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Research Article

Investigation Of The Effect Of Apricot Fibre Addition On The Chemical And Sensory Properties Of Peanut Butter

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ABSTRACT
In this study, the effects of adding different amounts of apricot fiber (0%, 1%, 2%, 4%, 8% and 16%) to peanut butters on the chemical and sensory properties of these products were investigated. As a result of chemical analyses, an increase in pH, total acidity and total phenolic compounds levels was observed with the increase in the amount of apricot fiber, while a decrease in dry matter and protein content occurred ($p<0.05$). In sensory analyses, significant differences were found between peanut butters in terms of parameters such as structure, color, taste and general liking ($p<0.05$) and the sample containing 4% apricot fiber had the highest liking. In line with these findings, it was concluded that peanut butter produced with 4% apricot fiber was preferable.
Keywords: Peanut butter, Apricot fibre, Chemical properties, Sensory properties

Kayısı Lifi İlavesinin Yer Fıstığı Ezmesinin Kimyasal ve Duyusal Özelliklerine Etkisinin İncelenmesi

ÖZ
Bu araştırmada, yer fıstığı ezmelerine farklı oranlarda kayısı lifi (%0, %1, %2, %4, %8 ve %16) eklenmesinin, bu ürünlerin kimyasal ve duyusal özellikleri üzerindeki etkileri incelenmiştir. Kimyasal analizler sonucunda, kayısı lifi miktarının artışıyla birlikte pH, toplam asidite ve toplam fenolik bileşiklerin seviyelerinde artış gözlemlenirken, kuru madde ve protein içeriğinde azalma meydana gelmiştir ($p<0.05$). Duyusal analizlerde ise yapı, renk, tat ve genel beğeni gibi parametreler bakımından yer fıstığı ezmeleri arasında anlamlı farklar bulunmuş ($p<0.05$) ve %4 kayısı lifi içeren örnek en yüksek beğeniye sahip olmuştur. Bu bulgular doğrultusunda, %4 kayısı lifi ile üretilen yer fıstığı ezmesinin tercih edilebilir olduğu sonucuna varılmıştır.
Anahtar Kelimeler: Yer Fıstığı ezmesi, Kayısı lifi, Kimyasal özellik, Duyusal Özellik

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Introduction

Peanut (Arachis hypogaea) is an annual summer oilseed plant from the legume family. It is grown in a wide range of regions, with cultivation extending from 40 degrees north to 35 degrees south latitude across the globe. Peanuts are widely consumed in many countries due to their nutritional benefits. Peanut seeds are an excellent source of protein, lipids, and fatty acids, making them an important part of human nutrition (Grosso et al., 1997).

Peanut is a nutrient-dense food, rich in monounsaturated fats, dietary fiber, proteins, minerals, and antioxidants (Esche et al., 2013). Including peanuts in a healthy diet can help reduce the risk of coronary heart disease, cancer, and Alzheimer's disease (Shin et al., 2009).

Among the major oilseeds in the world, peanut is an essential source of edible oil (Campos-Mondragon, et al., 2009). Peanuts contain 47%-50% oil and 26% protein (Nagaraj, 1995), 16-18% carbohydrates, 5% mineral substances such as Potassium (K), Calcium (Ca), Magnesium (Mg), Phosphor (P) and Sulfur (S) and vitamins A, B and E. It also contains various other nutrients for human nutrition, including tocopherols, fibre, phytosterols and phenolic compounds. Groundnut oil is more valuable than many other vegetable oils in terms of flavour and durability(Ros, 2010).

Peanut butter consists of solid particles suspended in a continuous oil phase, forming a thick suspension (Norazatul et al., 2016). It is typically made by roasting and grinding raw peanuts, which gives it a unique flavor (Gong et al., 2018) and offers numerous health benefits. Since peanuts serve as the raw material for peanut butter, the quality of the peanuts used in production plays a crucial role in determining the overall quality of the final product (Hashemian et al., 2017).

