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Determination of Essential Oil Content of Wild Olive and Its Comparison With Olive Oil

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Abstract

Olive oil is a natural fruit, product of fine aroma, pleasant taste and has high nutritional values. Olive oil is considered as most useful edible oil in the world due to its nutrient contents and well tolerated by the stomach. Olive oil provides beneficial effects against ulcer, gastritis and colon cancer. It is composed of triglycerides, free fatty acids hydrocarbons, antioxidants and flavor compounds. In the present study we report new edible oil extracted from fruit of wild olive (*Olea cuspedata*). Samples of olive fruits were collected from hilly areas of Kotli Sattian, (District Rawalpindi) and were analyzed to evaluate quantity and quality of this newly extracted olive oil. Results indicates that concentration level of oil in the fruits of wild olive (34.11-36.69%) , oleic acid (61.86-66.37%), linoleic acid (20.19-21.6%), linoenic acid (1.36-1.59%), polyphenol (344.07-352.86 mg/kg), peroxides(7.66-8.32 meqO_2/kg) and acidity (0.47-0.98 meqO_2/kg) was found. The level of these components was comparable with the level obtained from the fruits of cultivated olive and standard values reported for olive oil in the literature. Therefore it was observed that quality of new olive oil obtained from fruits of wild olive was comparable with olive oil (available in market) consumed by human population through out world. It is expected that this new oil will economically cheaper as compared to edible oils available in the market. This study will not only help to improve the nutritional values of existing oils but also provide oil with lower coast.

Key words: Wild olive, olive, essential oils.

Introduction

The olive is a member of the family Oleaceae, which comprises of thirty species such as wild olive, jasmine, ash, lilac and privet etc. The well known species is *Olea europaea*, which is cultivated for its plump, fleshy, oil containing fruits. There are 1000 varieties including *Olea cuspedate,* wild species found in forest of subcontinents and included in the World Catalogue of Olive (IOOC, 2004). In Pakistan, *Olea cuspedata* is found in the hilly areas of Muree, Kotli sattian, Khutta, Mensara Hairpure and Azad Kashmir. It is also found in the similar area of sub contents and other parts of world (Kafatos, 1995)

Pakistan spends over Rs. 45 billion every year to import edible oil. The per capital consumption of edible oil in Pakistan is the highest (approximately 13 kg per person) as compared to other countries of the world. Pakistan produces only 30 % of edible oil and to fulfill its requirements import about 70% of edible from other countries (GOP, 2000). In the years 2004 the total availability of oil from all sources was up to 1.763 million tones (GOP, 2004). Normally sunflower, canola, soybean, and olive oils are widely used as edible oil due to their high nutrients contents and easily digestibility in human body. Essential fatty acids like oleic acids and linoleic acids provides sufficient amount of energy to the human body after consumption. Scientists all over the world are looking for new resources for edible oils having not only good nutritional values that also provide economic benefits to public.

There are about 8.7 million hectares (21.5million acres) supporting a total of almost 750million olive trees in 33 countries of the world. The Mediterranean Basin accounts for 97 percent of area planted and slightly more in terms of volume production. Spain's production of olive oil, at just over a half million tons followed by Tunisia and Turkey, both under 100,000 tons .While the three largest producers are also the largest consumers, The United States, with only two percent of production, is the world's largest importer, at 50,000 to 60,000 tons annually (Kafatos, 1995; IOOC, 1992) Although olive oil accounts only for 3 % of the world market, however, it play major role in oil and fat supply to the people in the areas of production. The market share of extra virgin olive oil is 37% in Brazil and Australia, 50% in Japan, 54 % in United states and 61 % in Canada. The percentage of extra virgin olive oil in total oil sales is however, increasing year by year

