Sarı H. A., Otağ, M. R. (2024). Physicochemical Properties of Different Melon Seed Oils Dried at Different Temperatures. *The Black Sea Journal of Sciences*, 14(2), 970-981.

The Black Sea Journal of Sciences, 14(2), 970-981, 2024. DOI: 10.31466/kfbd.1466809

KFBD

Karadeniz Fen Bilimleri Dergisi
The Black Sea Journal of Sciences
ISSN (Online): 2564-7377 https://dergipark.org.tr/tr/pub/kfbd

Araştırma Makalesi / Research Article

Physicochemical Properties of Different Melon Seed Oils Dried at Different Temperatures

Hafize Ayla SARI[1*], Mustafa Remzi OTAĞ[2]

Abstract

In this study, the effect of the drying process on the quality of oils obtained from different melon seeds was investigated. The seeds of two different melon varieties (Kırkağaç, Hasanbey) were separated and dried in the oven at different temperatures (30, 50 and 70 °C). Moisture, 1000 grain weight, width, length, thickness, oil yield, free fatty acidity, peroxide value, color values (L*, a*, b*), and total phenolic substance amounts and fatty acid composition were examined. The average of initial moisture values was 6.42% and 5.48%. The drying process was carried out until the moisture rate of melon seeds reached 1%. The average of most values of the cores varied from 4.55-5.16 mm, length 12.82-13.18 mm, thickness 1.21-1.38 mm and 1000 grain weights varied from 52.40-45.70 g. The amount of total phenolic substances of Kırkağaç melon seed oil was found in the range of 584-691 mg GAE /kg, and Hasanbey melon seed oil in the range 780-840 mgGAE / kg. The amount of total phenolic substance decreased with the applied heat treatment. The peroxide values of the oil obtained from Kırkağaç and Hasanbey beans in terms of meqO2 / kg varied between 6.9-8.4 and 7.2-9.1, respectively. The highest peroxide value was observed in oil obtained from beans dried at 70°C in both varieties. It has been observed that oleic and palmitic acids are also followed by linoleic acid compared to fatty acid composition compared to other fatty acids. According to the results obtained, it was determined that the most effective drying temperature was 50°C in terms of efficiency and quality.

Keywords: Melon, Melon seed oil, Drying, Fatty acids, Total phenol, Physicochemical properties.

Farklı Sıcaklıklarda Kurutulan Değişik Kavun Çekirdeği Yağlarının Fizikokimyasal Özellikleri

Öz

Bu çalışmada, kurutma işleminin farklı kavun çekirdeklerinden elde edilen yağların kalitesine etkisi araştırılmıştır. İki farklı kavun çeşidinin (Kırkağaç, Hasanbey) tohumları ayrılarak farklı sıcaklıklarda etüvde kurutulmuştur. Kurutma sıcaklığı olarak 30, 50, 70°C, kavunlarda Kırkağaç ve Hasanbey çeşitleri kullanılmıştır. Nem, 1000 tane ağırlığı, en, boy, kalınlık, yağ verimi, serbest yağ asitliği, peroksit değeri, renk değerleri (L*, a*, b*) ve toplam fenolik madde miktarları ile yağ asidi kompozisyonu incelenmiştir. Başlangıç nem değerlerinin ortalaması %6,42 ve %5,48 olarak belirlenmiştir. Kurutma işlemi kavun tohumlarının nem oranı %1'e ulaşana kadar gerçekleştirilmiştir. Çekirdeklerin en değerlerinin ortalaması 4,55-5,16 mm, boyu 12,82-13,18 mm, kalınlığı 1,21-1,38 mm ve 1000 tane ağırlıkları 52,40-45,70 g olarak değişmiştir. Toplam fenolik madde miktarı Kırkağaç kavun çekirdeği yağı 584-691 mg GAE/kg, Hasanbey kavun çekirdeği yağı 780-840 mgGAE/kg aralığında bulunmuştur. Toplam fenolik madde miktarı uygulanan ısıl işlem ile azalmıştır. Kırkağaç ve Hasanbey çekirdeklerinden elde edilen yağların meqO2/kg cinsinden peroksit değerleri sırasıyla 6,9-8,4 ve 7,2-9,1 arasında değişmiştir. Her iki çeşitte de en yüksek peroksit değeri 70°C'de kurutulan fasulyelerden elde edilen yağda gözlenmiştir. Yağ asidi kompozisyonu diğer yağ asitleri ile kıyaslandığında oleik ve palmitik asidin linoleik asit tarafından takip edildiği görülmüştür. Elde edilen sonuçlara göre verim ve kalite açısından en etkili kurutma sıcaklığının 50°C olduğu tespit edilmiştir.