Peanut butter is produced from dry roasted peanuts, combined with ingredients such as salt, sugar, sweeteners, emulsifiers, flavorings, and other additives that affect its texture (Burks and Sampson, 1993). It is a nutritious food, rich in essential components, but to maximize its health benefits and increase its consumption, improvements in its composition, functional properties, and overall quality are essential.

Apricot (Prunus armeniaca L.) is a fruit classified under the Prunus species of the Rosaceae family of the Rosales order. Apricot fruit, which is beneficial for human health, is used in the production of fresh, dried, fruit juice, nectar, jelly, jam, extrusion products, etc. (Özbek, 1978).

Apricot is a highly nutritious fruit, providing a rich source of sugars, fiber and bioactive phytochemicals, alongside essential vitamins such as riboflavin, thiamine, A, C, pantothenic acid and niacin. Among the bioactive compounds, phenolic compounds, carotenoids, and antioxidants are especially important due to their notable biological value. (Ali et al., 2011). Vitamin A in apricot plays a crucial role in reproductive and growth functions, as well as enhancing the body's resistance to infections (Hacıseferoğulları et al., 2007).

Dietary fibres should be consumed frequently in terms of health. Fibres, which are called pulp and whose importance in terms of health is not known, have taken their place in healthy food consumption with the understanding that they are beneficial to people's health. The importance of these fibres in terms of human health has been emphasised by studies carried out in recent years and the need to use fibre in the production of more functional products has arisen.

Fibers from fruits and vegetables are rich in soluble dietary fiber (Herbafood, 2002). Plant fibers exhibit various functional properties, such as water holding capacity (WHC), swelling capacity (SWC), viscosity or gel formation, bile acid binding capacity, and cation exchange capacity. These properties are crucial for understanding the physiological effects of diet (Schneeman and Gallaher, 2001).

The commercialised fibre product should contain over 50% total dietary fibre, less than 9%

moisture, low lipid content, low calories and neutral aroma and taste (Larrauri, 1999). To take advantage of the functional properties of fibre, some formulated foods with high dietary fibre content have been developed in recent years (Herbafood, 2002). To be acceptable, a dietary fibre added to a food product must perform satisfactorily as a food ingredient (Jaime, et al., 2002).

Fibres obtained from fruits are consumed less than fibres obtained from cereals. Processes play an important role in the preparation of fruit fibre to minimise the loss of bioactive compounds and to show its beneficial effects on health. Fruit fibre has a better quality than cereals with higher soluble fibre content, water and fat retention capacity and lower calories (Larrauri, 1999).

Studies using apricot pulp powder or apricot kernel powder were generally carried out on bread, cakes, crackers, cookies and yoghurt products (Karaca, et al., 2019; Ağırbaş, et al., 2021; Nisar, et al., 2021; Yao, et al., 2021). No study on the production of peanut butter with added apricot fibre was found in the literature.

In this study, the effect of apricot fibre addition at different ratios on the chemical and sensory properties of peanut butters was investigated and it was aimed to improve the functional properties of peanut butters.

Material And Method

Material

Raw material

Apricots used in apricot fibre production were purchased from the fruit and vegetable market in Osmaniye, Türkiye. Apricots were produced in Mut, Mersin, Türkiye. The peanuts used in the production of peanut butter were obtained from Bağdatlılar Trading Dried Fruits and Nuts Industry Co. operating in Osmaniye, Türkiye.

Tools and Chemicals Used

For the preparation of peanut butter, the peanut crushing machine of Bağdatlılar Trading Dried Fruits and Nuts Industry Co. Ltd. (XUANHUA, China) was used. An oven (ON-O2G Oven) was used for drying the apricots. A blender (Arçelik, Türkiye) was used to reduce the size of dried apricots. Thermo Scientific Viscotester (Haake GmbH, Karlsruhe, Germany) rheometer was used for rheological analysis. pH values were determined with Orion Star™ A 211 pH Benchtop Meter digital pH meter (Inolab, Weilhem Germany). Konica Minolta colorimeter (Chroma Meter CR-400 Japan) was used for colour measurement of the samples.