Basically olive oil is a natural juice which preserves the taste, aroma, vitamins and properties of the olive fruit. There are at least 4 types of olive oil (i) **Extra virgin oil,** considered to best least processed from olive fruits (ii) **Virginal oil,** obtained from the second pressing (iii) **Pure oil,** obtained from processing such as littering (iv) **Extra light oil,** under goes considerable processing. Olive oil is a complex compounds made of fatty acids, vitamins, volatile compounds, soluble components and microscopic bits of olive. However, it was reported elsewhere that olive oil contained oleic acid between 83% of all fatty acids. The free acidity values must be less than 0.8%, where as polyphenols (responsible for oil taste) concentration > 200 and < 500 mg/kg. The peroxides level must be 12 meqo_2 /kg, however, extra virgin olive oil must have high contents of polyphenols and oleic acids but peroxides concentration and free acidity level will be low.

Nutritionally olive oil contained healthful fats that may provide 120 calories per tablespoon (nine calories per gram) to the human body after digestion. However, it was suggested that fats should not constitute more than 30 percent of daily caloric intake. Furthermore it was reported by some scientist that olive oil is free of cholesterol and do not have adverse effects on human body. Therefore in order to increase the number of edible oil and reduce the prices of oils in the markets. It is essential that new raw material should be identified. Some of wild material has potential to increase oil production, so need is to develop new and improved olive cultivars based on selection and oil analysis (Sedgley, 2000) The wild materials found in the surrounding areas of Rawalpindi/ Islamabad is not present being used for any purposes. While million and million tones of the fruit of wild olive (*Olea cuspedate*) is going to waste every year. Wood of this plant is being used for

domestic purposes which are not affected by insect or termites up to 100 years.

Keeping in the view the facts given above present study was undertaken with following aim and objectives:

i. To evaluate the quality of edible oil in fruit of wild olive (*Olea cuspedate*)

ii. To assess the level of oleic, linolecic, linolenic acids and other parameters in the fruits of wild and cultivated olive.

iii. To compare the levels of these essential components in edible oils

iv. To assess the economical values of new edible oil

Materials and Methods

In order to explore new sources of edible oil, the present study was conducted to evaluate the quantity and quality of oil in fruit of wild olive and its comparison with cultivated olive oil consume by public as edible oil. Samples of the ripe fruits of wild olive (*Olea cuspedata*, locally known as Kaho) were collected from hilly areas of Kotli Sattian, District, Rawalpindi.. Where as fruit of cultivated olive were purchased from markets of Rawalpindi and Islamabad .The chemical analysis were carried out in the Biochemistry laboratory of University of Arid Agriculture, Rawalpindi. This study was conducted during August 2004 to June 2005.

Collection of Samples

Seventy five samples of wild olive seeds were collected from 75 wild olive plants (*Olea cuspedata*) from 5 different locations of uniform type of hilly areas. Total 50 grams of fresh fruits (per tree) were collected in the fine plastic bags dully labeled with sample numbers, date and code of locations. Similarly 15 samples of cultivated olive fruit were purchased from markets of Rawalpindi and Islamabad. The samples soon after collections were transported to laboratory for further process.

Preparation of Samples

Fruit samples of wild olive and olive were subjected to sun dried for a week followed by oven drying at 105 °C for 24 hours. The dried fruits were grounded in to powder form. Total 2 grams of fruit sample and added 100 ml of petroleum ether were boiled for 4 hours in soxhlet apparatus for collection of ether extract of these materials (Frank, 1986; Guind *et al*.2003). After evaporation of solvent crude oil was obtained and percentage of oil in fruit of wild olive and cultivated olive was calculated separately.

Calibration Curve

Suitable amounts of oil samples were dissolved in Tetrahydrofuran (THF) to give a final concentration of 5 mg/ml and 20 μl of solution was injected in the gas chromatography system. The

calibration curve of the standards was obtained by dissolving a suitable amount of polystyrene mixture in 1 ml THF to obtain the concentration of 0.15%. The solution was injected to the Gc system. Three different standards of polystyrene mixtures of varying molecular weight were used.

