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THE POTENTIAL APPLICATION OF SOME UNUTILIZED SEED OILS AS FUNCTIONAL COMPONENTS IN BETIFORE MAKING

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ABSTRACT: Oils extracted from apricot, pumpkin, and mango seeds by cold and hot extractions were replaced with shortening in betifore by 25, 30, and 40%. The proximate composition, peroxide value, acid value, physical properties, crust color and sensory properties of betifore were evaluated. Peroxide value and acid value of apricot, pumpkin, and mango seed oils were 5.59 meq O_2/kg oil and 0.16 mg KOH/g oil, 20.3 meq O_2/kg oil and 0.12 mg KOH/g oil, and 3.69 meq O_2/kg oil and 3.74 mg KOH/g oil, respectively. Hot extraction had a higher peroxide value and acid value than cold extraction. The proximate composition of betifore was not affected by the type of oils, extraction methods, and concentration of oils. Control betifore, followed by pumpkin betifore, had a higher peroxide value and a lower acid value than apricot and mango betifores. The weight of betifore was not affected by seed oils. Betifore prepared with mango seed oil, followed by pumpkin seed oil and apricot seed oil, had a higher thickness, width, spread ratio, and spread factor than control betifore. Betifore prepared with apricot seed oil had higher lightness (L*), redness (a*), and yellowness (b*) values than control betifore and betifore prepared with other seed oils. The sensory properties of control betifore were similar to betifore prepared with apricot and pumpkin seed oils. The sensory properties of mango betifore were lower than those of control betifore and betifore prepared with apricot and pumpkin seed oils. The results suggested that apricot, pumpkin, and mango seed oils, as a byproduct, could be used to replace fat in bakery products to create high-quality and value-added products.

Key words: Seed oil, pumpkin seed oil, mango seed oil, acid value, peroxide value, betifore.

INTRODUCTION

Utilization of food waste is a challenge and necessity in day-to-day life. It's an important aspect of some food industry processes of modification, fortification, and recovery. The main aim is to minimize deterioration and maximize utilization of food, which will lead to fewer problems in waste management and environmental pollution. Food processing waste is a cheap source of valuable components (bioactive compounds) due to the ease of recovery and recycling of compounds within the food chain as food and functional additives in various products. The bioactive compounds can also be used as natural antioxidants as alternatives to industrial additives.

Apricot seeds contain sterol derivatives, carotenoids, cyanogenic glycosides, and volatile compounds. It can be used as a natural bactericidal, fungicidal, antioxidant, anti-parasitical, and antitumor agent as it possesses numerous phytochemical constituents such as phenolic and flavonoid compounds and other compounds including carotenoids, alkaloids, and vitamins. It has applications in the pharmaceutical, bakery, food, and cosmetic industries (Hamid *et al*., 2023). Apricot seeds are a good source of oil (> 30%) with bioactive components such as fatty acids, tocopherols, terpenoids, and phenolic compounds with strong antioxidant, anti-cancer, antimicrobial, and anti-inflammatory activity (Siddiqui *et al.*, 2022).

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Generally, pumpkin seeds are a by-product of the food industry. Pumpkin seeds have useful nutrients and nutraceuticals such as amino acids, phytosterols, unsaturated fatty acids, phenolic compounds, tocopherols, cucurbitacins, and valuable minerals (Dotto and Chacha 2020). Pumpkin seeds are characterized by their high oil and protein contents, along with a wide variety of nutrients. Pumpkin seed oil has many health benefits, including antioxidants, cardiovascular health boosts, treatment of benign prostatic hyperplasia, and reduction of hair loss. Pumpkin seed oil is used in the pharmaceutical and cosmetic industries. In addition, some sources refer to it as a potential functional food. The main phytochemicals in pumpkin seed oil with health-related properties are polyphenols, phytoestrogens, and fatty acids. However, carotenoids, squalene, tocopherols, and minerals may also contribute to health benefits. Most studies have been conducted in vitro and support the claim that pumpkin seed oil has antioxidant and antimicrobial activities (Morakul *et al.*, 2019; Šamec *et al*., 2022).