Method

Preparation of Apricot Fibre

Apricot fibre production was carried out in Osmaniye Korkut Ata University Food Engineering laboratory. Fresh 10 kg apricots from Mut, Mersin obtained from Osmaniye market were washed with tap water and pitted. Apricots were sliced longitudinally (half-moon shaped). Apricot pieces were soaked in water containing citric acid (1%, w/v) to prevent browning. Apricot slices removed from the water containing citric acid were placed on aluminium trays and kept at room temperature to remove moisture. Then, they were kept in an oven at 66ºC for 90 hours for drying. The dried apricot slices were powdered by reducing their particle size with a blender device, sieved to remove coarse particles and apricot fibres were obtained.

Addition of Apricot Fibre to Peanut Butter

The peanuts obtained from Bağdatlılar Ticaret Kuruyemiş San. Ltd. Şti. factory was roasted in an oven at 145oC until 1% humidity. The roasted product was subjected to membrane peeling and selection (foreign matter, unsuitable peanuts). Apricot fibre was added to the roasted peanuts at the rates of 1%, 2%, 4%, 8% and 16% respectively (Table 1). These mixtures were ground in a machine for peanut butter production. Peanut butter without added apricot fibre was also produced as a control product and the peanut butter was kept in 3 kg glass jars in the refrigerator until analyzed. The experiments were set up with two replicates.

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Table 1. Amounts of apricot fibre added to peanut butter

	Control	1%	2%	4%	8%	16%
Peanut (g)	3000	2970	2940	2880	2760	2520
Apricot fibre (g)	-	30	60	120	240	480

Analyses of Apricot Fibre Peanut Butter
The analyses of the samples were carried out at Osmaniye Korkut Ata University, Department of Food Engineering and Central Laboratory. Analyses were performed in two parallels.

Dry Matter Analysis
The dry matter content of groundnut paste was determined according to AOAC, (1990) by measuring in an oven at 110º C until the sample weight remained constant.

pH Analysis
The pH values of the peanut butters were measured using an Orion Star™ A 211 pH Benchtop Meter digital pH meter (Inolab, Weilheim, Germany).

Total Acid Analysis
The total acid content of peanut butter was determined by titration using 0.1 N NaOH and the results were given as %.

Protein Analysis
Protein content analysis of peanut butter was carried out according to AOAC (1990).

Total Phenolic Compounds Analysis
Total phenolic compounds were analysed using Folin-Ciocalteu reagent. The results are given in terms of gallic acid (Singleton and Rossi, 1965).

Colour Analysis
The colour (L, a and b) of the samples was measured using a Konica Minolta colorimeter (Chroma Meter CR-400 Japan). Colour analysis on peanut butter was evaluated in terms of L * a * b values. L* (Lightness) value represented brightness, a* value represented red-green colour and b* value represented yellow-blue colour (Bayarri et al., 2001).

Sensory Analyses
Apricot fibre added peanut butter was sensory evaluated for oiliness, fluidity, texture, stickiness, taste, colour and general liking. The sensory evaluation was carried out by a group of 7 panelists. Panel members independently scored the samples (1 point very bad, 10 points very good).

Statistical Analysis
Analysis of variance was applied to the chemical analysis results and the difference between the groups was evaluated according to Duncan multiple comparison test. For this purpose, SPSS 18.0 (SPSS Inc., Chicago, IL, USA) statistical package programme was used.

Results and Discussion
Chemical Properties of Peanut Butter
The results of chemical analyses (dry matter, pH, total acid, protein and total phenol compounds) of groundnut paste are given in Table 2.