Chromatography Analysis

The elution protocol was design to achieve adequate separation of fatty acids like oleic linoleic, linolenic acids within a reasonable length of time. THF was used as the eluent at a flow rate of 1 ml/min. Compounds were detected using the UV and RI detectors. Identification based on spectral characteristic of compounds. Percentage composition of essential fatty acids (oleic, linoleic and linoleic acids) were determined by using gas chromatographic analysis as explained by (Satyabrata *et al*. 1998; Sedgley, 2000). Furthermore for fatty acids methyl esters was prepared and analyzed by capillary column gas chromatography was carried out.

Identification of Peaks

The order in which the fatty acid methyl esters appear on the chromatogram was taken as direct function of carbon atoms. The unsaturated esters were eluted after the corresponding esters and their elution was direct function of the number of double bonds. Mostly *trans* fatty acids esters are eluted before the corresponding *cis* isomer. Therefore individual methyl esters were then identified by their retentions times and comparing the peaks with the peaks obtained for standards.

Quantitative analysis

The percentage of each fatty acid was calculated from the ratio of the area under the corresponding peak to the sum of the areas under all the

Further more the level of Polyphenol in the fruits of wild olive and olive was determined by using the method of Singleton *et al*.1999.Where as free acidity level and peroxides concentration was determined by using the method reported by EEC. (1991).

RESULTS AND DISCUSSION

During present study the level of essential oil (composition of fatty acids) oleic linoleic and linolenic acids in the fruits of olive and wild olive was determined and the results are presented in tables 1 to 6. Results indicates that levels of total oil, oleic linoleic and linolenic acids, polyphenol, free acidity and peroxydes in wild olive oil fruits are comparable to the levels of these parameters obtained from cultivated olive fruits .

OLIVE OIL

It was observed that level of total oil in different samples wild olive (34.11-36.69 %) as compared to (35.1-65.1 %) found in olive. The results of oil obtained in present study were comparable with results of oil reported by other authors like Sedgley, 2000. Therefore it was assumed that this variety of olive can supply sufficient amount of edible if use for consumption and maximum oil content can be obtained to improve the deficiencies of edible oil in future. (Frank *et al.,* 1986).

By comparing percentage of oil in wild and cultivated olive it was cleared that both varieties are closed to each other as long as total oil contents is concerned (Table 6) Olive oil is well know edible oil and consumes by public to get sufficient energy for metabolic reactions

OLEIC ACIDS

The concentration level of oleic acids found in the fruits of wild olive (61.86-66.37%) and cultivated olive (57.1- 97.3%) respectively (Tables 1-6). The values of oleic acid obtained in the present study from both varieties of olives are comparable to the standard values of oleic acids report for olive oil in the literature(IOOC, 1992) Furthermore values of oleic acid obtained from fruits of wild olive (*Olea cuspedate*) shows that this fruit have potential to supply essential fatty acids if refined properly

The results of oleic acid found in present study were closed to those reported by (Guinda *et al.,* 2003). Furthermore the comparison of oleic acid in wild olive and olive indicates that wild olive fruits can be good source of essential fatty acids like oleic which is required for health of human populatiopn (Eromocele, 2002).

LINOLEIC AND LINOLENIC ACIDS

The results of linoleic and linolenic ares are given in tables 1-6 . Linoleic and linolenic acid are an unsaturated fatty acids present in various oils in different percentages. In present study concentration of linoleic acid is found in wild olive (20.19-21.6%) and in olive (10.4-46.1%) where as the level of linolenic acid in wild olive found was (1.36-1.59 %) and olive (1.2-2.7%) . Both fatty acids are essential for good quality of oils (IOOC, 2004). The results of linoleic acid found in present study was closed to the results reported by (Sedgley, 2000).

POLYPHENOL, PEROXYDES AND ACIDITY

Polyphenol is required for taste of edible oils where as peroxydes required for oxidations of fats (oils) . While free acidity (produce by breakdown of triglycerides) is also consider as essential components of edible oil of olives (Tous and Ferguson, 1996). The results regarding polyphenol, peroxides and acidity is given in the tables 1-6 which indicates that both oils have sufficient amounts of these ingredients.

