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Short Communication

Study of the Changes in the Dietary Fatty Acids and Physicochemical Values of Sweet and Bitter Apricot Oils in Pakistan

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Abstract. The quantity of oil in local varieties of sweet and bitter apricot was found to be more than that earlier reported for the Indian varieties. Both, sweet and bitter apricot oils, were semi-drying type. Refractive index of bitter apricot oil was higher whereas, free fatty acids were more in sweet apricot oil. Amount of cyanide, cadmium, antimony, arsenic, lead and copper as well as of palmitic acid insignificantly increased with ripening, being more in bitter apricot oil. Major difference was noted in fatty acid composition. Linoleic acid was present in higher amount in sweet apricot oil (21.4%) than in bitter apricot oil (19.6%).Concentration of palmitic acid in sweet oil was 5.0%, while in bitter oil, it was 6.4%.

Keywords: apricot oils, non-conventional oils, fatty acid composition

Apricot is one of the major fruits of northern areas of Pakistan. The deciduous tree flowers from March to April. Biochemical changes occur in the fruits at different ripening stages (Sharif and Ahmed, 1989). The pulp of the ripened fruit contains 7.5% to10.5% sugar. Besides the sugar, certain volatile compounds are present in the fruit pulp like aromatic aldehydes, esters, alcohols, ketones and also amygdaline and prussine. The latter two breakdown in water and form hydrocyanic acid (cyanide or prussic acid), which in small amounts, stimulate respiration, improve digestion and give a sense of well being but as the amount of amygdaline and prussine increases in the pulp and kernel, they make the fruit and seed bitter in taste making them unsuitable for consumption (Bown, 1995). Apricot oil is added to the almond oil as an adulterant and is used in the manufacture of beauty soaps, cold creams and other preparations of perfumery (Hilditch and William, 1964; Winton and Winton, 1932).

Earlier some investigations were made on the apricot in respect of the oil content and fatty acid composition (Femenia *et al.*,1995) but without reference to the variety (sweet or bitter). The present study was carried out to evaluate the quality and chemical composition of oils extracted from sweet and bitter apricot seeds so as to explore alternate local sources (non-conventional) of oil which can help in reducing the import bill of edible oils in the future.

The kernels of apricots of sweet and bitter varieties, procured from northern areas of Pakistan, were dried in oven at 105 °C and crushed into fine powder. The lipids were extracted with 500 ml chloroform:methanol mixture (2:1, v/v) (Akhtar *et al.*, 1980), at room temperature, using magnetic stirrer for 2 h. After extraction of lipids and removal of non-lipid impurities, the oil was stored in an inert atmosphere.

The physicochemical values of oils like those for saponification, iodine, ester and free fatty acid were determined according to British Standard Specification (British Standard, 1958). The refractive index was determined with Abbe's refractometer. The fatty acids were obtained following the method of Raie *et al.* (1980). The methyl esters of fatty acids were prepared with BF_3 methanol reagent (Morrison and Smith, 1964), which were used for identification and analysis of fatty acids using Shimadzu GC-4A gas chromatograph (Akhtar *et al.*, 2006).

Toxic elements of the oils were determined through ashing, using atomic absorption spectrophotometer. The lipids extracted from the seeds of sweet and bitter apricot were 54.0% and 46.5%, respectively. These oil yields are comparatively higher than the yields of apricot kernel oil of Indian variety (Kapoor *et al.*, 1987) and New Zealand variety (Beyer and Milton, 1990).

Physicochemical constants are important in evaluating the suitability of oils for their utilization. The obtained values indicate that the refractive index of bitter apricot oil is slightly higher than that of the sweet apricot oil (Table 1). This may be due to slightly different arrangement of fatty acids in the oils of different varieties of apricot. The iodine values of oils of both sweet and bitter varieties (100.21 and 103.0, respectively) reveal the oils to be of semidrying type. Free fatty acid is in higher percentage in sweet apricot oil. Bitter apricot oil

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Table 1. Physicochemical parameters of sweet and bitter apricot oils

Parameter	Sweet apricot oil	Bitter apricot oil
Moisture (%)	0.17	0.11
Refractive index at 40°C	1.4630	1.4645
Colour	Y=9.8,R=0.8	Y=8.2,R=1.6
Saponification value	191.54	193.7
Iodine value	100.21	103.0
Free fatty acid (as % of oleic acid)	1.15%	0.28%
Ester value	189.26	193.15
Peroxide value meq/kg	1.59	3.21
Acid value	2.28	0.55
INS value	91.33	90.7

is darker in colour than that of the sweet one, probably due to the presence of aromatic aldehydes and ketones which were more prominent in bitter oil. Due to higher amount of volatile compounds, the values of peroxide were 1.59 and 3.21 in sweet and bitter apricot oils, respectively. Iqbal *et al.* (2001) reported slightly different physicochemical values of apricot oil which may be due to differences in the regions, climatic conditions, ripening time etc.