Mango seeds and peels contain significant amounts of proteins, fats, carbohydrates, and some specific bioactive compounds. Specifically, mango seed kernels are a remarkable source of phytochemicals that have the potential to improve human health and prevent the growth of pathogenic microorganisms. Mango seed kernels possess phytosterols, carotenoids, tocopherol, polyphenols, and phenolic acids. These phytochemicals are known for their high antioxidant, anticancer, antimicrobial, antidiabetic, and antiplatelet aggregation properties. Phytochemicals present in mango seed kernels showed antimicrobial activity (Choudhary *et al*., 2023).

The apricot, pumpkin, and mango seeds are an excellent source of oils with bioactive components, as mentioned by the reviewers above. These oils contain a variety of phytochemical components, including phenolic, flavonoid, and other compounds. These oils could be used as functional ingredients in food products because of their potential health benefits and potent antimicrobial and antioxidant properties.

The aim of this research is to utilize the extracted oils from untraditional sources as a functional ingredient in betifore to produce value-added bakery products with good quality.

MATERIALS AND METHODS

Apricot seeds

Apricot (*Prunus armeniaca L.*) seeds were obtained from juice shops at Shibin El Kom, Menoufia, Egypt. Seeds were cleaned, dried at room temperature, and dust-free before being stored at -18°C until used.

Pumpkin seeds

Pumpkin (*Cucurbita maxima L.*) seeds were obtained from Harraz's shop in Cairo, Egypt. Seeds were cleaned to render them free of dust, then stored at -18°C until use.

Mango seeds

Mango (*Mangifera indica L.*) seeds were collected from juice shops at Shibin El Kom, Menoufia, Egypt. Decortations were used to separate the mango stone kernels from the outer leather, which was then dried at room temperature and stored at -18°C until use.

Preparation of oil

Oil was extracted from crushed seeds by cold and hot extraction using a Soxhlet apparatus.

Hot extraction

The procedure of AOAC (2012) was followed to extract oil from different varieties of seeds using the Soxhlet apparatus. Five grams of sample were placed in a cellulose thimble, which was capped with cotton wool. The thimble was then placed in the Soxhlet chamber, which was fitted to a sealed distillation flask containing 80 ml of hexane and a boiling glass regulator. After extraction for 16 h, the solvent was released by a rotary evaporator, and the last traces were removed by placing the flask with the extract in a heater at 80 °C. The next day, the flask was cooled in a desiccator and weighed. This heatingweighing step was repeated until the difference between two consecutive weightings was smaller than 10 mg.

Cold extraction

The cold extraction of oil was performed according to the AOCS (2012). Seeds (apricot, pumpkin, and mango) were soaked individually in pure petroleum ether 40-60°C (1:2 W/V) for 24 hours at ambient temperature (25°C). The miscellany was collected and filtered through Whatman 40 filter paper. This process was repeated three times, using a new solvent each time. The solvent was evaporated under vacuum at 40-45°C in a rotary evaporator (SCILOGEX RE100). The oil was dried over anhydrous sodium sulfate, filtered, stored at -18°C in dark brown bottles without any further purification, and then kept until used.

Peroxide value and acid values

The peroxide and acid values of each oil sample was determined according to AOAC (2012).

Preparation of Betifore

Betifore was prepared according to the method of Mansour *et al.* (2003). The betifore formula consisted of 37.3% wheat flour, 29.9% shortening, 14.9% powdered sugar, 13.1% whole eggs, 0.59% baking powder, 0.47% salt, 0.04% vanilla, and 3.7% water. To prepare the control treatment, the shortening and sugar were creamed for 2 min. at low speed in an Oster Kitchen Center mixer (Model 972-26 H, Sunbeam Corporation, Milwaukee, Wisconsin, USA). The whole eggs and vanilla were added and mixed for another 2 min. at the same speed. The blended dry ingredients (flour, baking powder, and salt) and water were added to the mixture and beaten for 4 min. at medium speed. A manual scoop (about 5 g in weight, 5 cm in diameter, and 0.2 cm thick) was used to drop betifores onto trays. The betifores were baked at 190°C for 12 min. Betifores were allowed to cool for 30 min. before being wrapped in polyethylene film. Oil extracts were replaced with shortening in betifore by 25, 30, and 40%. The same order of mixing as described for the control was followed.