WILD OLIVE OIL VS OLIVE OIL

By comparing the results of Total oil, essential fatty acids (oleic, linoleic, linolenic acids), polyphenol, peroxydes and acidity in wild olive (Tables 1- 5) with the similar parameters analyzed from cultivated oil fruits (Table 6). It was observed that quality of both of these oils are comparable with each other and very less difference in the percentage composition of these parameters are presents in both oils. Therefore it was concluded that regardless of minor difference in percentage composition of these parameters in both oils, fruits of wild olive are easily available from hilly areas in the north of Pakistan. This fruit can be used for extraction of edible in large scales that should be a cheap source of edible oil, presently this fruit is not being use for any purposes in any party of this

country and huge amount of this fruit is going to be wasted every year. Therefore it is required to use this fruit for extraction of edible oil. This new edible oil will not only help to improve the quality but also help to reduce the prices of existing oils in the market.

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Table 1. Different parameters analyzed from seeds of wild olive *(Olea cuspedata)* collected from location No.1 N= 5.

Sample No.	Weight of sample (gram)	Percent (%) of total Oil	Percent (%) of Oleic acid	Percent (%) of Linoleic acid	Percent (%) of Linolenic acid	Polyphenol (mg/kg)	Peroxydes meqO_2/kg	Acidity meqO_2/kg	Acidity meqO_2/kg

1	2	34.1	82.1	11.4	1.2	250	10.5	0.3	0.5
2	2	34.8	65.2	22.9	2.0	260	9.8	0.1	0.4
3	2	35.1	66.5	23.1	1.8	270	11.2	0.4	0.5
4	2	36.8	64.6	31.4	1.1	308	9.5	0.5	0.7
5	2	37.1	74.7	25.3	1.2	351	8.5	0.2	0.6
6	2	38.2	65.7	15.2	1.7	340	7.1	0.3	0.8
7	2	39.1	67.1	22.1	1.9	368	8.5	0.5	0.7
8	2	38.4	68.2	21.8	2.3	369	7.5	0.6	1.3
9	2	39.4	69.4	20.1	2.6	370	8.5	0.4	1 .7
10	2	37.8	67.8	22.1	1.2	358	5.6	0.7	1.1
11	2	39.4	59.4	23.4	1.8	450	3.5	0.8	1.2
12	2	28.2	61.6	19.4	1.6	370	5.5	0.4	1.5
13	2	35.1	57.3	17.3	0.8	450	7.8	0.5	0.8
14	2	36.3	54.7	16.4	0.3	290	6.5	0.6	1.9
15	2	35.2	58.3	16.8	1.8	360	7.8	0.7	1.0
Mean	2	36.3	61.86	20.58	1.55	344.27	7.85	0.47	

Table 2. Different parameters analyzed from seeds of wild olive *(Olea cuspedata)* collected from location No.2 N= 5.

Sample No.	Weight of sample (gram)	Percent (%) of total Oil	Percent (%) of Oleic acid	Percent (%) of Linoleic acid	Percent (%) of Linolenic acid	Polyphenol (mg/kg)	Peroxydes meqO_2/kg	Acidity meqO_2/kg	Acidity meqO_2/kg
1	2	31.1	82.4	10.4	1.6	256	11.5	0.5	0.5
2	2	32.8	75.2	16.9	2.1	262	10.8	0.5 0.7	0.4
3	2	35.6	61.5	21.1	1.6	276	11.6	0.9	0.5
4	2	33.8	64.4	26.4	1.4	318	9.2	0.3	0.7
5	2	37.1	72.7	24.8	1.6	354	9.5	0.4	0.6
6	2	38.3	65.5	18.2	1.9	342	8.1	0.5	0.8

