**Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 13(4), 2646-2654, 2023**
***Journal of the Institute of Science and Technology, 13(4), 2646-2654, 2023***

**ISSN: 2146-0574, eISSN: 2536-4618**

**Food Engineering** **DOI: 10.21597/jist.1293261**

**Research Article**

**Received: 06.05.2023** **Accepted: 01.09.2023**

***To Cite:*** Gumus, P. & Erol, U. H. (2023). Comparison of Fatty Acid Profile and Quality Properties of Commercial Apricot (Prunus Armeniaca) Kernel Oils. *Journal of the Institute of Science and Technology*, x(x), 2646-2654.

# Comparison of Fatty Acid Profile and Quality Properties of Commercial Apricot (*Prunus Armeniaca*) Kernel Oils

Pinar GUMUS[1*], Umit Haydar EROL[2]

**Highlights:**

- Apricot is one of the important export products of Turkey.
- The apricot kernel oil has become widely popular in many industries.
- Oleic and linoleic acids were determined as major unsaturated fatty acids in apricot kernel oils.

**ABSTRACT:**

*Prunus armeniaca* L. known as apricot, is one of the important export products of Turkey and its kernel oil has become widely popular in different fields such as food pharmacy, aromatherapy and cosmetics industry. Apricot oil obtained from the kernels of apricots is characterized by high contents of oil, fiber, various minerals, proteins, vitamins and phenolics with health-improving effects. The aim of this study was to compare the fatty acid composition and some quality properties of 10 different kinds of apricot kernel oils produced by the different brands. The lowest value of free fatty acid with 0.30 % was determined in the A5 sample. The antioxidant activity results of A1 brand apricot oil sample were found similar to A4 brand apricot oil ($P$>0.05). In the results of the total phenolic content was lowest in A5 sample with 101.17 mg GAE/100g. The results of the highest antioxidant activity and total phenolic content were determined in the sample A3. The common major fatty acids in the analyzed oil samples were determined as oleic acid, linoleic acid, palmitic acid and stearic acid. Oleic acid was determined as the main unsaturated fatty acid component for all oil types except the A1 sample.

**Keywords:**

- Apricot Kernel Oil
- *Prunus Armeniaca*
- Fatty Acid
- Antioxidant Activity

[1] Pınar GÜMÜŞ (Orcid ID: 0000-0003-4085-9859), Kilis 7 Aralik University, Faculty of Yusuf Serefoglu Health Sciences, Department of Nutrition and Dietetics, Kilis, Türkiye
[2] Ümit Haydar EROL (Orcid ID: 0000-0001-6126-5844), Kilis 7 Aralik University, Advanced Technology Application and Research Center, Kilis, Türkiye

***Corresponding Author:** Pınar GÜMÜŞ, e-mail: dr.pinargumus@gmail.com

## INTRODUCTION

Apricot (*Prunus armeniaca* L.) is a member of the *Rosaceae* family (Kiralan et al., 2019). It is one of the main export products of Turkey widely grown around the worldwide (Kusmenoglu et al., 2008; Ozcan et al., 2010). It is characterized by high amounts of oil, carbohydrates, fibre, vitamins, minerals and phenolics with health-enhancing impacts (Sharma et al., 2016; Kiralan et al., 2018). Apricot is considered a delicious fruit consumed as fresh and dried; it is also used for edible, cosmetic and medicinal purposes due to its possible nutritional and chemical composition (Gundogdu et al., 2011; Akhone et al., 2022; Pawar and Nema, 2023).

Apricot is one of the most important fruits economically. It is widely known that apricot is one of the leading export products of Turkey. The main province of Turkey where apricots are frequently grown is Malatya. Apricot kernel, a waste product of apricot fruit, is a significant source of proteins, vitamins, minerals and carbohydrates and its oil is rich in unsaturated fatty acids and oleic acid being prevalent. Oil yield of apricot kernel alters with region, variety and oil extraction method (Kusmenoglu et al., 2008; Candan and Arslan, 2021; Akhone et al., 2022; Pawar and Nema, 2023).