Physical properties of betifore

Betifores physical properties were evaluated for weight (g), width (cm), thickness (cm), spread ratio, and spread factor. The spread ratio and spread factor were calculated according to Elkhalifa and Tinay (2002) using the following equations:

$$\text{Spread ratio} = \frac{\text{Width}}{\text{Thickness}}$$

$$\text{Spread factor} = \frac{\text{Spread ratio of the sample}}{\text{Spread ratio of the control}} \times 100$$

Crust color of betifore

The crust color of betifore was measured using the color profile system of lightness (L^*), redness (a^*), yellowness (b^*), and hue angle that was measured by a reflectance colorimeter (Minolta spectrophotometer CM-3500d, Japan).

Sensory Properties of Betifore

The sensory properties of betifore were evaluated by ten trained graduate students and staff members in the Department of Food Science and Technology, Menoufia University. Randomly coded samples were served to the panelists individually. Panelists were supplied with cold tap water for cleaning the palate between samples. Sensory quality attributes were evaluated using a 10-point rating scale, with 1 for dislike extremely and 10 for like extremely for each attribute evaluated. Betifores were evaluated for appearance, texture, crispness, color, flavor, mouth feel, and overall acceptability.

Statistical Analysis

Data of peroxide and acid values of seed oils and betifore were analyzed using four-way analysis. An analysis of variance was conducted using Costat version 6.311 (Copyright 1998-2005, CoHort software). When a significant main effect was detected, the means were separated with the Student-Newman-Keuls test. The predetermined acceptable level of probability was 5% ($P \leq 0.05$) for all comparisons.

RESULTS AND DISCUSSION

Peroxide and acid values of seed oils

The data in Table 1 showed the changes in peroxide value and acid value of seed oils during storage at 60°C for 9 days. The peroxide value was affected ($P \leq 0.05$) by the type of seed oils, extraction methods, and storage period at 60°C for 9 days. The pumpkin seed oil (20.3 meq O_2/kg oil), followed by the apricot seed oil (5.59 meq O_2/kg oil), had a higher ($P \leq 0.05$) peroxide value than the mango seed oil (3.69 meq O_2/kg oil). This indicated that mango seed oil, followed by apricot seed oil, was more stable than pumpkin seed oil.

The hot extraction method had a higher ($P \leq 0.05$) peroxide value than the cold extraction method. This is attributed to the effect of heating during hot extraction. Mirzaei and Rezaei (2019) showed that hot press extraction had a higher peroxide value than cold press extraction for apricot seed oil.

Table (1): Peroxide and acid values of seed oils extracted by cold and hot extraction during storage at 60°C for 9 days

Treatment	Peroxide value (meq O_2/kg oil)	Acid value (mg KOH/g oil)
Type of oil		
Apricot	5.59[b]	0.16[b]
Pumpkin	20.3[a]	0.12[c]
Mango	3.69[c]	3.74[a]
LSD	0.058	0.038
Extraction method		
Cold	9.52[b]	1.63[b]
Hot	10.74[a]	2.38[a]
LSD	0.047	0.031
Storage period (days)		
0	0.23[i]	0.99[j]
1	1.98[h]	1.08[i]
2	4.16[g]	1.19[h]
3	6.53[f]	1.37[g]
4	8.23[e]	1.56[f]
5	9.81[d]	1.78[e]
6	13.4[c]	2.21[d]
7	18.1[b]	2.77[c]
8	18.2[b]	3.37[b]
9	19.2[a]	3.90[a]
LSD	0.12	0.069

Means ± standard deviations in the same column with different letters are significantly different ($P \leq 0.05$)

The peroxide values were increased ($P \leq 0.05$) by increasing the storage period at 60°C. No significant ($P > 0.05$) difference in peroxide value was observed between the seventh and eighth days of storage at 60°C. But the peroxide values on the seventh and eighth days were higher ($P \leq 0.05$) than the peroxide value on the sixth day of storage. Ndiaye *et al.* (2022) showed that the peroxide value of baobab oil increases during storage at 20, 30, and 45°C for three months. Nadeem *et al.* (2017) reported that the peroxide value of butter with mango seed oil increased during storage at 25 and 50°C for 90 days. Kaleem *et al.* (2015) found that at the beginning of oil heating, the peroxide value increased due to the formation of hydroperoxides of unsaturated fatty acids as a result of lipid oxidation. While the peroxide value decreased when the secondary products formed. This was close to the peroxide value of pumpkin seed oil, which increased during storage at 60°C for 7 days and then decreased on the eighth and ninth days.