Anahtar Kelimeler: Kavun, Kavun çekirdeği yağı, Kurutma, Yağ Asitleri, Toplam fenolik madde, Fizikokimyasal özellikler.

[1]Aydın Adnan Menderes University, Çine Vocational School, Food Processing Department, Aydın, Turkiye, asari@adu.edu.tr
[2]Giresun University, Engineering Faculty, Food Engineering Department, Giresun, Turkiye, mustafa.otag@giresun.edu.tr

[*]Sorumlu Yazar/Corresponding Author
Geliş/Received: 08.04.2024 **Kabul/Accepted:** 02.06.2024 **Yayın/Published:** 18.06.2024

1. Introduction

Melon (*Cucumis melo*), one of the species belonging to the family of *Cucurbitaceae*, is an annual plant that is cultivated in regions with warm and mild climates. Its oval or elliptical fruit with long seeds weighs between 1 and 7 kg. Melon is a pulpy and succulent vegetable with a pleasant aroma and a delicate flavor; it is generally harvested during the summer months. Typically, it is oval or round, growing up to a length of 3.21 cm and a width of 2.86 cm (Khoshnm et al., 2016).

It is known that melon fruit contains approximately 90% water, 0.84% protein, 0.19% fat, 0.65% ash, 0.9% fiber and 8.16% carbohydrate (Schaffer and Paris, 2003). In a study on growth and yield characteristics and characterization of some melon varieties, it was reported that sucrose was the most important carbohydrate followed by fructose and glucose. It was also found that vitamin A content was between 500 and 4200 IU/100g, vitamin C content was 6-60 mg/100g and potassium content was between 130 and 330 mg/100g depending on the variety. In a study on growth and yield characteristics and characterization of some melon varieties. (Salunkhe and Kadam,1998). Amaro et al. (2015), in a study on biologically active compounds in melon, determined that the vitamin C content of melon fruit was 36 mg/100g, vitamin A content was 0.17 mg/100g, α tocopherol content was 0.05 mg/100g, γ tocopherol content was 0.11 mg/100g and total phenolic substance content was 109 mg/100g. Melon seeds are a good source of protein (15-36%) and fiber (7-44%) (Silva et al., 2020). According to the study reported by Mallek-Ayadi et al. (2018), the most abundant phenolic compound in melon seed oil was amentoflavone (32.80 ± 0.21 μg/g fresh weight (fw)). The phenolic acids identified were gallic (7.26 ± 0.02 μg/g fw), protocatechuic (0.89 ± 0.01 μg/g fw), caffeic (3.13 ± 0.00 μg/g fw) and rosmarinic acids (2.91 ± 0.04 μg/g fw).

According to cultivation areas around the world, melon varieties are classified as: A. Cantaloupes or Aromatic Melons, B. Casaba (with a fruit with white flesh) and Honeydew (with a fruit with green flesh) Melons, C. Galia Melons, D. Japanese Melons, E. Melons of Ananas Variety, F. French (Charentais) Melons, G- Spanish Melons, H. Italian Melons and I- Turkish Melons (Rolim et al., 2019).

Melon varieties are widely cultivated in numerous countries all over the world, the biggest producer countries are China, Turkey, Iran, Egypt and India (FAO, 2018). Table 1 illustrates the volumes of melon production by producer countries.

Table 1. Volumes of melon production by producer countries (FAO, 2018).

Country	China	Turkey	Iran	Egypt	India	Kazakhstan	USA	Spain	Italy
Volume of Production (in tons)	16009	1854	1615	1060	1028	898	783	661	632

With a production capacity of 1403 tons, Turkey is a major melon producer ahead of many other countries (TUIK, 2023). Due to favorable climatic conditions that ensure the cultivation of melons, melon is widely produced in all regions across our country (Eşiyok et al., 2005). The melon varieties produced in our country include Topatan and Kantalup, two important varieties found in markets during summer, and the varieties of Altınbaş and Hasanbey which are winter melons with a higher resistance level (Yılmaz et al., 2021; Lija and Beevy, 2021).