Vegetable oils are a crucial component of the diet and help maintain health. Depending on the plant source, the oils extracted from plant seeds might be either edible or not. Some fruit seeds such as apricot, citrus and apple can be used as sources of oils. Apricot kernel oil considered as edible oil has become quite popular. This oil is an important source of saturated and unsaturated fatty acids, containing palmitic, stearic, linoleic, myristic, oleic, palmitoleic, and linolenic acid. It can also be utilized for industrial purposes gained importance amongst the consumers (Kusmenoglu et al., 2008; Ozcan et al., 2010; Gupta et al., 2012; Shariatifar et al., 2017; Stryjecka et al., 2019; Pawar and Nema, 2023).

In this study, apricot kernel oils supplied in the local markets of Turkey were evaluated in terms of some quality attributes such as free fatty acid, color, refractive index, total phenolic compounds and antioxidant activity and fatty acid composition.

## MATERIALS AND METHODS

### Materials

In this study, methanol, gallic acid, trolox, phenolphthalein, NaOH, Folin-Ciocalteu's reagent, sodium carbonate, potassium persulfate were purchased from Merck Milipore (Hohenbrunn, Germany); hexane, potassium hydroxide, diethyl ether, and ABTS purchased from Sigma-Aldrich Co. (Louis, USA). 10 different apricot kernel oils used in the study were obtained from various local markets of Turkey.

### Methods

### Chemical Extraction for Total Phenolics and Antioxidant Activity Analyses

100 ml of methanol was added to approximately 25 grams of each oil and mixed at room temperature on magnetic stirrers and in sealed flasks until the extraction solvent became colorless. This process was repeated at least five times. The obtained extracts were filtered with Whatman filter paper and the filtrate was collected. Then, methanol was removed at 60 °C in a Buchi, R300 model evaporator. The residues formed at the bottom of the flask were dissolved in methanol at volumes depending on detection limits and used for analysis (AOAC, 1990).

## Physicochemical and Color Analyses

Color analyses of apricot kernel samples were made using the colorimetric method. Colorimetric measurements were made with Techkon, SpectroDens model (Königstein, Germany) colorimeter by taking L*, a* and b* values. The refractive index of apricot kernel oil samples was determined by placing 2-3 drops of oil sample on the prism using Abbe type refractometer (Soif Optical Instruments, China). The process was carried out at room temperature (AOAC, 1995). The free fatty acid (FFA%) values of apricot kernel oils were calculated by taking 5 g oil samples and dissolving them in 50 ml of methanol/diethyl ether (50/50%) solution, adding a few drops of phenolphthalein and titration with 0.1 N NaOH solution (AOAC, 1995).

## Determination of Total Phenolic Content

The total phenolic content of oil samples collected from different brands was determined. Briefly, the analyses were carried out as follows: 0.02 mL of extract and 1.58 mL of water were taken as a sample, to which 0.1 mL of Folin-Ciocalteu's reagent was added, followed by 0.3 mL of 20% (w/v) sodium carbonate. The mixture was allowed to stand at room temperature for 2 hours and then its absorbance was measured at 760 nm wavelength using a Biochrom, Libra S70 spectrophotometer (Cambridge, UK). Gallic acid was used as standard and the results were expressed as milligrams of gallic acid equivalent (GAE) per 100 gram. The total phenolic content of the samples was calculated using a calibration graph plotted with standard gallic acid solutions (Castro-Concha et al., 2014).

## Determination of Antioxidant Activity (ABTS Assay)

Antioxidant activity measurements of the extracts of different types of oil samples were carried out using ABTS (2,2-azino bis (3-ethyl benzothiazoline-6-sulfonic acid) method. The analyses were performed according to the method developed by Re et al. (1999) and were determined on the basis of the decrease in absorbance values measured at 734 nm wavelength by oxidation of ABTS radical cation by antioxidants. 7 mM ABTS solution was mixed with 2.45 mM potassium persulfate solution for 12-15 hours and diluted by reduction. The absorbance value was measured by adding 50 µL of oil extracts to this diluted ABTS solution. The diluted ABTS solution was used as a blind sample and Trolox was used as a standard solution. Antioxidant activity results were calculated as µmol TEAC/g using Trolox standard calibration graph.