7	2	36.1	66.1	22.4	1.1	336	9.2	0.5	0.7
8	2	31.1	64.2	21.5	2.3	339	7.5	0.7	1.3
9	2	34.4	64.9	20.6	2.7	372	8.1	0.3	1 .7
10	2	37.2	61.8	21.7	1.4	348	6.6	0.6	1.1
11	2	35.4	61.4	25.4	1.7	456	4.5	0.5	1.2
12	2	29.2	64.6	19.1	1.5	376	5.3	0.6	1.5
13	2	32.1	59.3	18.3	1.2	410	8.8	0.7	0.8
14	2	34.3	56.1	18.2	0.7	391	6.9	0.5	1.9
15	2	33.2	59.3	17.9	1.1	380	7.2	0.6	1.0
Mean	2	34.11	65.29	20.19	1.59	34.773	8.32	0.52	

Table 3. Different parameters analyzed from seeds of wild olive *(Olea cuspedata)* collected from location No.3 N= 5.

Sample No.	Weight of sample (gram)	Percent (%) of Oil	Percent(%) of Oleic acid	Percent (%) of Linoleic acid	Percent (%) of Linolenic acid	Polyphenol (mg/kg)	Peroxydes meqO_2/kg	Acidity meqO_2/kg	Acidity meqO_2/kg
1	2	35.1	81.1	12.4	1.6	256	11.5	0.6	0.5
2	*2*	36.8	75.2	23.9	2.1	262	9.9	0.9	0.4
3	2	36.1	68.5	22.1	1.8	276	11.4	0.7	0.5
4	2	37.8	74.6	32.4	1.3	318	9.0	0.4	0.7
5	2	39.1	74.7	27.3	1.8	353	8.5	0.3	0.6
6	2	33.2	61.7	14.2	1.4	346	8.1	0.5	0.8
7	2	39.3	66.1	23.1	1.3	367	7.5	0.4	0.7
8	2	37.4	68.2	24.8	2.4	361	8.5	0.3	1.3
9	2	39.1	67.4	21.1	2.3	374	6.5	0.6	1 .7
10	2	33.8	67.2	20.1	1.1	368	9.6	0.8	1.1
11	2	37.4	58.4	24.4	1.6	453	4.5	0.7	1.2
12	2	28.1	63.6	19.1	1.7	376	6.5	0.8	1.5
13	2	38.1	57.1	18.3	0.8	451	7.9	0.5	0.8
14	2	33.3	53.7	16.2	0.3	370	7.5	0.6	1.9

15	2	35.6	58.0	17.8	1.8	362	6.8	0.8	1.0
Mean	2	36.01	66.37	21.14	1.55	352.86	8.25	0.59	

Table 4. Different parameters analyzed from seeds of wild olive *(Olea cuspedata)* collected from location No.4, N= 5.

Sample No.	Weight of sample (gram)	Percent (%) of Oil	Percent (%) of Oleic acid	Percent (%) of Linoleic acid	Percent (%) of Linolenic acid	Polyphenol (mg/kg)	Peroxydes meqO_2/kg	Acidity meqO_2/kg
1	2	32.1	80.1	11.4	1.1	251	10.2	0.6
2	2	36.8	75.2	21.9	2.1	255	9.7	0.4
3	2	34.1	67.5	24.1	1.4	271	11.1	0.5
4	2	36.2	66.6	32.4	1.3	306	9.4	0.8
5	2	37.0	71.7	25.5	1.0	352	8.6	0.6
6	2	39.2	69.2	17.2	1.3	342	7.2	0.8
7	2	39.4	68.4	24.1	1.1	358	8.4	0.5
8	2	37.5	69.2	23.8	2.0	367	7.3	1.3
9	2	36.4	67.4	21.1	2.2	372	8.6	1 .2
10	2	39.8	65.8	25.1	1.3	356	5.5	1.1
11	2	36.1	57.4	24.2	1.5	452	3.6	1.3
12	2	37.2	60.6	23.4	1.4	373	5.4	1.4
13	2	34.1	58.2	16.3	0.7	451	7.9	0.8
14	2	38.3	57.6	17.4	0.5	292	6.3	1.9
15	2	36.2	59.3	16.1	1.5	363	7.9	1.1
Mean	2	36.69	66.28	21.6	1.36	344.07	7.81	0.95

Table 5. Different parameters analyzed from seeds of wild olive *(Olea cuspedata)* collected from location No.5, N= 5.