The melon varieties that are widely cultivated in Turkey are Hasanbey, Kırkağaç, Yuva, Van, Topatan, Honeydew and Casaba (Anonymous, 2007). Table 2 shows the volumes of melon production in our country by year.

Table 2. Volumes of melon production in Turkey by years (TUİK, 2023).

Years	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Volumes of Production (in tons)	1647	1688	1699	1707	1719	1854	1813	1753	1777	1724	1638	1587	1403

With a production amount of 116 tons, the province of Adana ranks first in respect of melon production in our country, followed by the provinces of Konya, Denizli, Ankara, Manisa, Balıkesir, Çankırı and Diyarbakır, respectively (TUİK, 2023).

Besides being used for fresh consumption and also for the production of fruit juices, jams, ice creams, fruit yogurts, cakes and pickles, melons are used in the pharmaceutical and cosmetic industries as well (Zia et al., 2021).

The seeds of the melon varieties produced in our country can be consumed in many ways: Besides being directly consumed as a snack food, used to produce pastry products after roasting or can be eaten mixed with grape molasses or are also used in cooking dishes like stuffed meatballs, a kind of stuffed meatballs. Sübye, a kind of caudle, is also produced from melon seeds (Lija and Beevy, 2021).

In recent times, the food processing industry has focused on the possibilities to make optimal use of waste materials and by-products. This has created highly reusable new sources, which has eventually made it possible to produce a great variety of new foods. As a result, it is suggested that more efforts are required to improve the by-products and waste materials with nutritional and industrial value (El-Adawy et al., 1999).

As it is known, linoleic acid, which is one of the essential fatty acids, is very beneficial for human health, especially in terms of the brain and cardiovascular systems. Phytosterols are beneficial for human health by reducing cholesterol absorption. Tocopherols act as primary antioxidants by disrupting the reaction chain during oxidation (Katan et al., 2003; Wahle et al., 2015; da Silva and Jorge, 2017). Considering the mentioned important properties of essential fatty acids, phytosterols and tocopherols, it becomes very important to produce watermelon and melon seed oils containing these substances at significant rates and to offer them to people for consumption.

Nowadays, there has arisen a need for alternative oily seeds and kernels due to a scarcity of the resources of edible oils that are currently widely used (Ramadan et al., 2006). This gap in the supply of vegetable oils and saturated fats that is observed today all over the world has increased as a result of rapid industrial growth and an uncontrolled increase in population. This is a phenomenon that impacts developing countries with the result that it increases their dependence on foreign resources, and, additionally, people have difficulty in meeting their needs for edible oil. Such a shortage in vegetable oil sources has led to further research on alternative sources of oils and saturated fats of vegetable origin (Anwar et al., 2008).

The objective of this work is to investigate the effect of three different temperatures (30, 50, and 70 ºC) on the quality of oils obtained from the seeds of two different melon varieties (Kırkağaç, Hasanbey).

2. Materials and Methods

The seeds used in the present study were obtained from the variety of Kırkağaç-Altınbaş and from that of Hasanbey harvested in October 2019. The seeds were manually selected from the fruit pulp, washed and dried in a drying oven before using. The melon seeds used in the study were subjected to a drying process in a drying oven at three different temperatures of 30, 50, and 70 ºC. The seeds used in these three different drying experiments, 20 grams of seeds for each process, were obtained by manual selection from the fruit pulp. The analyses were undertaken in triplicate, with the average values of each analysis taken into account for the final analysis. Weight loss was monitored at 1 hour time intervals during the drying process. The drying process was completed when the moisture content of the melon seeds reached approximately 1%. A drying oven (Yücebaş Makine Tic. Ltd. Şti., İzmir, Turkey) with a constant air velocity of 0.3 m/s and 40x60 cm trays was used for the experiments.

2.1. Analyses on Melon Seeds

Fruit and seed dimensions: The width, length and thickness of 50 fruits were calculated, and the average values were taken into account.

2.1.1. 1000-Seed Weight

The 1000-seed weight was determined by weighing 100 unbroken and intact seeds and then multiplying the result by ten (Aksoy, 1991).