## Fatty Acid Composition

Extraction and esterification processes were carried out to detect the fatty acid ester content of apricot kernel oil samples (O'Fallon et al., 2007). The oil sample was taken and extracted with hexane for 1 hour. Extracted samples were filtered and esterified using 0.1N methanolic KOH. Esterified samples were analyzed in a mass detector (5977MSD) using a DB-WAX (30m, 0.32mm, 0.25µm) column in a GC/MS (Agilent, 7890B GC-5977MSD) instrument. Analysis was carried out with minor modifications to the methodology of Saini & Keum (2016). The temperature program was applied by modifying it according to the reference method. The oven temperature was first increased from 110°C to 175 °C by increasing 10°C per minute and kept at this temperature for 20 minutes. Then, the temperature was increased to 240ºC by increasing 10ºC per minute and kept at this temperature for 5 minutes. Detector and injection temperature were kept constant at 250ºC.

## Statistical Analysis

Statistical analysis of the data and multiple comparison tests was performed in the JMP 14 program. Student's t-test was used for multiple comparisons. For the parameters in the analysis of variation, any P value below 0.05 was considered significant. All analyzes were carried out with 3 replications.

## RESULTS AND DISCUSSION

### Physicochemical and Color Analyses

Color, FFA, and refractive index results of apricot kernel oils of different brands are given in Table 1. The color is one of the most significant parameters for detecting consumer acceptance. As the L* value approaches 0, it shows the darkness of the oil, and as it approaches 100, it shows the lightness of the oil. The L* values of the samples were determined in the range of 10.66-30.02. When the L* values of the oils were examined, it was determined that the A5 sample was the brightest, while the A7 sample had the darkest color. When the a* values of the samples were analyzed, it was found that the A2 coded sample had the lowest a* value (-0.58), and the highest a* value belonged to the A7 sample (8.67). When the b* values of the samples were analyzed, the lowest b* value was found in the A5 (8.70) coded sample, while the highest b* value was found in the A8 (26.27) sample. Candan and Arslan (2021) stated that apricot kernel oils obtained by conventional methods had higher L* (31.15), while, a*(-1.66) and b* (3.98) values. It can be seen that the refractive indexes of apricot kernel oils varied between 1.433-1.474. A3 sample had lowest refractive index value, while the highest values were seen in A1, A5, A6 and A9 coded samples. Singh et al. (2010) reported that the wild apricot oil has refractive index with 1.468. The refractive index of apricot kernel oil was found to range between 1.4720-1.4729 (Gupta et al. 2012). While free fatty acid (% oleic acid) was measured at the highest value with 6.59 in A7 sample; the lowest value was determined in the A5 sample with 0.30. Ozcan et al. (2010) evaluated the acid value of different brands of apricot kernel oil and detected between 0.3 and 1.56% of oleic acid; Gupta et al. (2012) reported that apricot oils showed low acid value (2.27-2.78 mg KOH/g). Ozyurt (2019) stated that the acid value of apricot oil 0.81 mg KOH/g oil. Gayas et al. (2020) studied that the application of ultrasound extraction compared with conventional methods (mechanical and soxhlet extraction) in order to obtain oil from apricot kernels. It was reported that acid values of apricot kernel oil acquired by different extraction methods 2.73, 2.71, and 2.86 mg KOH/g oil, respectively.