The acid value was affected ($P \leq 0.05$) by the type of seed oils, extraction method, and storage period at 60°C for 9 days. Mango seed oil (3.74 mg KOH/g oil), followed by apricot seed oil (0.16 mg KOH/g oil), had a higher ($P \leq 0.05$) acid value than pumpkin seed oil (0.12 mg KOH/g oil). Aktaş *et al.* (2018) reported that oil extracted from roasted pumpkin seeds had a low acid value. This indicated that pumpkin seed oil, followed by apricot seed oil, was more stable against hydrolysis than mango seed oil.

The hot extraction method had a higher ($P \leq 0.05$) acid value than the cold extraction method. This was attributed to the effect of heating during hot extraction, which increased the hydrolysis of the oil. Adejumo *et al*. (2013) reported that the acid value of Moringa oleifera seeds increased with increasing heating treatments. Acid values were increased ($P \leq 0.05$) by increasing the storage period at 60°C. This was attributed to the oil's hydrolysis during the storage period. Nina *et al*. (2020) found that free fatty acids increased during the storage period.

Proximate composition of betifore

Data in Table 2 showed the proximate composition of betifore prepared with different levels of oils extracted by cold and hot extraction. The proximate composition of betifore was not affected ($P > 0.05$) by the type used of oil seed, extraction methods, and concentration of oils. Rangrej *et al.* (2015) reported that no significant change in the proximate chemical composition of flaxseed oil cookies was observed as compared with the shortening (control) cookies. Ragaee and Abdel-Aal (2006) reported that increasing oil replacement didn't affect the chemical composition of cookies.

Peroxide and acid values of betifore

Data in Table 3 showed the changes in peroxide and acid values of betifore prepared with different levels of seed oils extracted by cold and hot extractions. The peroxide value was affected ($P \leq 0.05$) by the type of seed oils, extraction method, and concentration of oil. The control betifore (6.02 meq O_2/kg oil), followed by betifore prepared with pumpkin seed oil (6.57 meq O_2/kg oil), had a higher ($P \leq 0.05$) peroxide value than betifore prepared with apricot seed oil (3.77 meq O_2/kg oil) and mango seed oil (3.35 meq O_2/kg oil). Betifore prepared with mango seed oil had a lower ($P \leq 0.05$) peroxide value than control betifore and betifore prepared with other seed oils. These results indicated that apricot and mango seed oils were effective in reducing the oxidative deterioration of fat in betifore. Gurjar and Raj (2022) showed that the addition of mango seed oil to cookies decreased the peroxide values.

Betifore prepared with hot extraction oils had a higher ($P \leq 0.05$) peroxide value than betifore prepared with cold extraction oils. Mirzaei and Rezaei (2019) showed that hot press extraction had a higher peroxide value than cold press extraction for apricot seed oil. This finding may also proves that mango kernel oil may have an antioxidant activity.

Table (2): Proximate composition of betifore prepared with different levels of seed oils extracted by cold and hot extractions (on a dry weight basis)

Treatment	Moisture	Crude protein	Crude fat	Total ash	Total carbohydrate
	(%)				
Control	5.79[a]	5.81[a]	30.57[a]	1.85[a]	55.98[a]
Type of oil					
Apricot	5.79[a]	5.76[a]	30.62[a]	1.84[a]	55.99[a]
Pumpkin	5.80[a]	5.80[a]	30.59[a]	1.95[a]	55.86[a]
Mango	5.86[a]	5.80[a]	30.57[a]	1.83[a]	55.94[a]
LSD	0.09	0.07	0.20	0.12	0.23
Extraction method					
Cold	5.77[a]	5.77[a]	30.64[a]	1.92[a]	55.90[a]
Hot	5.80[a]	5.80[a]	30.55[a]	1.89[a]	55.96[a]
LSD	0.04	0.04	0.20	0.04	0.19
Concentration of oil %					
25	5.80[a]	5.80[a]	30.60[a]	1.92[a]	55.88[a]
30	5.76[a]	5.76[a]	30.51[a]	1.89[a]	56.08[a]
40	5.80[a]	5.80[a]	30.68[a]	1.91[a]	55.81[a]
LSD	0.05	0.05	0.25	0.05	0.28

