinda	37.8	1.4758	192.5	126.5
5.	*Citrullus Vulgaris*	Tarbooz	13.0	1.4753	186.0	124.4
6.	*Cucumis melo*	Kharbooza	26.7	1.4788	188.0	132.0
7.	*Cucumis mamordica*	Phoot	38.0	1.4680	197.7	97.9
8.	*Cucumis sativus*	Kheera	28.0	1.4743	194.0	113.0
9.	*Cucumis utilissima*	Tar	28.6	1.4788	209.0	137.5
10.	*Luffa cylindrica*	Ghia Tori	20.0	1.4743	188.2	99.8
11.	*Luffa acutangula*	Kali Tori	13.9	1.4733	190.2	104.7
12.	*Mamordica charantia*	Karela	31.0	1.4972	179.5	120.5

duction of modern instrumental methods. However, no systematic approach seems to have been made to study the potential of the cucurbitaceae species as a source of oil seed crops. In the present investigations, therefore, the approach has been to not only study this potential but also to analyse the seed oils by modern instrumental techniques. Efforts have thus been made to examine the seed oils of all the species and varieties cultivated for use as vegetables or fruits in Pakistan.

The characteristics and percentages of various cucurbita oils are given in Table 1, while the fatty acid composition is reported in Table 2.

The seed oils, from all the fruit seeds of cucurbitaceae, have excellent content of unsaturated fatty acids. Because of this composition all the oils can be used for edible and or soap making purposes. The presence of triene acids in the oils of some species of Cucurbitaceae has been already reported and therefore, whenever they are present the oil, can find excellent application in the paint and varnish industry[13].

The percentage of linoleic acid, in almost all the seed oils examined so far, is higher than that of oleic acid except in *Cucumis sativus, Cuccurbita pepo,* and *Cucurbita maschata.* It is, therefore, possible to obtain linoleic acid rich oils from the members of Cucurbitaceae by providing proper environment. That the environment plays a role in determining the over all composition of the component fatty acids of an oil is examplified by the variations reported for seed oils grown in different localities[9,10].

The members are grown for use both as fruits and vegetables. Invariably the unripe fruits of certain species and varieties are traditionally consumed as vegetables along with unripe seeds. However, a number of species bear fruits which when ripe are consumed as such and the seeds

Table 2: Fatty acid composition of the Cucurbitaceae seed oils

S. No.	Name		Fatty Acids					
	Botanical	Common	$C_{14:0}$	$C_{16:0}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$	$C_{18:3}$
1.	*Benincasa hispida*	Paitha	4.78	14.32	4.69	7.53	68.67	–
2.	*Cucurbita moschata*	Halva Kaddu	1.24	21.6	6.53	38.69	31.51	–
3.	*Cucurbita pepo*	Ghia Kaddu	–	18.15	8.39	43.45	30.0	–
4.	*Citrullus fistullosus*	Tinda	1.74	11.85(a)	10.70	21.23	50.80	–
5.	*Citrullus (b) Vulgaris*	Tarbooz	2.82	17.21	9.84	18.50	51.63	–
6.	*Cucumis melo*(b)	Kharbooza	1.28	15.98	5.97	16.72	60.05	–
7.	*Cucumis Memordica[12]*	Phoot	23.63	1.12	–	16.20	51.67	7.38
8.	*Cucumis sativa*	Kheera	–	21.45	9.42	35.76	33.37	–
9.	*Cucumis utilissima*	Tar	25.45	10.96	4.36	12.33	46.90	–
10.	*Luffa cylindrica*	Ghia Tori	1.15	13.58	6.53	10.30	68.44	–
11.	*Luffa acutangula*	Kali Tori	1.60	19.25	8.08	26.49	44.58	–
12.	*Mamordica*[13] *charantia*	Karela	1.8	2.8	21.7	30.0	–	43.7(c)

(a) $C_{16:1} = 3.67$

(b) Similar compositions for the other varieties of *Citrullus vulgaris* and *Cucumis melo* were observed. For *Citrullus vulgaris* the differences in varieties are only for the colour of fruit seeds while in *Cucumis melo* they thave different vernacular names like 'garma' and 'sarda' and also the seed size is larger.

(c) Elaeostearic acid.

of these fruits find no application. In the absence of any fruit processing industry cucurbitaceae seeds are hard to collect. It is, therefore, proposed that extensive cultivation of Cucurbitaceae species be carried out in the normal summer months and the fruits be processed with a view to obtaining the oil from the seeds that go waste.

In an earlier publication the introduction of *Cucurbita foetidisma* (buffalo gourd) has already been studied[11]. Currently a large number of species of Cucurbitaceae are under cultivation studies in PCSIR Laboratories, Lahore. Also the seeds of many of the local varieties and wild growing plants of this family have been collected and have been examined for their fatty acid composition. The results of these studies will be reported separately.

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