



## Physiochemical properties and total phenolic content of date palm (*Phoenix sylvestris* (L.) Roxb) seed oil Grown in district Panjgur, Pakistan

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### Abstract

The date palm *Phoenix sylvestris* (L.) Roxb. is an agricultural plant of remarkable importance in south Asian countries and its seeds have significant amount of oil which has great biochemical properties. In this study, the physiochemical properties of seed oil extracted from *Phoenix sylvestris* (L.) Roxb has been evaluated which are related with its biochemical properties. The viscosity, density, refractive index, specific gravity, acid value, saponification value, total phenolic content of oil extracted from soxhlet extraction were evaluated and other physical parameters of seed (i.e. length, weight, moisture content, ash content) were determined. The following values were obtained respectively: viscosity 20.313 mPa.s, density 0.9254 g/dm<sup>3</sup>, refractive index 1.432, specific gravity 0.935, acid value 2.516, saponification value 210.369mg KOH/g, total phenolic content 3.641 mg GAE/100g, moisture content 7.283% and ash content 1.152%. Results showed that the seed oil of *Phoenix sylvestris* (L.) Roxb has significant nutritional values that can be used in industrial products.

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## Introduction

Pakistan grows many of the varieties of vegetable and fruits of export quality throughout the year and dates are on third number in fruit export there for it is an important commercial fruit in the country. It is harvested from July to September. It is estimated that during 2007 to 2008 about 557 thousand tons' dates were produced by Pakistan. Khudravi, Halavi, Aseel Begum Jangi, Muzawati are some of the common types of dates produced in Pakistan (Abul-Soad *et al.*, 2015). Carbohydrates are an instant source of energy for human and dates are rich in carbohydrate content which is about seventy to eighty percent, mostly in monosaccharide form such as glucose and fructose which are readily absorbed by the body. Many of the inorganic elements of biological importance are present in dates such as calcium, magnesium, iron, phosphorous, potassium, sodium, zinc, copper, and manganese.

Elemental fluorine present in dates prevents the tooth decay, so its consumption does not harm the teeth like other sweet. Selenium is also present in dates which is important for immune system, it also helps to prevent the risk of cancer (Nadeem *et al.*, 2011). Polysaccharides obtained from dates are used in drugs as a functional part of drug (Puri *et al.*, 2000) Moreover, dates also have anti-oxidant as well as anti-mutagenic properties. They also prevent the risk of cardiovascular diseases as they decrease serum level of triglycerides in the body and after their consumption, there is no significant increase or decrease in blood cholesterol (Vayalil, 2002; Jerga and Rock, 2009). Antioxidant properties of dates are due to phenolic compounds present in dates. Vitamin E ( $\alpha$ -tocopherol), vitamin C, carotenoid and flavonoid also increase their anti-oxidant properties and this property is enhanced in dry dates due to enzymes which become mature and tannins degradation due to heat (Biglari *et al.*, 2009). Date fruit has a significant vitamin B2 and B3 content these water soluble vitamins performs vital functions in the body like energy production, tissue repair, growth and waste removal (Nadeem *et al.*, 2019). Date seeds are very hard and mostly they are

considered as a waste product from the date processing or food processing factories, but some time people use the ground seed with feed for animals.

These seeds are also used to give flavor of coffee drinks which are non-caffeinated by the Arabs from hundreds of the years (Afiq *et al.*, 2013). Moisture content in date seed or pits is about 10.64% and amount of crude protein is about 5.68%. Oil content in date seed is 7.52%, which has great significance (Habib and Ibrahim, 2009). Many of the important fatty acids are present in date seed oil such as lauric acid, oleic acid, palmitic acid, Myristic acid and linoleic acid (Nehdi *et al.*, 2018). Date fruit has many of the other uses, such as it is widely used in food processing factories to make juices, pudding, syrups, and cookies, candy bars etc. Other parts of the plant such as leaves are used to make baskets, mats, bags, fans, furniture, etc. The ribs of leaves are used to make small fishing boats by the local people (Chao and krueger *et al.*, 2007). The aim of this study is to evaluate the physiochemical properties of seed and seed oil of *Phoenix sylvestris* (L.)Roxb grown in district Panjgur, Pakistan.

## Materials and methods

### Study area

The study area (Panjgur) is located in the west region (26° 58' 0" North, 64° 6' 0" East) of Balochistan, Pakistan. It is famous for date palm cultivation and product of dates.

### Sample collection

Fruits of date palm were collected from farms of different areas of district Panjgur.

### Sample preparation

Seeds were isolated from the fruit and kept in water to clean and then dried and crushed to make powder.

