

Physicochemical Analysis and Fatty Acid Composition of Oil Extracted from Olive Fruit

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ABSTRACT

Research work was carried out to investigate the physicochemical analysis of olive oil extracted from olives grown in Khyber pakhtunkhwa. The samples were studied for physicochemical characteristics (Specific gravity, refractive index, Acid value, Saponification value and Peroxide value). The free fatty acidity is thus a direct measure of the quality of the oil. Olive oils contain fatty acids commonly present in olive oils which were analysed which are Palmitic, Palmitoleic, Stearic, Oleic, Linoleic, Linolenic, Arachidic and Gadoleic which have specific carbon number and their values in percentage are C16:0 (15.4), C16:1(1.5), C18:0 (3.5), C18:1 (65.2), C18:2 (16.3), C18:3 (0.7), C20:0 (0.3) and C20:1(0.2) respectively. The major fatty acid found in kalamata variety of olive oil contain oleic acid. Oleic acid percentage is high in olive oil which contained considerable amount of 65.2 %. The oil was compared with two olive oil samples S₂ and S₃ collected from local market.

Keywords: Olive oil, Fatty acids, Sensory evaluation

INTRODUCTION

The olive (Kalamata variety) belongs to the family Oleacea. The genus *Olea* is divided into the subgenera *Tetrapilus* (containing tropical species) and *Olea*. (Dubur-Jarrige, 2001).

The olive is the only member of the Oleaceae to bear edible fruit. The fruit, a drupe like a peach, cannot be eaten fresh because of the presence of a bitter glucoside. Thus the olive must be processed in order to be served as food; either processed for its oil or processed with lye and salt to produce the canned or preserved table fruit. While fruit processed in California has almost all of the bitterness removed, that processed in the Mediterranean area is often left somewhat bitter (Mc Eachern and Stein, 1997).

Olive contains oxalic, succinic, malic and citric acids and high levels of free fatty acids. The sugars i.e. glucose, saccharose and minitol 3.5 to 6.0% of the flesh in total. The sugar content decreases with maturation. Protein content ranges between 1.5 and 2.2% of the fruit by weight. The pectic substances cement the cells and affect the texture of the olive flesh. These pectic substances during processing are hydrolysed by pectinolytic enzymes and the fruit texture become softer (Marsilio, 2006)

Table olives are the most popular agro-fermented food product and are consumed and enjoyed throughout the entire world. Consumers perception of quality is improving and nowadays an increased seek for healthier products can be observed worldwide. Olives consumption (water 45-55%, oil 13-28%, N-compound 1.5-2.0%, C-compound 18-40%, Ash 1-2% and fibre 5-8%) can prevent and reduce the risk of cardiovascular diseases (Kastorini *et al.*, 2010).

In addition, other minor constituents like tocopherols and phenolic compounds are responsible for antioxidant and antimicrobial properties, protecting the organism from diseases in which free radicals and pathogenic microorganisms are involved, preventing also the body from certain kinds of cancer and arthrosclerosis (Armstrong *et al.*, 1997).

To achieve an edible grade, table olives are mainly processed by three methods: Spanish-style green olives in brine, Greek-style naturally black olives in brine, and Californian black ripe olives (Sabatini *et al.*, 2009).

Olive fruits have a characteristic phenolic composition, which depends on quality and quantitatively on type of olives, stage of maturity, season and/or climatological conditions (Romero *et al.*, 2004).

MATERIAL AND METHODS

Determination of Specific Gravity

Specific Gravity was determined by the standard method of A.O.A.C 17th edn, 2000.

$$\text{Specific Gravity at } 30^{\circ}\text{C} / 30^{\circ}\text{C} = \frac{A - B}{C - B}$$

Where

A = weight in gm of specific gravity bottle with oil at 30 °C

B = weight in gm of specific gravity bottle at 30C

C = weight in gm of specific gravity bottle with water at 30 °C

Determination of Refractive Index

Measurement of the refractive index of the sample was done by means of Abbe Refractometer by the method of AOAC (2000).

