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Evaluation of olive (*olea europaea* l.) cultivars grown in Himachal Pradesh for oil extraction purposes

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Abstract

Eight cultivars of olive (*Olea europaea* L. cvs. *Coratino, Ascolano, Frantoio, Pendulino, Leccino, Moraiolo, Cornicobra* and *Ballenquata*) grown in Himachal Pradesh were evaluated for oil extraction purposes. The fruit weight among different cultivars ranged between 1.90-3.88g. Maximum pulp recovery (75.90% w/w) was recorded in *Cornicobra* followed by *Coratino*, *Leccino* and *Frantoio* (73.80-74.35% w/w). However, cultivar *Leccino* gave highest (42.95%) oil yield on moisture free basis followed by *Coratino* (41.20%) and *Frantoio* (40.05%). The free fatty acid content and peroxide value of oil from different cultivars ranged from 0.63 to 0.85 per cent and 4.95-7.25 meq/Kg, respectively. However, these values were well with in the maximum limit specified under Indian Food Laws. The cultivars *Frantoio*, *Pendulino*, *Coratino* and *Leccino* showed higher degree of unsaturation (Iodine Value) as compared to other cultivars. Saponification value of oil from different cultivars varied between 186.55-200.60. Overall oil extracted from different cultivars had their quality comparable to the standards of olive oil given by Prevention of Food Adulteration Act and Codex Alimentarius Commission and thus can find a good market acceptability.

Introduction

Olive, a member of family Oleaceae, is relatively a small evergreen tree with silvery leaves, known for its longevity and liquid gold-*oil*. The Mediterranean and its surroundings are considered as the home of olive, from where it spread to other parts of the world. Olive oil is one of the vegetable oils, which can be used in crude form without refining, thus conserving the essential vitamins, fatty acids and other natural elements of dietetic importance. Besides its rapid digestibility, olive oil is also known for its anti-ulcer and plasma cholesterol lowering properties. In addition, it is also used for manufacturing various industrial products such as soaps, textiles, lubricants, cosmetics and skin applications (Christakis *et al.* 1980, Katiyar *et al.* 1989). In India, olive is marginally grown in the temperate regions comprising of Himachal Pradesh, Uttaranchal and Jammu & Kashmir. However, our demand for olive oil is met entirely through imports. In order to fulfill the country's demand for olive oil, some exotic Italian and Spanish cultivars of olive have been introduced in Himachal Pradesh, Uttaranchal and Jammu & Kashmir. Some of the olive cultivars introduced in Himachal Pradesh under the Indo-Italian Olive Development Project during late eighties, have now come into bearing and hence need to be evaluated and recommended for oil production. Therefore, this study was undertaken to evaluate some cultivars grown in Himachal Pradesh for oil extraction purposes.

Material and Methods

Olive fruits: Eight cultivars of olive (*Olea europaea* L. cvs. *Coratino, Ascolano, Frantoio, Pendulino, Leccino, Moraiolo, Cornicobra and Ballenquata*) were collected from Olive Development Station, Kigus, Panarsa, Distt. Mandi (1300 m amsl).

Oil Extraction: The oil was extracted by using solvent extraction method (Ranganna, 1997). A 100 g fruit (mesocarp) sample of each variety at one time was dried in a hot air oven (70°C $\pm$ 2°C) to a constant weight. The oil was extracted from the moisture free mesocarp in soxhlet apparatus using petroleum ether (40-60°C) as solvent. Excess of solvent was removed from the oil by placing it in an oven at 50°C till it was free from solvent. Sufficient oil extracted by repeating

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the process was used for further analysis.

Physico-chemical characteristics of fruit: The physical characteristics of fruit such as average fruit weight, size of fruit (length and breadth), pulp recovery and pulp: stone ratio were estimated according to standard methods. Moisture content was determined according to AOAC (1995) methods.

Quality parameters of oil: Butyrorefractometer reading, free fatty acids, peroxide value, iodine value and saponification value were determined following the methods of AOAC (1995). The quality of oil of various cultivars was compared with PFA standards and the standards of Codex Alimentarius commission.

Statistical analysis: Data pertaining to physico-chemical characteristics of fruit and quality parameters of oil were analyzed by Completely Randomized Block Design (CRD) as described by Cochran and Cox (1967).

Results and Discussion

Physico chemical characteristics of different cultivars of olive grown in Himachal Pradesh presented in Table 1 revealed that average fruit weight varied from 1.90 to 3.88 g with maximum recorded in *Cornicobra* and minimum in *Moraiolo* cultivars. However, the average fruit length varied from 16.60 to 26.75 mm, while the average fruit breadth varied from 12.80 to 20.15 mm. Maximum pulp recovery among different cultivars of olive was obtained in *Cornicobra* (75.90%) followed by *Coratino* (74.35%) and *Leccino* (74.30%). However, the highest pulp: stone ratio was recorded in *Cornicobra* (3.15) and lowest in *Moraiolo* (2.36). Similar results for various physico-chemical characteristics in different olive cultivars being grown in Himachal Pradesh have also been reported by Singh *et al.* (1986) and Katiyar *et al.* (1989). Further, the moisture content among different cultivars varied from 70.36 to 67.50 percent. As such there was only a slight variation in the moisture content of olive fruits however; the existing variation in moisture content could be due to differences in available soil moisture during the fruit development and maturity period.