2.1.2. Determination of Moisture

The drying trays were weighed at an assay balance after they were dried for two hours at a temperature of 105±2°C in the drying oven and kept in a desiccator. To calculate the moisture content in percentage, the drying trays with 3-4 g seeds were kept in the drying oven, cooled off in the desiccator, and the process was carried on until the fixed weighing (AOAC, 2000).

2.2. Analysis of Oil in Melon Seed Oil

2.2.1. Determination of Free Fatty Acids (FFA) content

Free fatty acids and acid values were determined using the AOCS method (2006). Samples of 5 or 10 grams were weighed and dissolved in an ethyl alcohol-diethyl ether mixture of 50 or 150 ml. The solvent thus obtained was titrated in a 0.1N KOH solvent with a phenolphthalein indicator. FFA value was calculated as mg KOH/g oil.

2.2.2. Determination of Color

The Minolta Chroma Meter was used to measure the color coordinates (L*, a* and b* values) of the melon seed oil samples obtained in our study. The color coordinates of L* value, 0 (black) and100 (white), a* (+60 red; -60 green) and b* (+60 yellow; -60 blue) were determined using the color coordination system of CIE L*, a*, b*. The measurements were undertaken in triplicate on the melon seed oil samples obtained from each type and variety (Veg-Galvez et al., 2009).

2.2.3. Determination of peroxide value

The AOCS's Cd 8-53 standard method was used for this analysis (Anonymous, 1989).

2.2.4. Oil's Fatty Acid Composition

The fatty acid composition of the oil samples was determined using a chromatography technique based on fatty acid methyl ester values by esterifying them in an alkaline environment according to the method of FAME DGF c-VI11d. Fatty acid methyl esters were determined by gas chromatography (Shimadzu GC 2010) using a flame ionization detector (FID) and capillary column (Teknokroma TR CN 100, P/N TR882162 fused silica column, 60m x 0.25mm x 0.20µm). Operating conditions of the device; detector and injection block 260 °C, total flow rate 80ml/min, split ratio 1/40 ml/min.

2.2.5. Extraction

In the process of extraction the melon seed samples were ground for one minute in a coffee grinder (Bosch, MKM 6000, Type: KM 13) and homogenized by adding an 80% methanol solvent at a rate of 1:10 (w/v). The solvent thus obtained was then centrifuged for 10 minutes at 4°C and 5000 rpm, after which the first extract phase was separated, and the residue was extracted twice more. The samples were analyzed immediately after the extraction.

2.2.6. Determination of Total Phenolic Content

Total phenolic content was determined spectrophotometrically after extraction of phenolic substances from melon seeds. For extraction, 20 ml of methanol and water (80:20 v/v) was added to approximately 2g sample and shaken for 3 hours at room temperature. 20 ml of hexane was added to the remaining extract from the filtered samples and after phase separation in the separatory funnel, the remaining methanol phase was taken into tubes and used in the analyses (Vinha et al., 2005). The Folin-Ciocalteu assay was used for this analysis. The total phenolic content was calculated using a calibration graph consisting of Gallic acid solvents in different concentrations (Slinkard et al., 1977).

2.3. Statistical Analyses

The data obtained from the experiments realized in two parallel assays on the samples from triplicate experiments on two different melon varieties were subjected to variance (ANOVA) analyses in compliance with experiment designs. The package program of SPSS 17.0 for Windows was used to perform the variance analyses.

3. Findings and Discussion

The physical characteristics, oil contents, different drying temperatures as well as chemical characteristics of two different melon seeds were examined in comparison with each other. Table 3 shows the values of melon seeds such as moisture, 1000-seed weight, width, length and thickness.

Table 3. Melon seeds moisture, 1000 grain weight, width, length, thickness values

Variety	Moisture (%)	1000 Grain Weight (g)	Width (mm)	Length (mm)	Thickness (mm)
Kırkağaç	6.42±0.47	52.40±0.57	4.55±0.11	12.82±0.67	1.21±0.08
Hasanbey	5.48±0.23	45.70±0.74	5.16±0.18	13.18±1.12	1.38±0.13

Mean ± standard deviation N=3

According to their physical characteristics, the average values of the Kırkağaç and Hasanbey melon varieties were found as 6.42% and 5.48%. The averages of the maximum values of the seeds were found as 4.55 – 5.16 mm, length as 12.82-13.18 mm, thickness as 1.21-1.38 mm and 1000-seed weights as 52.40-45.70 g.