Table 2. Chemical composition of peanut butter

Peanut butter	Dry matter (%)	pH	Total Acidity (%)	Protein (g)	Total Phenolic Compounds (mgGAE/kg)
Control	97.8^{a}±0.1	6.3^{a}±0.1	1.14^{c}±0.0	22.15^{a}±0.9	360^{b}±0.0
1% AF	97.4^{a}±0.0	6.0^{a}±0.2	1.21^{c}±0.1	22.65^{a}±0.1	361^{b}±3.5
2% AF	97.9^{a}±0.2	6.1^{a}±0.2	1.24^{bc}±0.0	22.95^{a}±0.2	360^{b}±2.1
4% AF	97.3^{a}±0.1	6.1^{a}±0.1	1.33^{b}±0.0	22.70^{a}±0.0	371a±3.5
8% AF	96.0^{b}±0.1	5.8^{b}±0.1	1.47^{ab}±0.0	21.50^{ab}±0.1	368^{a}±2.8
16% AF	94.4^{c}±0.2	5.0^{c}±0.0	1.56^{a}±0.4	20.00^{b}±0.4	369^{a}±4.2

AF: Apricot Fibre, the difference between the values shown with different letters from top to bottom in the same column is statistically significant ($p<0.05$).

It was observed that % dry matter values of peanut butters varied between 94.4-97.9. The difference between the peanut butters in terms of dry matter content was found to be statistically significant ($p<0.05$). It was determined that the amount of dry matter decreased as the apricot fibre concentration increased. Hepsağ (2018) found the % dry matter value in the range of 85.7-90.4 in his peanut butter study.

The pH values of apricot fibre added peanut butters varied between 6.3-5.0. The difference between peanut butters in terms of pH was found to be statistically significant ($p<0.05$). It was observed that the pH values of peanut butter decreased as the concentration increased with the addition of apricot fibre. Hepsağ (2018) found pH values in the range of 4.5-6.83 in his peanut butter study. Tanrıkulu et al. (2022) determined the pH value as 7.01 in peanut butter.

The % total acidity values of peanut butters varied between 1.14-1.56. The difference between peanut butters in terms of total acidity was statistically significant ($p<0.05$). Total acidity increased as the amount of apricot fibre increased. 16% AF added peanut butter had the highest total acidity value while the product without AF addition had the lowest total acidity value. The increase in total acidity parallel to the amount of apricot fibre is related to the higher acidity in apricot fibre than in peanut butter.

The % protein values of peanut butters varied between 20.00-22.95. The difference between peanut butters in terms of protein content was statistically significant ($p<0.05$). The lowest protein value was found in peanut butter with 16% AF added and the highest was found in peanut butter with 2% AF added. This is due to the higher protein content of peanut butter compared to apricot fibre. Yu, et al. (2021) determined the average protein value of peanut butter as 23.6, the lowest as 19.3 and the highest as 26.4. Bello, et al. (2020) observed protein values between 15.70-17.41 in peanut butter with

preservative addition. Shibli, et al. (2019) found protein values between 20.50-23.00 in peanut butter. An average of 25.090 g protein was found in 100 g peanut butter (USDA, 2008).

It was observed that total phenol compounds in peanut butter varied between 360-371 mgGAE/kg. It was found that the difference between apricot spreads in terms of total phenol compounds was statistically significant ($p<0.05$). Hathorn, et al. (2012) observed that the total phenolic value of peanut butter increased from 14.1 to 28.1 mg GAE/g with the addition of peanut shell. El sayed, et al. 2020 found the total phenolic value of peanut butter as 224 mg/g. Tanrıkulu et al. (2022) determined the total phenolic content of peanut butter as 611,30 mg/kg. The total phenolic value of peanut butter with and without apricot fibre additive was found to be higher than this study. Peanut butter has a good antioxidant activity and total phenol content. It was observed that total phenol compounds increased with the addition of apricot fibre. This may be related to the higher total phenol compounds in apricot fibre than in peanut butter.