**Table 1.** Physicochemical and color results of different apricot kernel oils

| Samples | Free Fatty Acid (% Oleic Acid) | Refractive Index ($°n_D$) | L* | a* | b* |
|---|---|---|---|---|---|
| A1 | $0.63\pm0.01^{ef}$ | $1.474\pm0.00^{a}$ | $16.07\pm0.08^{d}$ | $0.01\pm 0.03^{f}$ | $19.98\pm0.05^{c}$ |
| A2 | $0.60\pm0.21^{ef}$ | $1.473\pm0.00^{b}$ | $20.58\pm0.77^{b}$ | $-0.58\pm0.33^{g}$ | $17.47\pm0.56^{d}$ |
| A3 | $0.74\pm0.01^{e}$ | $1.433\pm0.00^{e}$ | $17.79\pm0.83^{c}$ | $-0.16\pm 0.03^{f}$ | $11.87\pm0.17^{e}$ |
| A4 | $6.44\pm0.07^{a}$ | $1.470\pm0.00^{d}$ | $15.86\pm0.58^{d}$ | $5.73\pm 0.06^{c}$ | $25.75\pm0.99^{a}$ |
| A5 | $0.30\pm0.08^{f}$ | $1.474\pm0.00^{a}$ | $30.02\pm0.45^{a}$ | $1.60\pm0.18^{e}$ | $8.70\pm1.36^{f}$ |
| A6 | $0.71\pm0.04^{e}$ | $1.474\pm0.00^{a}$ | $15.28\pm0.22^{d}$ | $1.59\pm0.03^{e}$ | $21.69\pm0.24^{bc}$ |
| A7 | $6.59\pm0.01^{a}$ | $1.473\pm0.00^{b}$ | $10.66\pm0.11^{e}$ | $8.67\pm0.02^{a}$ | $17.33\pm0.15^{d}$ |
| A8 | $2.11\pm0.03^{b}$ | $1.472\pm0.00^{c}$ | $15.85\pm0.23^{d}$ | $6.60\pm0.06^{b}$ | $26.27\pm0.36^{a}$ |
| A9 | $1.50\pm0.06^{c}$ | $1.474\pm0.00^{a}$ | $16.66\pm0.62^{cd}$ | $4.23\pm0.04^{d}$ | $23.21\pm0.50^{b}$ |
| A10 | $1.09\pm0.03^{d}$ | $1.473\pm0.00^{b}$ | $19.63\pm0.91^{b}$ | $-0.09\pm0.04^{f}$ | $22.21\pm0.59^{b}$ |

Values followed by different letters within the same column are significantly different from each other ($p<0.05$)

## Antioxidant Activity and Total Phenolic Content

The results of total phenolic compound and antioxidant activity of apricot kernel oils are shown in Table 2. The characteristic properties of these oils are important in terms of the quality of the oil as well as the amount of total phenolic compound, while the antioxidant activity of these oils has an influence on the health effect (Ozyurt, 2019). It can be seen that A3 coded sample had the highest total phenolic content, 3914.74 mg GAE/100 g. The total phenolic contents of the other samples were determined in the range of 101.17 and 354.46 mg GAE/100 g. It was found that the A10 coded sample had the lowest antioxidant activity, while the highest antioxidant activity was found in the A3 sample. For total phenolic content results, the difference between A9 and A10 coded samples was statistically insignificant ($P > 0.05$); for antioxidant results, the difference between A1 and A4 coded samples was statistically insignificant ($P > 0.05$) (Table 2). The effects of processing, packaging and storage of oils can also be another reason for the differences in the quality properties of oils. Uluata (2016) found that total phenolic content of apricot seed oils was 24.9 and 26.3 μg gallic acid/g oil and antioxidant activity of apricot seed oils were 168.8 and 151.2 μg Trolox/g oil, using ABTS assay. Ozyurt (2019) stated that total phenolic compound and antioxidant activity (ABTS assay) of apricot seed oil 804.47 and 380.93 mg GAE/L oil, respectively. Yucel Sengun et al. (2021) stated that total phenolic content of apricot kernel oil was 86.75 mg GAE/100 g.