Mansouri et al. (2017), found that the length, width and thickness of melon seeds were 7.79 mm 3.34 mm and 1.20 mm, respectively. It is an expected result that there is a difference in seed sizes due to the difference in melon varieties.

Thousand-grain weight and seed hull ratio values are important parameters that show the value of seeds used in oil production. Thousand-grain weight is accepted to give an idea about the density of the seed and the amount of seed content.

Table 4. Chemical analysis results of oil of melon seeds

Variety	Drying Temperatures (°C)	Oil (%)	Free acidity (mgKOH/g)	Peroxide value (meq O_2 /kg)	Color			Total Phenolic Content (mgGAE/kg)
					L*	a*	b*	
Kırkağaç	30	26.18±2.13[a]	1.39±1.2[a]	6.9±1.05[a]	65.84±2.45[a]	-6.45±0.002[b]	29.87±1.15[a]	691±1.00[b]
	50	28.52±1.74[b]	1.78±1.1[ab]	7.5±1.11a	68.78±2.12[b]	-5.86±0.15[a]	31.12±1.02[a]	662±1.15[b]
	70	25.60±2.02[a]	3.05±0.8[c]	8.4±1.06[b]	70.42±2.04[b]	-7.14±0.16c	38.45±1.14[c]	584±2.07[a]
Hasanbey	30	29.49±2.35[ab]	1.22±0.7[a]	7.2±1.09[a]	64.52±2.13[a]	-5.98±0.009[a]	33.45±1.26[ab]	840±2.00[c]
	50	33.45±1.41[c]	1.48±0.9[b]	7.9±1.12[ab]	68.14±2.45[b]	5.20±0.0018[a]	35.89±1.24[b]	802±2.18[c]
	70	28.36±1.24[b]	2.89±1.0[c]	9.1±1.09[c]	71.01±2.37[b]	-6.42±0.002[b]	39.76±1.09[c]	780±1.90[bc]

*Mean ± standard deviation (n=3) with different superscript letters for varieties are significantly different at $p \leq 0.05$;

The average values regarding the raw oil content of Kırkağaç and Hasanbey varieties obtained after the drying of the melon seeds in different temperatures were found 26.18, 29.49% in the seeds dried at 30°C, 28.52, 33.45% in those dried at 50°C and 25.60, 28.36% in the ones dried at 70°C, respectively. The results revealed that the seeds of the Hasanbey variety dried at 50°C gave the best extraction yield. In a study examining the effects of heat treatments on kernel components, some increase in oil content as a result of the roasting process applied to the kernels of *Cucurbitaceae* species was explained by the ease of oil extraction as a result of the heat treatment applied (Badifu, 2001). In this study, when the drying temperature was increased from 30°C to 50°C, the yield increased, but when the drying temperature was increased to 70°C, it was thought that the separation of oil from water was difficult due to the formation of oil-water emulsions, and the oil yield obtained decreased because the phase separation could not be done completely.

The results showed that, while the free fatty acid values varied between 1.22-3.05 mgKOH/g, the values of the Hasanbey variety were lower than the ones of the variety of Kırkağaç. Higher temperatures indicated higher free fatty acid values.

The peroxide values in meq/kg of the oils obtained varied between 6.9-8.4 and 7.2-9.1 for the seed oil of Kırkağaç melons and for that of the Hasanbey variety, respectively. The seeds dried at 70°C yielded the highest peroxide value in both varieties. It is thought that the oils contained in the kernels are oxidized due to the heat treatments they are exposed to before oil extraction.

The total amount of phenolic substances was between 584-691 mgGAE/kg in the oil of the Kırkağaç variety and between 780-840 mgGAE/kg in that of the Hasanbey melons. The seed oil of the Hasanbey variety dried at 30°C yielded the best values regarding total phenolic compound content (Table 2).

As far as the L*, a*, and b* values are concerned, which relate to color properties, the study results revealed that, while a parallel increase was found in both of the oil samples extracted from the melon seeds that were heat treated during the drying process, the values of the Hasanbey variety were higher than all other results except for the *L** value at 30°C.