Table 3. Colour characteristics of peanut butters

	Control	**1% AF**	**2% AF**	**4% AF**	**8% AF**	**16% AF**
L	$41,9^{b}\pm1.6$	$35,2^{c}\pm1.8$	$43,0^{ab}\pm2.4$	$45,3^{a}\pm2.1$	$43,7^{ab}\pm1.3$	$32,2^{c}\pm0.8$
a	$3,4^{c}\pm0.1$	$3,5^{c}\pm0.1$	$3,4^{c}\pm0.2$	$4,2^{b}\pm0.2$	$5,3^{a}\pm0.3$	$5,5^{a}\pm0.3$
b	$20,5^{c}\pm1.3$	$17,5^{d}\pm1.2$	$21,3^{bc}\pm1$	$24,5^{a}\pm2.7$	$24,2^{ab}\pm1.6$	$17,4^{d}\pm1.4$

AF : Apricot Fibre. The difference between the values shown with different letters from left to right in the same row is statistically significant ($p<0.05$).

The L values of peanut butters were 32.2-45.3, a values were 3.4-5.5 and b values were 17.4- 24.5 (Table 3). The difference between peanut butters in terms of colour characteristics was statistically significant ($p<0.05$). L value was found to be higher in the samples with 2%, 4% and 8% apricot fibre additives compared to the control and it was observed that the colour became brighter. a value also increased in parallel with the increase in apricot fibre between 4-16% and the samples became redder. In addition, the b value was found to be higher in the samples with 2%, 4% and 8% apricot fibre additives compared to the control and it was determined that the colour increased towards yellowness. Hepsağ (2018) found L value between 24.09-67.27, a value between 5.02-7.17, and b value between 5.00-32.95 in peanut butter. Yu, et al. (2021) determined the average L value as 53.3, a value as 9.6 and b value as 27.0 in peanut butter.

Sensory Characteristics of Peanut Butter

The oiliness, viscosity, texture, stickiness, taste, colour and general impression of peanut butter were sensory evaluated. The results of sensory evaluation are given in Table 4.

Table 4. Sensory properties of peanut butter

	Oiliness	Viscosity	Texture	Stickiness	Taste	Colour	General Impression
Control	6.6±1.1	6.4±2.1	5.9^{c}±1.2	5.1±1.3	6.1^{b}±1.1	7.0^{b}±0.8	6.1^{b}±0.7
1% AF	6.9±1.6	6.3±2.4	7.0^{b}±1.8	6.6±1.5	6.3^{b}±1.0	7.9^{a}±0.4	7.0^{ab}±0.8
2% AF	7.3±1.4	7.1±1.1	7.6^{ab}±1.3	6.3±1.0	6.0^{b}±1.4	7.6^{ab}±1.0	6.9^{ab}±1.1
4 %AF	6.6±0.5	7.6±1.1	8.3^{a}±0.8	6.4±1.6	8.1^{a}±0.7	8.1^{a}±0.9	7.3^{a}±1.0
8% AF	7.1±0.7	6.6±1.6	6.9^{bc}±0.9	7.3±1.4	6.4^{b}±2.1	6.9^{b}±0.7	5.3^{bc}±0.8
16% AF	7.0±1.3	7.0±2.0	7.4^{ab}±0.8	6.9±0.9	6.7^{ab}±2.1	6.0^{c}±0.6	5.6^{bc}±1.5

AF: Apricot Fibre, The difference between the values shown with different letters in the same column is statistically significant ($p<0.05$).

The difference between the peanut butters in terms of texture, taste, colour and general impression level was found to be significant ($p<0.05$). In terms of texture, the highest value was determined in the peanut butter containing 4% AF, while the lowest value was determined in the control sample (sample without apricot fibre). In terms of taste, the highest value was determined in peanut butter containing 4% AF, while the lowest value was determined in the 2% AF sample.

In terms of color, the sample containing 4% apricot fiber (AF) exhibited the highest value, while the sample with 16% AF showed the lowest value. The difference between the 1% AF, 2% AF, 8% AF, and control samples was found to be insignificant..