**Table 2.** Total phenolic content and antioxidant activity results of different apricot kernel oils

| Samples | Total phenolics (mg GAE/100g) | Antioxidant activity (μmol TEAC/g) |
|---|---|---|
| A1 | $281.23 \pm 8.75^{c}$ | $9.82 \pm 0.73^{def}$ |
| A2 | $354.46 \pm 8.62^{b}$ | $18.01 \pm 1.34^{b}$ |
| A3 | $3914.74 \pm 14.51^{a}$ | $34.02 \pm 2.53^{a}$ |
| A4 | $120.45 \pm 2.85^{fg}$ | $9.87 \pm 0.73^{def}$ |
| A5 | $101.17 \pm 3.15^{h}$ | $11.74 \pm 0.87^{cd}$ |
| A6 | $131.74 \pm 1.75^{f}$ | $8.51 \pm 0.77^{efg}$ |
| A7 | $199.30 \pm 7.47^{d}$ | $13.78 \pm 0.92^{c}$ |
| A8 | $165.67 \pm 1.63^{e}$ | $10.49 \pm 1.12^{de}$ |
| A9 | $107.51 \pm 3.49^{gh}$ | $7.80 \pm 1.16^{fg}$ |
| A10 | $111.84 \pm 4.16^{gh}$ | $7.36 \pm 0.84^{g}$ |

Different letters within the same column are statistically different from each other ($p<0.05$)

## Fatty Acid Composition

The results of fatty acid composition of apricot kernel oils are shown in Table 3. The common major fatty acids in the analyzed oil samples were determined as oleic acid, palmitic acid, linoleic acid and stearic acid. The minor fatty acids are behenic acid, arachidic acid, myristic acid and cinnamic acids. In terms of saturated and unsaturated fatty acids in all oil samples; palmitic acid was measured as the major saturated fatty acid component, while the minor saturated fatty acid component was measured as myristic acid. Apricot kernel oil is an important source of unsaturated and saturated fatty acids, containing myristic, oleic, palmitic, linoleic, stearic, palmitoleic, and linolenic acid (Stryjecka et al., 2019). Oleic acid was detected as the major unsaturated fatty acid component for all species (31.28%, except A1 sample). The highest percentage of fatty acid was found in A4 sample as oleic acid (71.40%). The amount of oleic acid in the examined oil samples constitutes approximately 32% to 72% of the total fatty acids. While cinnamic acid was detected only in A2 sample; myristic acid and arachidic acid were determined as fatty acids in A8, A9 and A10 samples and behenic acid was found only in A9 and A10 samples. It was concluded that this may be due to the use of different extraction methods (Femenia et

al., 1995; Al-Juhaimi et al., 2021; Hao et al., 2022; Akhone et al., 2022; Alajil et al., 2022; Pawar and Nema, 2023). The ratios of monounsaturated fatty acids were measured between 31.28% and 71.40%. Polyunsaturated fatty acids in apricot kernel oil samples were determined at rates ranging from 8.14% to 43.36%. The richest oil sample in terms of total unsaturated fatty acids content was A7 with 87.57%, while A3 with 16.86% of total saturated fatty acids was the oil sample containing the most saturated fatty acids. The ratio of ΣPUFA/ΣSFA is very important in terms of nutrition. If the ΣPUFA/ΣSFA ratio is greater than 1 in human nutrition, it is considered as edible oils with high nutritional value (Guici El Kouacheur et al., 2023). The ΣPUFA/ΣSFA ratio was 0.72, which was the lowest in A3 sample. In other oil samples, this ratio is above 1 and can be evaluated in the category of oil with high nutritional value. The importance of the nutritional value and health advantages of fatty acids is obvious. In addition, linoleic acid has a positive nutritional role and beneficial physiological effects in the prevention of coronary heart disease and cancer. In particular, the inability of linoleic acid to be produced in the body for humans requires it to be taken from outside the body (Dubois et al., 2007). The fact that linoleic acid is the second most plentiful unsaturated fatty acid in the examined apricot kernel oils explains the importance of these oils in human nutrition. If the previous studies on *Prunus* cultivars are compared in terms of fatty acids; it can be seen that the linoleic and oleic acid percentages of the examined apricot kernel oils are quite high (Zhou et al., 2016).