Means ± standard deviations in the same column with different letters are significantly different ($P \leq 0.05$)

Table (3): Peroxide and acid values of betifore prepared with different levels of seed oils extracted by cold and hot extractions

Treatment	Peroxide value	Acid value
	(meq O_2/kg oil)	(mg KOH/gm oil)
Control	6.02[b]	1.27[d]
Type of oil		
Apricot	3.77[c]	1.51[b]
Pumpkin	6.57[a]	1.39[c]
Mango	3.35[d]	1.58[a]
LSD	0.068	0.056
Extraction method		
Cold	4.37[b]	1.45[b]
Hot	4.76[a]	1.53[a]
LSD	0.056	0.046
Concentration		
25	4.69[a]	1.45[b]
30	4.69[a]	1.52[a]
40	4.31[b]	1.51[a]
LSD	0.068	0.046

Means ± standard deviations in the same column with different letters are significantly different ($P \leq 0.05$)

No significant ($P > 0.05$) difference in peroxide value was observed between betifore prepared with 25% seed oils and betifore prepared with 30% seed oils. However, betifore prepared with 40% seed oils had a lower ($P \leq 0.05$) peroxide value than betifore prepared with 25% and 30% seed oils. The low peroxide values of betifore prepared with seed oils supported this result. Abdel-Razik *et al*. (2012) reported that increasing mango seed oil levels in muffins raised oxidative stability.

The acid value of betifore product was affected ($P \leq 0.05$) by the type of seed oils, extraction methods, and concentration of oils. The control betifore (1.27 mg KOH/g oil), followed by betifore prepared with pumpkin seed oil (1.39 mg KOH/g oil), had a lower ($P \leq 0.05$) acid value than betifore prepared with apricot seed oil (1.51 mg KOH/g oil) and mango seed oil (1.58 mg KOH/g oil). Betifore prepared with pumpkin seed oil had a lower ($P \leq 0.05$) acid value compared with betifore prepared with other seed oils. Aktaş *et al*. (2018) reported that oil extracted from roasted pumpkin seeds had a low acid value.

Betifore prepared with hot extraction oils had a higher ($P \leq 0.05$) acid value than betifore prepared with cold extraction oils. Adejumo *et al*. (2013) reported that acid values increased with increasing heating temperatures.

Betifore prepared with 25% seed oils had a lower ($P \leq 0.05$) acid value than betifore prepared with 30% and 40% seed oils. No significant ($P > 0.05$) difference in acid value was observed between betifore prepared with 30% seed oils and that prepared with 40% seed oils.

Physical properties of betifore

Data in Table 4 showed the changes in physical properties of betifore prepared with different levels of oils extracted by cold and hot extraction. The physical properties except for weight were affected ($P \leq 0.05$) by the type of seed oils, extraction methods, and concentration of oils. No significant ($P > 0.05$) differences in betifore weight were observed between control betifore and that prepared with different types and levels of seed oils extracted by cold and hot extraction. Abdel-Razik *et al*. (2012) reported that the weight of cupcakes was not affected by adding mango seed oil to the cupcake mixture.

Control betifore had lower ($P \leq 0.05$) thickness, width, spread ratio, and spread factor than betifore prepared with seed oils. Betifore prepared with mango seed oil had higher ($P \leq 0.05$) thickness, width, spread ratio, and spread factor than these of control betifore and betifore prepared with apricot and pumpkin seed oils. Betifore prepared with pumpkin seed oil had higher ($P \leq 0.05$) thickness, width, spread ratio, and spread factor than betifore prepared with apricot seed oil. Gurjar and Raj (2022) reported that cookies prepared with mango seed oil were similar to the control. Atta and Ismaiel (2020) reported that the physical properties of biscuits were not affected by adding pumpkin seed oil.

The thickness, width, spread ratio, and spread factor of betifore prepared with seed oils extracted by hot extraction were higher than those extracted by cold extraction.

The betifore prepared with 30% seed oils was higher ($P \leq 0.05$) in thickness, width, spread ratio, and spread factor than betifore prepared with other seed oils. The betifore prepared with 25% seed oils had lower ($P \leq 0.05$) thickness, width, spread ratio, and spread factor than the betifore prepared with other seed oils. Ragaee and Abdel-Aal (2006) showed that cookies prepared with a 25% replacement level of rice bran oil had a lower width and spread factor than cookies prepared with higher replacement levels.