In terms of general impression level, the peanut samples scored between 5.6-7.0. Peanut butter with 4% AF additive received the highest score in terms of general impression. Bello, et al. (2020) determined the general impression values between 8.30-6.10 in their peanut butter study in which they added aframomum danielli (preservative).

When a general evaluation is made, it can be said that the peanut butter sample containing 4% AF received the highest score in terms of texture, taste, colour and general impression by the panelists and has high preferability.

Conclusions

The effect of different ratios of apricot fibre (0%, 1%, 2%, 4%, 8% and 16%) on chemical and sensory properties of peanut butter was investigated. When the chemical analysis results of peanut butter were evaluated, pH value decreased, total acidity increased and total phenol compounds increased as the amount of apricot fibre increased. However, as the amount of apricot fibre increased, dry matter and protein values decreased. As a result of sensory evaluation, the difference between the peanut butters in terms of texture, taste, colour and general impression was found to be significant ($p<0.05$) and peanut butter containing 4% apricot fibre received the highest score. As a result, the production of peanut butter containing 4% apricot fibre can be recommended.

References

Ağırbaş, H. E. T., Yavuz-Düzgün, M., Özçelik, B. (2021) The effect of fruit seed flours on Farinograph characteristics of composite dough and shelf life of cake products. *J Food Measur Character*, 1-12.

AOAC. (1990) Official methods of analysis of the AOAC, 15th ed. Methods 932.06, 925.09, 985.29, 923.03, Association of official analytical chemists. Arlington, VA, USA.

Bayarri, S., Calvo, C., Costell, E., Duran, L. (2001) Influence of color on perception of sweetness and fruit flavor of fruit drinks. Food Sci. Technol Int, 7:399–404.

Bello, F. A., Ndah, L. S., Irem Oka, J. A. (2020) The preservative effect of Aframomum danielli spice powder on the chemical, microbial and sensory properties of groundnut butter, MOJ Food Process Technol, 8(2), 71-78.

Burks, A. W., Sampson, H. (1993) Food allergies in children. Curr Probl Pediatr, 23(6), 230-252.

Campos-Mondragon, M. G., Calderon, D. L., Barca, A. M., Duran-Prado, A., Campos-Reyes, L. C., Oliart-Ros, R. M., Angulo, O. (2009) Nutritional composition of new peanut (*Arachis hypogaea L.)* cultivars, Grasas Y Aceites, 60, 161–167.

El-Sayed, S. M., Salama, H. H., El-Sayed, M. M. (2020). Function processed cheese sauce fortified with peanut butter. J Food Process Preserv, 44(9), e14656.

Gong, A., Shi, A., Liu, H., Yu, H., Liu, L., Lin, W. (2018). Relationship of chemical properties of different peanut varieties to peanut butter storage stability, J Integrative Agric, 17(5), 1003–1010.

Grosso, N.R., Zygadlo, J.A., Lamarque, A.L., Maestri, D. M., Guzman, C. A. (1997) Proximate, fatty acid and sterol compositions of aboriginal peanut (*Arachishypogaea L*) seeds from Bolivia, J Science Food Agric, 73,249-356.

Hacıseferoğulları, H., Gezer, I., Özcan, M. M., MuratAsma, B. (2007) Post-harvest chemical and physical–mechanical properties of some apricot varieties cultivated in Turkey, J Food Eng, 79(1), 364-373.

Hashemian, M., Murphy, G., Etemadi, A., Dawsey, S. M., Liao, L. M., Abnet, C. C. (2017) Nut and peanut butter consumption and the risk of esophageal and gastric cancer subtypes, Am J Clin Nutr, 106(3), 858–864.

Hathorn, C. S., Sanders, T. H. (2012) Flavor and antioxidant capacity of peanut paste and peanut butter supplemented with peanut skins, J Food Sci, 77(11), 407-411.