### Oil extraction

Extraction of oil was done through Soxhlet extraction using n-hexane as solvent. 20 g of seed powder was washed with 250 ml of n-hexane for four hours. The

extracted oil was kept in a desiccator and then stored in refrigerator. Extraction was done by the method describe by Ali *et al.*, 2015 with some modification.

#### *Physiochemical properties*

**Length of seed:** Seed length was measured by a using digital caliper.

**Weight of seed:** Seed weight was taken through advanced weight balance.

**Seed moisture content:** The moisture content was determined by the AOAC methods 934.06. 5 g o sample was taken in a Petri dish and kept in oven at 105°C. Moisture content was measured by the formula.

Moisture content = weight of the seed before drying / weight of the seed after drying.

**Ash content of seeds:** Ash content of seeds was measured by the method of Pearson (1981). 5g of the grounded seed sample was taken in a clean and air dried crucible and heated in muffle furnace and temperature was set at 1100°C for four hours.

**Colour of seed oil:** Colour of seed was visualised by eyes.

**Viscosity of oil:** Viscosity of oil was measured by using Brook field DV-II + pro viscometer.

**Density of oil:** Density of oil was measured by using Mettler toledo densitometer.

**Refracted index:** Refracted index of oil was checked on a refractometer and calculated by the method described by cock and vanRede, 1997. The water bath was set at 40°C. The oil spot was placed on refractometer's slide and value is recorded by viewing the scale of refractometer.

**Specific gravity of oil:** The Specific gravity was measured according to the AOAC methods (2000) against water by the formula.

Specific gravity=weight of bottle with water - weight of empty bottle/ weight of bottle with oil- weight of empty bottle.

**Saponification value:** AOAC-1999 method was followed to determine Saponification value of oil sample. For that 10ml of methanolic KOH was added in a flask having 1g oil sample and boiled by connecting with air condenser for one hour. Then solution was titrated against 0.1N HCL solution having phenolphthalein as indicator. The value is calculated by the formula.

Saponification value = (B-S) ×28.05/weight of sample.

**Acid value:** Acid value was also calculated by the AOAC methods 1999. 5g of a sample was taken in Erlenmeyer and 50ml of Alcohol - ether solution was added. Then this mixture was heated on water bath and then allowed to cool.

The sample mixture was titrated against 0.1N alcoholic KOH as indicator. The acid value was calculated by the formula.

Acid value =  $56.1 \times V \times N$  /weight of sample

V= Volume of 0.1N KOH used

N= Normality of KOH

**Total phenolic content:** Total phenolic content was measured by the method followed by Yoo *et al.* 2004 after some modifications. Gallic acid (phenolic compound) was used as standard. 1ml of oil sample and 1ml of folin ciocalteu reagent were taken in a flask. After four minutes 1ml of 15% Na<sub>2</sub>CO<sub>3</sub> solution was added in it and allow to stand for 2 hours.

The absorbance was set at 517 nm. The value was given in mg/100g of GAE (Gallic acid equivalent).

#### *Statistical analysis*

The Statistical data was analysed by using Microsoft excel 2013. Components were express by mean and standard deviation.

### Results and discussion

The physiochemical values obtained from this study are given in the Table 1. Length of seed of *Phoenix sylvestris* (L.) Roxb is about 16.69 mm.

As estimated, the length of the seed of different varieties of phoenix dactylifera is range from 6.85 to 23.22. The mean weight of the seed is about 0.863g. This result is close to the values calculated by Fahad-al-juhaimi *et al.* (2012) about *Phoenix dactylifera* L. that was reported about (0.52-0.99g). Habib and Ibrahim, 2009 had calculated the seed length between 17.20 to 23.60mm and weight of the seed as 0.6g to 1.26g. Means value of moisture and ash content are 7.283 and 1.152 respectively. Amany *et al.*, 2012 has reported date seed moisture content which was about 3.10 to 7.10% and ash content as

about 0.9 to 1.80% which are according to the result obtained after our study. Besbes *et al.*, 2004 has given the ash content 1.15 and 1.12% for Deglet nour and Allig varieties of date Amir Azodi *et al.*, 2014 has also reported the date seed moisture content about 10.50 % for Irani dates. There is no significant difference in ash and moisture content of seed of *Phoenix sylvestris* (L.) Roxb and other varieties of dates. The oil obtained by soxhlet extraction using n-hexane as a solvent was brownish yellow in color. It was reported by Saafi *et al.*, 2008 that color of date seed oil is intense yellow due to carotenoid pigment present in it. As reported by Hsu and Yu, 2002 the color of date seed oil is more yellow than vegetable oils. The color of date seed oil may vary between green, yellow and brown or pale yellow (Devshony *et al.*, 1992; Boukuada and yousfi, 2009).