The evaluation of different olive cultivars for their total oil yield (on moisture free basis) indicates that it ranged from 22.16 to 42.95 per cent with maximum recorded in *Leccino* and minimum in *Cornicobra* cultivars (Table 1). Overall, the olive cultivars viz. *Leccino, Coratino* and *Frantoio* had better oil yields compared to other cultivars and thus these cultivars can be recommended for cultivation for oil extraction purposes. On the other hand the cultivars such as *Cornicobra* having large fruit size and low oil yields may be grown for pickle making and other table purposes. However, cultivars like *Ascolano* and *Pendulino* may be grown for dual purposes.

Further, the oil extracted from these cultivars was evaluated for various quality parameters. Data in table 1 revealed that butyrorefractometer reading of oil various cultivars was well within the specification of PFA except of *Moraiolo* and *Cornicobra* cultivars. However, specific gravity of oil of different cultivars grown in Himachal Pradesh was found to be insignificant. The amount of free fatty acids (FFA) also used as an indicator of hydrolytic rancidity ranged between 0.63-0.85 percent. Lesser the amount of free fatty acids present in the oil better would be the oil (Thimmaiah, 1999). Similarly, the peroxide value measured as milli-equivalent of oxygen present in oil ranged from 4.95-7.25 meq/Kg with minimum value recorded in *Pendulino*, which was at par with *Leccino* and *Coratino*. However, all the oils had their peroxide value well with in the specifications of Codex Alimentarius Commision. While, according to Jacobs (1959), the peroxide value is the indicator of spoilage in unsaturated fatty acids and shall not exceed 125. Further, iodine value representing the degree of unsaturation in oil ranged between 72.60 (*Cornicobra*) to 82.50 (*Coratino*). Iodine value of oil extracted from cultivar *Cornicobra* did not met the specifications of PFA and Codex Alimentarius Commission. The saponification value of olive oil specified under Indian Food Laws and Codex Alimentaruis Commision is reported to range between 184 to196, thus the olive oil extracted from different cultivars except *Cornicobra* in this study was found to be well with in the specified limits.

However, oil extracted from cultivars *Coratino, Leccino, Pendulino* and *Frantoio* grown in Himachal Pradesh was better compared to others, thus, can be recommended for cultivation for oil extraction purposes in different olive growing regions of Himachal Pradesh.

Table 1. Physico–chemical characteristics of fruit and oil of different olive cultivars grown in Himachal Pradesh

Parameters	Pendulino	Ascolano	Coratino	Frantoio	Leccino	Moraiolo	Cornicobra	Ballenquata	$CD_{0.05}$
Fruit									
Weight of fruit (g)	2.30	2.85	2.80	2.75	2.15	1.90	3.88	2.30	0.26
Size of fruit:									
Length (mm)	20.25	22.15	21.90	21.78	18.10	16.60	26.75	18.85	0.93
Breadth (mm)	12.90	15.50	14.50	13.44	12.95	12.80	20.15	13.25	0.79
Pulp recovery (% w/w)	71.75	72.25	74.35	73.80	74.30	70.25	75.90	73.10	1.55
Pulp: stone ratio	2.54	2.60	2.90	2.82	2.89	2.36	3.15	2.78	0.14
Moisture (%)	70.20	70.06	69.48	70.00	67.50	68.65	70.36	68.45	1.08
Oil yield (%) on moisture free basis*	36.20 (10.79)	37.75 (11.30)	41.20 (12.57)	40.05 (12.02)	42.95 (13.96)	26.35 (8.26)	22.16 (6.57)	30.65 (9.67)	1.98
Oil									
Butyrorefracto- meter reading (40°C)	55.0	53.0	53.5	54.5	53.5	52.0	52.0	53.5	1.51
Specific gravity (25/25°C)	0.920	0.910	0.914	0.918	0.915	0.912	0.912	0.918	NS
Free fatty acids (%)	0.65	0.70	0.63	0.65	0.70	0.78	0.85	0.82	0.05
Peroxide value (meq/kg)	4.95	5.50	5.15	5.85	5.08	6.12	7.25	7.10	0.20
Iodine value	82.00	79.05	81.78	82.50	82.16	76.35	72.60	78.50	1.20
Saponification value	186.55	195.50	190.25	188.75	190.43	195.30	200.60	196.00	1.06
Unsaponifiable matter (%)	0.80	0.88	.0.76	0.70	0.68	0.90	0.98	0.82	0.12

Quality Parameters	**PFA Standards**	**Codex Alimentarius Commission (1993)**
Butyrorefractometer reading	53-56	-
Saponification value	185-196	184-196
Iodine value	79-90	75-94
Unsaponifiable matter	Not more than 1.0%	Not more than 1.5%
Free fatty acids	Not more than 3.3 %	-
Peroxide value	-	Not more than 20 meq O_2 per Kg

* Figures in parentheses represent the values on fresh weight basis.

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