Melting Point

Melting Point of the sample was done by the standard method of AOAC (2000)

Determination of Iodine Value

Iodine value was determined by the standard method of A.O.A.C. 17th edn, 2000, Official method 920. 159 – Iodine absorption number of oils and fats / I.S.I. Handbook of Food Analysis (Part XIII) –1984 page 76).

$$\text{Iodine value} = \frac{12.69 (B - S) N}{W}$$

Where,

B = volume in ml of standard sodium thiosulphate solution required for the blank.

S = volume in ml of standard sodium thiosulphate solution required for the sample.

N = normality of the standard sodium thiosulphate solution.

W = weight in g of the sample

Determination of Acid Value

The acid value was determined by directly titrating the oil/fat in an alcoholic medium against standard potassium hydroxide/sodium hydroxide solution describe by A.O.A.C 17th edn,2000.

$$\text{Acid value} = \frac{56.1VN}{W}$$

Where

V = Volume in ml of standard potassium hydroxide or sodium hydroxide used

N = Normality of the potassium hydroxide solution or Sodium hydroxide solution; and

W = Weight in g of the sample

Determination of Saponification Value

Saponification Value was determined by the following formula

$$\frac{(A - B) \times N \times 56.1}{W}$$

Where:

A = H₂SO₄, for blank, mL

B = H₂SO₄, for sample, mL

W = weight of sample (dry basis), g

N = normality H₂SO₄ solution

56.1 = equivalent weight of potassium hydroxide

Fatty acid profile

Fatty acid of the sample was determined by GC methods as described in AOAC (2002).

Preparation of methyl ester of fatty acid

Methyl ester weighed amount of oil (1.0g) were transfer to a Teflon test tube. Methonolic potassium hydroxide (0.5N 10 ml) was then added to the oil sample. The mixtured was refluxed until the globules of the oil got into solution 90 minutes. Sulphuric acid (2N) was then added to the cooled mixture to liberate the fatty acids. Esterification of the liberated fatty acids was carried out in the presence of catalytic amount of methonal BF₃ (10ml) and boil for 20 minutes. The etherified mixture was cooled and extracted with hexane. Separate hexane layers were washed with water and dried over anhydrous sodium sulphate.

Determination of fatty acid methyl Easters

The fatty acid composition of olive fruit pulp oils was determined by Gas Chromatography (Perkin elemyre 8410 series with flame ionization detector) using a column (2 meter) packed with celite coated with 10% DEGS. The GC operating conditions were: column temperature 140, FID temperature 270C, injector temperature 260C and carrier gas nitrogen with flow rate of 40 ml/min.the determined percentage fatty acid composition.

RESULTS AND DISCUSSION

Fatty acid composition

The samples were analyzed physiochemically for Specific gravity, refractive index, Acid value, Saponification value and Peroxide value. Three consecutive readings were taken and then mean values and standard deviation were taken out statistically as shown in figure-1. The fatty acid compositions of the olive oils are shown in figure-2. Olive oils contain fatty acids commonly present in olive oils, such as Palmitic, Palmitoleic, Stearic, Oleic, Linoleic,

Linolenic, Arachidic and Gadoleic which have specific carbon number and their values in percentage are C16:0 (15.4), C16:1(1.5), C18:0 (3.5), C18:1 (65.2), C18:2 (16.3), C18:3 (0.7), C20:0 (0.3) and C20:1(0.2) respectively. The major fatty acid found in kalamata variety of olive oil contain oleic acid. Oleic acid percentage is high in olive oil which contained considerable amount of 65.2 %.

Three samples were subjected to the trained judges. One sample which which were given code as S₁ and two samples (S₂ and S₃) were collected from local market and brought to laboratories. The coded samples were placed in front of judges in sensory evaluation laboratory to gave it the value from 1 to 9 in which 1 represents extremely dislike and 9 represent extremely like (Larmond 1977). Sample which is extracted from kalamata variety of Khyber pakhtunkhwa got high score followed by S₃ and S₂ which were collected from the local market.