**Table 3**. Fatty acid composition of different apricot kernel oils

| Component (%) | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cinnamic acid (C9:0)** | - | 0.18 | - | - | - | - | - | - | - | - |
| **Myristic acid (C14:0)** | - | - | - | - | - | - | - | 0.06 | 0.08 | 0.09 |
| **Palmitic acid (C16:0)** | 6.88 | 8.53 | 13.97 | 4.64 | 9.98 | 6.66 | 8.01 | 9.88 | 9.38 | 8.70 |
| **Stearic acid (C18:0)** | 2.89 | 2.45 | 2.89 | 2.28 | 2.51 | 2.39 | 1.49 | 1.67 | 4.17 | 3.73 |
| **Oleic acid (C18:1)** | 31.28 | 45.05 | 51.86 | 71.40 | 51.92 | 46.06 | 56.61 | 61.01 | 45.47 | 42.26 |
| **Linoleic acid (C18:2)** | 43.36 | 31.84 | 12.16 | 8.14 | 31.76 | 33.75 | 30.96 | 23.75 | 38.01 | 41.98 |
| **Arachidic acid (C20:0)** | - | - | - | - | - | - | - | 0.13 | 0.26 | 0.42 |
| **Behenic acid (C22:0)** | - | - | - | - | - | - | - | - | 0.49 | 0.49 |
| **ΣMUFA** | 31.28 | 45.05 | 51.86 | 71.40 | 51.92 | 46.06 | 56.61 | 61.01 | 45.47 | 42.26 |
| **ΣSFA** | 9.77 | 11.16 | 16.86 | 6.92 | 12.49 | 9.05 | 9.50 | 11.74 | 14.38 | 13.43 |
| **ΣUFA** | 74.64 | 76.89 | 74.92 | 79.54 | 83.68 | 79.81 | 87.57 | 84.76 | 83.48 | 84.24 |
| **ΣPUFA** | 43.36 | 31.84 | 12.16 | 8.14 | 31.76 | 33.75 | 30.96 | 23.75 | 38.01 | 41.98 |
| **ΣPUFA/ ΣSFA** | 4.43 | 2.85 | 0.72 | 1.18 | 2.54 | 3.73 | 3.26 | 2.02 | 2.64 | 3.12 |

(MUFA: Monounsaturated fatty acids, SFA: Saturated fatty acids, UFA: Unsaturated fatty acids and PUFA: Polyunsaturated fatty acids)

## CONCLUSION

In this study, 10 apricot kernel oils obtained from the different brands were researched to determine whether they have generally similar physicochemical properties, antioxidant activities, fatty acid composition and compared with each other. Based on this study, it was observed that there were not significant differences between A1 and A4 samples with respect to antioxidant activity results ($P>0.05$); for total phenolic content, the difference between A9 and A10 samples was statistically insignificant ($P>0.05$). Although there is no significant difference between the L*, a* and b* values of some of the samples ($P>0.05$), it has been found that all color values are statistically different from each other ($P<0.05$). According to the physicochemical analysis results, A1 and A3 coded samples had the lowest unsaturated fatty acid composition, while A7 and A8 coded samples had the highest unsaturated fatty acid composition. Considering the data obtained from this study, it can be said that the oil coded A2 is the good quality oil since it has desired FFA value and refractive index, higher antioxidant activity and

total phenolic content. It can also be considered as edible oils with high nutritional value since the ratio of ΣPUFA/ΣSFA was greater than 1. This research increases the understanding of the quality and characterization of apricot kernel oils and can also be a baseline for improving regulations for these oils.

## ACKNOWLEDGEMENTS

Both authors thank Kilis 7 Aralik University for providing laboratory facilities for this study.

### Conflict of Interest

The article authors declare that there is no conflict of interest.