Andjelkovic et al. (2010) found color values (L, a, b) in 5 different cold-pressed pumpkin seed oils in the range of 43.09-43.99; 1.88-3.44; -0.46-1.44, respectively. de Conto et al. (2011) stated that the reason why the watermelon seed oil obtained by the cold pressing method is redder than the solvent extraction method may be due to the higher carotenoid content of the oils obtained by the cold pressing method compared to the solvent method. In another study, L, a*, b* values of different melon seed oils were found between 48.29-91.78, (-)3.51-(-)5.21, 22.05-49.44, respectively (Petkova et al., 2014). Color changes were observed due to Maillard products caused by the heat treatment applied during the drying process.

Table 5. Fatty Acid Composition of Melon Seeds Oil (%)

Variety	Drying Temperatures (°C)	Palmitic	Stearic	Oleic	Linoleic	Arachidic	Linolenic	Arachidonic
Kırkağaç	30	8.107±0.63[a]	5.903±0.017[a]	17.740±0.16[a]	71.110±0.24[bc]	0.177±0.010[a]	0.194±0.0025[b]	0.125±0.045[ab]
	50	7.925±0.74[a]	5.245±0.026[ab]	17.967±0.23[a]	70.239±0.43[c]	0.198±0.018[b]	0.174±0.0027[b]	0.137±0.03[ab]
	70	7.157±0.6[b]	6.102±0.036[a]	18.093±0.17[a]	69.749±0.27[ab]	0.185±0.010[a]	0.151±0.0019[b]	0.132±0.02[ab]
Hasanbey	30	7.854±0.52[a]	5.120±0.048[ab]	19.580±0.21[ab]	67.900±0.31[b]	0.201±0.008[b]	0.081±0.0032[a]	0.102±0.035[a]
	50	7.267±0.7[b]	4.986±0.029[b]	19.879±0.32[ab]	66.732±0.17[a]	0.225±0.014[ab]	0.075±0.0029[a]	0.118±0.02[b]
	70	6.845±0.5[b]	5.256±0.026[ab]	20.034±0.02[b]	65.579±0.46[a]	0.218±0.026[ab]	0.058±0.0033[a]	0.105±0.03[a]

*Mean ± standard deviation (n=3) with different superscript letters for varieties are significantly different at p≤0.05;

The linoleic acid predominated in all oils, followed by the oleic acid, which classified them as linoleic type of oils. The results about the fatty acid composition of the oils of the studied seeds from different melon varieties were similar to the data announced by other authors as a result of their studies of the composition of the melon seed oils, in which the main acids were: linoleic (66.73-71.11%), oleic (17.74-20.03.0%), palmitic (6.84-8.11%), and stearic acid (4.99-6.10%) (de Mello et al., 2001; Hemavathy, 1992; Imbs & Pham, 1995; Milovanovic & Picuric-Jovanovic, 2005).

Besong et al., 2011 compared melon seeds with peanuts and soya beans and reported similar contents of palmitic (10.27%), stearic (10.26%), oleic (15.90%), and linoleic (62.42%).

The results regarding oil acid composition revealed that the average palmitic (C16:1) and linoleic (C18:2) acid values of all the varieties decreased parallel to an increase in thermal process temperature, and the oleic (C18:1) and linoleic (C18:3) acid values, on the other hand, increased parallel to an increase in thermal process temperature. The results showed that, while the value of stearic acid (C18:0) decreased at a temperature of 50°C, it increased at 70°C. On the other hand, no change that would have a significant effect on the arachidic and arachidonic acid values was observed.

The results concerning fatty acid composition show that linoleic acid was higher than other fatty acids, followed by oleic and palmitic acid.

4. Conclusions and Recommendations

The overall results of the present study show that the best drying temperature concerning the oil quality parameters of the melon seeds was 50°C. Even though an increase in the temperature accelerated the drying process, it decreased the total phenolic compound amount and caused a decrease in the peroxide values. For this reason, the temperature must be maintained constant to a certain extent in order not to deteriorate the chemical structure of the dehydrated products. The results regarding fatty acid composition indicate a high essential linoleic acid content, a character that is an indication of usability in the food industry. The study concludes, based on the analyses of the two varieties investigated in the present study, that the variety of Hasanbey yields better results in comparison with the Kırkağaç variety.