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Figure-1

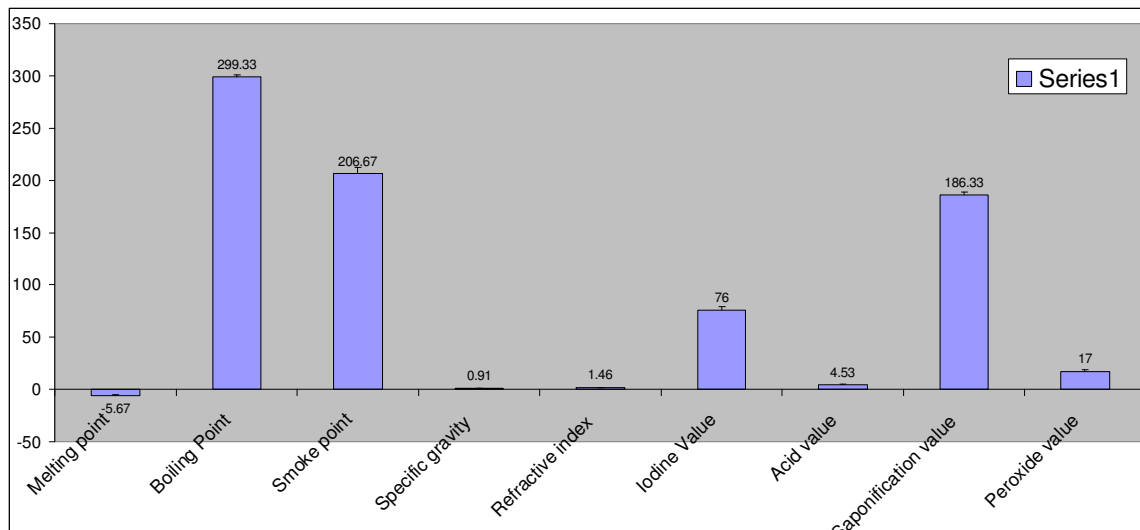


Figure-2 Fatty acid profile of olive oil (%)

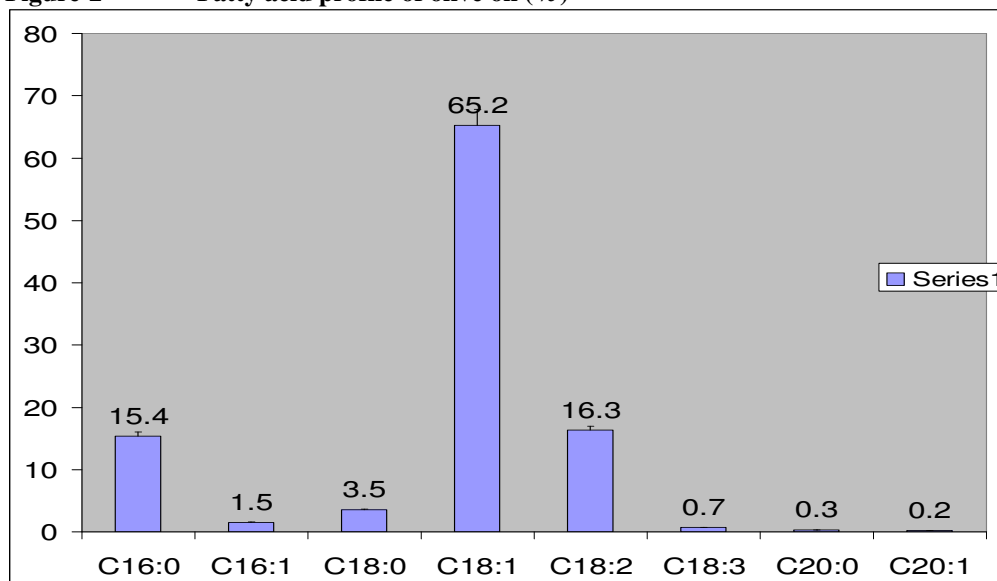


Figure-3 Sensory evaluation of Olive oil