The substances like amygdaline and prussine are present in all the genera of the family Rosaceae (Bown, 1995). The concentration of toxic elements varied according to the degree of ripening (Table 2). The concentration of antimony, lead and cadmium was higher in bitter apricot oil 0.25, 0.01, 0.08 ppm than in sweet apricot oil 0.20, nil, 0.07 ppm, respectively.

Sweet apricot oil contained 92.0% unsaturated fatty acids, and 7.5% saturated fatty acids, whereas bitter apricot oil contained 94.0% and 6.0%, respectively. Eight fatty acids were found to be present in sweet apricot oil and six in bitter oil (Table 3).

The percentage of oleic acid was the highest in both the oils along with appreciable amount of essential fatty acids. Apricot oils (sweet and bitter) had almost all the properties of edible oil and because of their health promoting fatty acid composition, they could be used as the substitute of almond oil and olive oil (Table 4).

Due to lower percentage of palmitic acid ($C_{16:0}$), apricot oil has minimum potential for raising cholesterol level in the body. Oleic acid ($C_{18:1}$) is present in large amount (more than 70%). which can lower the low density lipoprotein (LDL), while maintaining the high density lipoprotein (HDL) thus minimizing the risk of cardiovascular diseases (CVD) because

Table 2. Toxic elements present in sweet and bitter apricot oils

Toxic element (ppm)	Sweet apricot oil	Bitter apricot oil
Arsenic	-	-
Lead	0.07	0.08
Copper	0.05	0.05
Cyanide	-	-
Cadmium	-	0.01
Antimony	0.20	0.25

Table 3. Fatty acid composition of sweet and bitter apricot oils

Fatty acid	Sweet apricot oil (%)	Bitter apricot oil (%)
Lauric acid ($C_{12:0}$)	0.1	–
Myristic acid ($C_{14:0}$)	0.1	–
Palmitic acid ($C_{16:0}$)	5.0	6.4
Palmitolic acid ($C_{16:1}$)	0.9	1.0
Stearic acid ($C_{18:0}$)	1.33	0.99
Oleic acid ($C_{18:1}$)	71.4	71.5
Linoleic acid ($C_{18:2}$)	21.4	19.6
Linolenic acid ($C_{18:3}$)	0.1	0.1

Table 4. Fatty acid composition of apricot oil, almond oil and olive oil

Fatty acid	Apricot oil (%)	Almond oil (%)	Olive oil (%)
Lauric acid ($C_{12:0}$)	0.1	T	0.1
Myristic acid ($C_{14:0}$)	0.1	T	0.8
Palmitic acid ($C_{16:0}$)	5.0	4.72	19.0
Palmitolic acid ($C_{16:1}$)	0.9	–	–
Stearic acid ($C_{18:0}$)	1.33	1.65	1.7
Oleic acid ($C_{18:1}$)	71.4	71.28	65.7
Linoleic acid ($C_{18:2}$)	21.4	10.62	10.9

monounsaturated fatty acids are considered risk factor in CVD (Mata *et al.*, 1992).

Polyunsaturated fatty acids $C_{18:2}$, $C_{18:3}$ of *n*-6 and *n*-3 series are also present in good amounts in both the oils, which not only help in decreasing low density lipoprotein-cholesterol (LDL-C) but also increase the amount of high density lipoprotein-cholesterol (HDL-C) (Frank, 2003; Clark, 2001). The oils of such fatty acid composition are supposed to control and regulate the genes that affect metabolic pathway (Oslon, 2002). These essential fatty acids are primary constituents of cell membranes and as such they are vital to the make-up of human body and are also used to generate certain intracellular hormones, responsible for regulating key

bodily processes. So on the basis of ideal fatty acid moiety, these oils can be used for edible purpose. However, changes in the chemical composition and fatty acid profile make the bitter apricot oil less nutritious as compared to the sweet apricot oil; the former is more suited for use in cosmetics.

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