In order to contribute to the literature, it is planned to carry out further studies on the drying of different types of melon seeds grown in our country and in the world at 50-70°C, with fewer temperature intervals, in addition to different drying techniques, so the results of this study are important in this respect.

Authors' Contributions

All authors contributed equally to the study.

Statement of Conflicts of Interest

There is no conflict of interest between the authors.

Statement of Research and Publication Ethics

The author declares that this study complies with Research and Publication Ethics.

References

Aksoy, U., (1991). Kuru İncir Üretiminde Kaliteyi Etkileyen Faktörler, İncirde Verimlilik Paneli MPM, Aydın.

Amaro A.L., Oliveira A., and Almeida D.P.F. (2015). *Biologically Active Compounds in Melon: Modulation by Preharvest, Post-harvest, and Processing Factors*. In: Preedy, V., Ed. Processing and Impact on Active Components in Food. Academic Press, London.

Anonymous, (1989). American Oil Chemists' Society Peroxide Value Offical Method Cd 853 (93) Volume-1

Anonymous, (2007). TS-1073 Kavun Standardı, Türk Standartları Enstitüsü, Ankara,

Anwar, F., Naseer, R., Bhanger, M.I., Ashraf, S., Talpur, F.N., and Aladedunye, F.A. (2008). Physico-chemical characteristics of citrus seeds and seed oils from Pakistan. *Journal of the American Oil Chemists' Society*, 85 (4), 321-330.

AOAC, (2000). Official Methods of Analysis. Virginia, USA.

AOCS, (2006). Official Methods and Recommended Practices of the American Oil Chemists Society, 4th ed, edited by AOCS. Champaign, IL Official Method Ai 2 75.

Badifu, G. I. O. (2001). Effect of processing on proximate composition, antinutritional and toxic contents of kernels from Cucurbitaceae species grown in Nigeria. *Journal of Food Composition and Analysis*, *14*(2), 153-161.

Besong, S.A., Ezekwe, M.O., Fosung, C.N., and Senwo, Z.N. (2011). Evaluation of nutrient composition of African melon oilseed (Cucumeropsis mannii Naudin) for human nutrition. *International Journal of Nutrition and Metabolism*, 3(8), 103-108.

da Silva A.C., and Jorge N. (2017). Bioactive Compounds of Oils Extracted from Fruits Seeds 70 Obtained from Agroindustrial Waste. *European Journal of Lipid Science and Technology,* 119, 1-5.

de Mello, M.L., Bora, P.S., and Narain, N. (2001). Fatty and amino acids composition of melon (Cucumis melo var. saccharinus) seeds. *Journal of Food Composition and Analysis*, *14*(1), 69-74.

El-Adawy, T.A., Rahma, E.H., El-Bedawy, A.A. ve Gafar, A. M., (1999). Properties of some citrus seeds Part 3, Evaluation as a new source of protein and oil, Nahrung, 43, 385-391.

Eşiyok, D., Bozokalfa, M. K., Boztok, K. (2005). Bazı Kavun (Cucumismelo L.) Çeşitlerinin Verim ve Kalite Özelliklerinin Belirlenmes., *Ege Üniversitesi Ziraat Fakültesi Dergisi,* 42(1), 25-33.

FAO, (2018). The Food and Agriculture Organization Corporate Statistical Database.

Hemavathy, J. (1992). Lipid composition of melon (*Cucumis melo*) kernel. *Journal of Food Composition and Analysis.* 5, 90-95.

Imbs, A.B., and Pham, L.Q. (1995). Lipid composition of ten seed species from North Vietnam. *The Journal of the American Oil Chemists' Society*, 72(8), 957-961.

Katan, M.B., Grundy, S.M., Jones, P., Law, M., Miettinen, T., and Paoletti R. (2003). Efficacy and Safety of Plant Stanols and Sterols in the Management of Blood Cholesterol Levels. *Mayo Clinic Proceedings*, 78, 965-978.

Khoshnam, F., Namjoo, M., Golbkhshi, H., and Dowlati, M., (2016). Physical and Mechanical Changes in Ripening Melon Fruits. *Yuzuncu Yıl University Journal of Agricultural Sciences,* 26(2), 135-144.

Lija, M., and Beevy, S.S. (2021). A review on the diversity of Melon. *Plant Science Today*, 8, 995-1003.