Herbafood. (2002) Herbacel AQ Plus. Apple and citrus fibre Available from www.herbafood.de/eaqplus.pdf. Date November 2021.

Hepsağ, F. (2018). Osmaniye ilinde üretilen yer fıstığı ezmelerinin kalite özelliklerinin belirlenmesi, ADYUTAYAM, 6(2), 55-66.

Jaime, E. Molla, A. Fernández, M. Martín-Cabrejas, F. LópezAndreu, R. (2002) Soğan (*Allium cepa L.*) dokularının yapısal karbonhidrat farklılıkları ve potansiyel diyet lifi kaynağı. Tar Gıda Kim Derg, 50, s. 122 – 128.

Karaca, O. B., Güzeler, N., Tangüler, H., Yaşar, K., Akın, M. B. (2019) Effects of apricot fibre on the physicochemical characteristics, the sensory properties and bacterial viability of nonfat probiotic yoghurts. Foods, 8(1), 33.

Larrauri, J. (1999) Meyve yan ürünlerinden yüksek diyet lifli tozların hazırlanmasında yeni yaklaşımlar, Gıda Bil Teknol Eğil, 10, 3-8.

Nagaraj, G. (1995) Groundnut. Quality and utility of oilseeds (pp. 2–8). Hyderabad: Directorate of Oilseeds Research.

Nisar, A., Jan, N., Gull, A., Masoodi, F. A., Amin, T., Bashir, O., Wani, S. M. (2021). Effect of the incorporation of apricot pulp powder on physicochemical, functional, rheological and nutraceutical properties of wheat flour based cookies. *Br Food J*, 123(11), 3776-3788.

Norazatul Hanım, M. R., Chin, N. L., Yusof, Y. A. (2016). Effects of grinding time on rheological, textural and physical properties of natural peanut butter stored at different temperatures. *J Texture Stud*, 47(2), 131-141.

Özbek, S. (1978). Özel Bahçe Bitkileri. Ç.Ü. Ziraat Fakültesi no. 128, Adana, Türkiye

Ros, E. (2010) Health benefits of nut consumption, Nutrients, 2(7), 652–682.

Schneeman, B. O., Gallaher, D., Spiller, G. A. (2001) Effects of dietary fiber on digestive enzymes. CRC Handbook of dietary fiber in human nutrition, 3, 277-283.

Shibli, S., Siddique, F., Raza, S., Ahsan, Z., ve Raza, I. (2019) Chemical composition and sensory analysis of peanut butter from indigenous peanut cultivars of Pakistan, Pakistan J Agric Res, 32(1), 159.

Shin, E. C., Huang, Y. Z., Pegg, R. B., Phillips, R. D., Eitenmiller, R. R. (2009) Commercial runner peanut cultivars in the United States: Tocopherol composition, J Agric Food Chem, 57(21), 10289-10295.

Singleton, V. L., Rossi, J. A. (1965). Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *Am J Enol Viticult*, *16*(3), 144-158.

Tanrıkulu, E., Bozdogan, A., Durmaz, G. (2022) A research of the chemical and sensory properties of carob molasses-and carob powder-added peanut butter. *J Raw Materials to Processed Foods*, *3*(2), 49-54.

USDA. (2024). Nutrition facts, commodity peanut butter, smooth. Retrieved 15.11.2024 from http://www.tititudorancea.com/z/nutrition_facts_usda_commodity_peanut_butter_smooth.htm

Yao, J. L., Zhang, Q. A., Liu, M. J. (2021). Utilization of apricot kernel skins by ultrasonic treatment of the dough to produce a bread with better flavor and good shelf life. *LWT - Food Sci Technol*, 145, 111545.

Yu, H., Liu, H., Erasmus, S. W., Zhao, S., Wang, Q., Ruth, S. M. (2021). An explorative study on the relationships between the quality traits of peanut varieties and their peanut butters. *LWT - Food Sci Technol*, 151, 112068.