Sample No.	Weight of sample (gram)	Percent (%) of Oil	Percent (%) of Oleic acid	Percent (%) of Linoleic acid	Percent (%) of Linolenic acid	Polyphenol (mg/kg)	Peroxydes meqO_2/kg	Acidity meqO_2/kg	Acidity meqO_2/kg
1	2	35.1	81.1	12.4	1.3	251	10.0	0.5	0.5
2	*2*	37.8	67.2	21.9	2.1	260	9.6	0.6	0.4
3	2	35.1	65.5	22.1	1.9	272	11.1	0.8	0.5
4	2	34.8	66.6	30.4	1.2	308	9.3	0.7	0.7
5	2	37.1	75.7	26.3	1.3	354	8.6	0.4	0.6
6	2	38.2	66.7	15.2	1.6	341	7.0	1.1	0.8
7	2	38.1	68.1	22.1	1.7	368	8.0	0.5	0.7
8	2	38.2	69.2	21.8	2.2	369	7.1	0.9	1.3
9	2	36.4	69.3	20.2	2.8	373	8.4	1.3	1 .7
10	2	38.8	66.8	22.4	1.1	351	5.5	0.7	1.1
11	2	36.4	58.4	22.4	1.9	420	3.4	0.8	1.2
12	2	29.2	62.6	18.4	1.3	360	5.6	0.7	1.5
13	2	34.1	57.3	19.3	0.8	451	7.8	0.6	0.8
14	2	39.3	55.7	17.4	0.3	292	6.5	0.7	1.9
15	2	33.2	57.3	18.8	1.7	363	7.1	0.8	1.0
Mean	2	36.12	65.83	20.74	1.54	344.2	7.66	0.74	

Table 6. Different parameters analyzed from fruits of olive *(Olea europea)* collected from market of Rawalpindi and Islamabad. N=5.

Sample No.	Weight of sample (gram)	Percent (%) total Oil	Percent (%) of Oleic acid	Percent (%) of Linoleic acid	Percent (%) of Linolenic acid	Polyphenol (mg/kg)	Peroxydes meqO_2/kg	Acidity meqO_2/kg	Acidity meqO_2/kg
1	2	33.1	82.2	10.4	1.4	251	10.3	0.7	0.5
2	2	35.8	65.1	20.9	2.1	262	9.7	0.5 1.1	0.4
3	2	35.4	67.5	22.1	1.7	271	13.1	1.3	0.5

4	2	37.8	64.1	34.4	1.2	318	9.3	0.9	0.7
5	2	38.1	73.7	26.3	1.3	341	9.5	0.4	0.6
6	2	39.2	64.7	17.2	1.6	341	9.1	1.4	0.8
7	2	37.1	69.1	23.1	1.8	358	8.4	1.1	0.7
8	2	39.4	67.2	21.3	2.4	359	7.4	0.7	1.3
9	2	37.4	68.4	21.1	2.7	371	8.4	1.3	1 .7
10	2	39.8	68.8	22.2	1.1	368	5.4	1.1	1.1
11	2	37.4	58.4	24.4	1.7	451	3.4	0.8	1.2
12	2	27.2	62.6	19.3	1.5	371	5.3	0.5	1.5
13	2	35.1	57.3	17.3	0.8	450	7.8	1.1	0.8
14	2	36.2	54.6	16.1	0.5	291	6.4	1.0	1.9
15	2	35.1	57.3	16.3	1.6	362	7.7	0.8	1.0
Mean	2	38.60	66.33	20.82	1.72	344.8	8.08	0.98	