Mallek-Ayadi, S., Bahloul, N., and Kechaou, N. (2018). Chemical composition and bioactive compounds of Cucumis melo L. seeds: Potential source for new trends of plant oils. *Process Safety and Environmental Protection*, *113*, 68-77.

Mansouri A., Mirzabe A.H., Raufi A., 2017. Physical properties and mathematical modeling of melon (Cucumis melo L.) seeds and kernels. Journal of the Saudi Society of Agricultural Sciences, 16: 218-226.

Milovanović, M., and Pićurić, J.K. (2005). Characteristics and composition of melon seed oil. *Journal of Agricultural Sciences (Belgrade)*, 50(1), 41-47.

Petkova, Z.Y., Antova, G.A., Nikolova, K.T., and Eftimov, T.A. (2014). Physicochemical characteristic of seed oils of Bulgarian species pumpkin and melon. *Bulgarian Chemical Communications*, *46*, 57-62.

Ramadan, M.F., Sharanabasappa, G., Seetharam, Y.N., Seshagiri, M. and Moersel, J.T. (2006). Characterization of fatty acid and bioactive compounds of kachnar (Bauhinia purpurea L.) seed oil, *Food Chemistry,* (98), 359-365.

Rolim, P.M., Seabra, L. M.J., and de Macedo, G.R. (2019). Melon by-products: Biopotential in human health and food processing. *Food Reviews International*, 1-24.

Salunkhe, D. K., ad Kadam, S S. (1998). *Handbook of vegetable science and technology: production, composition, storage, and processing*. CRC press.

Schaffer, A.A, and Paris, H.S., (2003). *Melons, Squashes, and Gourds*. In: Caballero, B., Ed. Encyclopedia of Food Science and Nutrition. Academic Press, London.

Silva, M.A., Albuquerque, T.G., Alves, R.C., Oliveira, M.B.P., and Costa, H.S. (2020). Melon (Cucumis melo L.) by-products: Potential food ingredients for novel functional foods? *Trends in Food Science & Technology*, *98*, 181-189.

Slinkard, K., Singleton, V.L., (1977). Total phenol analyses: Automation and comparison with manual methods. *American Journal of Enology and Viticulture*, 28, 49-55

TUİK, (2018). Türkiye'de Kavun yetiştiriciliği ve Kavun üretim miktarları, (27.08.2018), http://www.tuik.gov.tr/PreTablo.do?alt_id=1001.

TUİK, (2023). Türkiye'de Kavun yetiştiriciliği ve Kavun üretim miktarları, (25.04.2024), http://www.tuik.gov.tr/PreTablo.do?alt_id=1556.

Wahle, K.W.J., Heys, S.D., Rotondo, D. (2015). *Authorized EU Health Claims for the Essential Fatty Acids: n-6 Linoleic (18:2n-6) and n-3 a-Linolenic (18:3n-3) Acids*. In: Sadler, M., Ed. Foods, Nutrients and Food Ingredients with Authorised EU Health Claims: Woodhead Publishing, Cambridge, UK.

Vega-Galvez, A., Di Scala, K., Rodríguez, K., Lemus-Mondaca, R., Miranda, M., Lopez, J., and Perez-Won, M. (2009). Effect of air-drying temperature on physico-chemical properties, antioxidant capacity, color and total phenolic content of red pepper (Capsicum annuum, L. var. Hungarian). *Food Chemistry*, 117(4), 647-653.

Vinha, A.F., Ferreres, F., Silva, B.M., Valentao, P., Gonçalves, A., Pereira, J.A., Andrade, P.B. (2005). Phenolic profiles of Portuguese olive fruits (Olea europaea L.): Influences of cultivar and geographical origin. *Food Chemistry*, 89(4), 561-568.

Yılmaz, N., Kaya, N., Pınar, H., Hancı, F., and Uzun, A. (2021). Detailed morphological and molecular characterizations of melon (Cucumis melo L.) accessions collected from Northern Cyprus and Turkey. *Horticultural Science and Technology*, 39,471-481

Zia, S., Moazzam, R.K.., Muhammad, Z.S., and Rana, M.A. (2021). An update on functional, nutraceutical and industrial applications of watermelon by-products: A comprehensive review. *Trends in Food Science and Technology*, 114, 275-291.