**Table 1.** Properties of *Phoenix sylvestris* (L.) Roxb seed. All values recorded through mean of 10 determinations.

Components	Mean value	Standard deviation
Length	16.69 mm	± 0.390
Weight	0.863g	± 0.109
Moisture content	7.283 %	± 0.029
Ash content	1.152 %	± 0.022

Properties of oil are given in the Table 2. The mean values of density and viscosity of the oil were 0.9254 g/dm<sup>3</sup> and 20.313 mPa.s respectively.

The result of viscosity is similar to Deglet Nour seed oil reported by Besbes *et al.* 2005 which was 20 mPa.s but different from Allig seed oil which was reported 40 mPa.s. Viscosity value ranged between 50 to 100 mPa.s for most of the vegetable oil. Abdalla *et*

*al.*, 2012 had reported the oil viscosity as 17 to 20cP and density about 0.9174g/cm<sup>3</sup>. These values clearly resemble to the value obtain for *Phoenix sylvestris* (L.) Roxb. The mean value of specific gravity is 0.935 which is according to FAO/WHO standard values and this value also resemble to the oil extracted from desert date seed oil which was about 0.90 Zang *et al.*, 2017. The mean value of refractive index of the oil is 1.432.

**Table 2.** Physical properties of *Phoenix sylvestris* (L.) Roxb. Seed oil. All values recorded through mean of 10 determinations.

Component	Mean values	Standard deviation
Viscosity	20.313mPa.s	± 0.197
Density	0.925 g/dm <sup>3</sup>	± 0.002
Refractive index	1.435	± 0.003
Specific gravity	0.935	± 0.042

The value of refractive index closely resembles to the value recorded by S. Besbes *et al.* 2004 for two varieties of dates which were Deglet Nour having

value of refractive index as 1.457 and for Allig as 1.462. A low value of refractive index of date seed oil indicates that it has short to medium chain

hydrocarbons attached with fatty acid. The chemical properties of the oil are given in Table 3.

Seed oil has saponification value about 210.369 mg KOH/g which is slightly less than value obtained by Soliman *et al.*, 2015 which was 217 mg KOH/g. In

comparison with other oils such as palm kernel oil 247mg KOH/g, corn oil 187-196mgKOH/g. Palm oil 196-205 mgKOH/g, the value of Saponification for date seed oil is at same level to some oil which are edible(Alkinhanmi *et al.*, 2007).

**Table 3.** Physiochemical properties of Phoenix sylvestris (L.) Roxb seed. All values recorded by mean of 10 determinations.

Components	Mean values	Standard deviation
Saponification value	210.369	± 0.004
Acid value	2.516	± 0.013
Total phenolic content	3.641	± 0.069

The acid value has a great significance in order to determine the lipid base properties of oils. The acid value obtained was 2.516 for date seed oil which resemble to the value given by Soliman *et al.*, 2014 for seven date varieties which were 2.56mgKOH/g, 2.50mgKOH/g, 2.54mgKOH/g etc.

These values indicate a low number of free fatty acid. A low number free fatty acid indicates a long shelf life for the oil and also make it edible. Total phenolic content describe that how much phenolic compound are generally present in a sample.

The value obtained for TPC is 3.641 mg/100g for this oil. Juhaimi *et al.*, 2012 has reported the TPC for different date varieties of Saudi Arabia which closely resemble to this value.

The values given for different varieties were 4.65mg/100g for soughi, 3.66 mg/100g for monaif, 3.71mg/100g for soulkari, 3.21 mg/100g for rozaiz etc. According to another study conducted by AL Harthi *et al.*, 2015 the TPC of four different varieties of dates seed oil were fall in the range of 139 to 147 mg/100g indicating that differences in values may be due to change in harvesting time, change in moisture, PH and some other factors.

All the physicochemical properties closely resemble with the value obtained from different varieties of the date palm which indicates that there must be

similarities in their biochemical properties.

### Conclusion

The results of this study indicate that it has significant quantities of oil, which can be easily extracted using n\_ hexane as solvent. Moreover physiochemical properties of oil closely resembles to other varieties of date palm. Some of the values slightly vary which might be due to the difference in characteristics of different species.

Very less research work has been previously done on this species of date palms. Furthermore, more study needed in order to understand its properties and how could it be used to treat many of the drastic diseases which are a major problem in today's world.

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