### Author's Contributions

Both authors significantly contributed to different processes in the article. The authors read and approved the final manuscript.

## REFERENCES

Al-Juhaimi, F. Y., Ghafoor, K., Özcan, M. M., Uslu, N., Babiker, E. E., Ahmed, I. A. M., & Alsawmahi, O. N. (2021). Phenolic compounds, antioxidant activity and fatty acid composition of roasted alyanak apricot kernel. *Journal of Oleo Science*, 70(5), 607-613.

Alajil, O., Sagar, V. R., Kaur, C., Rudra, S. G., Vasudev, S., Chandran, D., & Lorenzo, J. M. (2022). Chemical Characterization of Apricot Kernel: Nutraceutical Composition, Amino Acid, and Fatty Acid Profile. *Food Analytical Methods*, 15(9), 2594-2604.

AOAC, M. (1990). Association of official analytical chemists. Official methods of analysis. AOAC: Official Methods of Analysis, 1, 69-90.

AOAC. (1995). Association of official analytical chemists. Official methods of analysis 16th Ed. Washington DC, USA.

Akhone, M. A., Bains, A., Tosif, M. M., Chawla, P., Fogarasi, M., & Fogarasi, S. (2022). Apricot kernel: bioactivity, characterization, applications, and health attributes. *Foods*, 11(15), 2184.

Candan, A., & Arslan, D. (2021). Enzymatic pre-treatment in cold pressing: Influence on flaxseed, apricot kernel and grape seed oils. *Grasas y Aceites*, 72(4), e432-e432.

Castro-Concha L. A., Tuyub-Che J., Moo-Mukul A., Vazquez-Flota F. A., Miranda-Ham, M. L. (2014). Antioxidant capacity and capsicum total phenolic content of chinense jacq. (habanero pepper) in fruit tissues at different stages of ripening. *The Scientific World Journal*, 25:23. https://doi.org/10.1155/2014/809073

Dubois, V., Breton, S., Linder, M., Fanni, J., & Parmentier, M. (2007). Fatty acid profiles of 80 vegetable oils with regard to their nutritional potential. *European Journal of Lipid Science and Technology*, 109(7), 710-732.

Femenia, A., Rossello, C., Mulet, A., & Canellas, J. (1995). Chemical composition of bitter and sweet apricot kernels. *Journal of Agricultural and Food Chemistry*, 43(2), 356-361.

Gayas, B., Kaur, G., & Singh, A. (2020). Ultrasound assisted extraction of apricot kernel oil: Effect on physicochemical, morphological characteristics, and fatty acid composition. *Acta Alimentaria*, 49(1), 23-31.

Guici El Kouacheur, K., Cherif, H. S., Saidi, F., Bensouici, C., Fauconnier, M. L. (2023). *P runus amygdalus* var. amara (bitter almond) seed oil: fatty acid composition, physicochemical parameters, enzyme inhibitory activity, antioxidant and anti-inflammatory potential. *Journal of Food Measurement and Characterization*, 17(1), 371-384.

Gupta, A., Sharma, P. C., Tilakratne, B. M. K. S., & Verma, A. K. (2012). Studies on physico-chemical characteristics and fatty acid composition of wild apricot (Prunus armeniaca Linn.) kernel oil. *Indian Journal of Natural Products and Resources*. 3(3), 366-370.

Gundogdu, M., Ozrenk, K., Kan, T. & Gecer, M. K. (2011). Van Yöresinde Yetiştirilen Bazı Kayısı Çeşitlerinin Fenolik Bileşik, Tokoferol ve Yağ Asidi İçerikleri. *Journal of the Institute of Science and Technology*, 1(4), 31-36.

Hao, Y., Wang, J., Qi, L., Qiu, Y., Liu, H., Zhang, Y., & Wang, X. (2022). A comparative study of apricot kernel oil yield using different extraction methods. *BioResources*, 17(3), 5146.

Kiralan, M., Kayahan, M., Kiralan, S. S., & Ramadan, M. F. (2018). Effect of thermal and photo oxidation on the stability of cold-pressed plum and apricot kernel oils. *European Food Research and Technology*, 244, 31-42.

Kiralan, M., Özkan, G., Kucukoner, E., & Ozcelik, M. M. (2019). Apricot (*Prunus armeniac* a L.) Oil. Fruit oils. *Chemistry and functionality*, 505-519.

Kusmenoglu, S. Orhan, İ., Koca, U., Aslan, S., Kartal, M. (2008). Fatty acid analysis of some Turkish apricot seed oils by GC and GC-MS techniques. *Turkish Journal of Pharmaceutical Sciences*, 5(1), 29-34.

Ozcan, M. M., Ozalp, C., Unver, A., Arslan, D., Dursun, N. (2010). Properties of apricot kernel and oils as fruit juice processing waste. *Food and Nutrition Sciences*, 1, 31-37.

O'Fallon, J. V., Busboom, J. R., Nelson, M. L., & Gaskins, C. T. (2007). A direct method for fatty acid methyl ester synthesis: application to wet meat tissues, oils, and feedstuffs. *Journal of animal science*, 85(6), 1511-1521.

Ozyurt, H. (2019). The comparison of the quality properties of some commercial cold pressed seed oils. *Journal of the Turkish Chemical Society Section A. Chemistry*, 6(2), 149-156.

Pawar, K. R., & Nema, P. K. (2023). Apricot kernel characterization, oil extraction, and its utilization: a review. *Food Science and Biotechnology*, 1-15.

Re, R., Pellegrini, N., Proteggente, A., Pannala, A., Yang, M., & Rice-Evans, C. (1999). Antioxidant activity applying an improved ABTS radical cation decolorization assay. *Free Radical Biology and Medicine*, 26(9-10), 1231-1237.

Saini, R. K., & Keum, Y. S. (2016). GC–MS and HPLC–DAD analysis of fatty acids and tocopherols in sweet peppers (Capsicum annuum L.). *Journal of Food Measurement and Characterization*, 10(3), 685-689.

Shariatifar, N., Pourfard, I. M., Khaniki, G. J., Nabizadeh, R., Akbarzadeh, A., Nejad, A. S. M. (2017). Mineral Composition, Physico-Chemical Properties and Fatty Acids Profile of Prunus Armeniaca Apricot Seed Oil. *Asian Journal of Chemistry*, 29(9).

Sharma, M., Sharma, P. C., Kaundal, K., & Sharma, H. (2016). Antifungal activity assessment of essential oil of bitter apricot (Prunus armeniaca) kernels. *Indian Phytopathol*, 69(3), 290-293.

Singh, R., Gupta, A., Joshi, D., & Nainwal, N. (2010). Wild apricot (Prunus armeniaca) kernel oil: a strategic alternative to value added fatty acids. *International Journal of Essential Oil Therapeutics*, 4, 1-5.

Stryjecka, M., Kiełtyka-Dadasiewicz, A., Michalak, M., Rachoń, L., & Głowacka, A. (2019). Chemical composition and antioxidant properties of oils from the seeds of five apricot (Prunus armeniaca L.) cultivars. *Journal of oleo science*, 68(8), 729-738.

Uluata, S. (2016). Effect of extraction method on biochemical properties and oxidative stability of apricot seed oil. *Academik Food Journal*, 14(4), 333-340.

Yucel Sengun, İ., Yucel, E., Kilic, G., & Ozturk, B. (2021). Kabak ve kayisi çekirdeği yağlarinin yağ asidi kompozisyonu, biyoaktif özelliklerinin belirlenmesi. *The Journal of Food*, 46(3), 608-620.

Zhou, B., Wang, Y., Kang, J., Zhong, H., & Prenzler, P. D. (2016). The quality and volatile-profile changes of Longwangmo apricot (Prunus armeniaca L.) kernel oil prepared by different oil-producing processes. *European Journal of Lipid Science and Technology*, 118(2), 236-243.