Crust color of betifore

Data in Table 5 showed the changes in crust color of betifore prepared with different levels of oils extracted by cold and hot extraction. The crust color of betifore was affected ($P \leq 0.05$) by the type of seed oils, extraction methods, and concentration of oils. Betifore prepared with apricot seed oil had higher ($P \leq 0.05$) L*, a*, and b* values than those of control betifore and betifore prepared with other seed oils. Betifore prepared with mango seed oil had lower ($P \leq$

0.05) L*, a*, and b* values than those of control betifore and betifore prepared with other seed oils. The control betifore had higher ($P \leq 0.05$) L*, a*, and b* values than betifore prepared with pumpkin seed oils.

Table (4): Physical properties of betifore prepared with different levels of seed oils extracted by cold and hot extractions

Treatment	Weight (g)	Thickness (cm)	Width (cm)	Spread	Spread
Control	5.51[a]	0.75[d]	3.70[d]	4.84[d]	100[d]
Type of oil					
Apricot	5.56[a]	0.78[c]	3.91[c]	4.89[c]	100.3[c]
Pumpkin	5.59[a]	0.80[b]	3.98[b]	5.13[b]	105.2[b]
Mango	5.50[a]	0.83[a]	4.48[a]	5.37[a]	113.4[a]
LSD	0.079	0.008	0.004	0.033	0.035
Extraction method					
Cold	5.52[a]	0.77[b]	3.85[b]	4.70[b]	99.31[b]
Hot	5.57[a]	0.81[a]	4.19[a]	5.44[a]	110.17[a]
LSD	0.056	0.006	0.18	0.024	0.025
Concentration of oil %					
25	5.52[a]	0.76[c]	3.91[c]	4.78[c]	97.86[c]
30	5.53[a]	0.83[a]	4.11[a]	5.33[a]	113.13[a]
40	5.56[a]	0.78[b]	4.04[b]	5.10[b]	103.25[b]
LSD	0.079	0.007	0.003	0.029	0.031

Means ± standard deviations in the same column with different letters are significantly different ($P \leq 0.05$)

Table (5): Crust color of betifore prepared with different levels of seed oils extracted by cold and hot extractions

Treatment	L*	a *	b *
Control	27.75[b]	0.76[b]	20.71[b]
Type of oil			
Apricot	33.02[a]	1.36[a]	21.73[a]
Pumpkin	16.27[d]	-9.31[d]	15.67[d]
Mango	25.73[c]	0.21[c]	16.99[c]
LSD	0.81	0.087	0.065
Extraction method			
Cold	22.75[b]	-2.08[b]	17.89[b]
Hot	28.63[a]	-1.62[a]	19.66[a]
LSD	0.57	0.061	0.046
Concentration of oil %			
25	23.57[c]	2.91[c]	18.36[c]
30	25.22[b]	3.00[b]	18.60[b]
40	28.29[a]	3.23[a]	19.37[a]
LSD	0.70	0.039	0.056

Means ± standard deviations in the same column with different letters are significantly different ($P \leq 0.05$)

Betifore prepared with hot extraction oils had higher (P ≤ 0.05) L*, a*, and b* values than betifore prepared with cold extraction oils. The L*, a*, and b* values of betifore were decreased (P ≤ 0.05) by increasing the concentration of seed oils. Abdel-Razik *et al*. (2012) reported that the muffin prepared with 50% mango seed oil had a higher b* value than the control muffin.

Sensory properties of betifore

Data in Table 6 showed the changes in sensory properties of betifore prepared with different levels of oils extracted by cold and hot extraction. The sensory properties were affected (P ≤ 0.05) by the type of seed oils and their concentration. The sensory properties of control betifore were similar (P > 0.05) to betifore prepared with apricot and pumpkin seed oils. Although the physical properties of betifore prepared with mango seed oil were higher (P ≤ 0.05) than those of control betifore and betifore prepared with apricot and pumpkin seed oils (Table 4), their sensory properties were lower (P ≤ 0.05) than those of control betifore and betifore prepared with apricot and pumpkin seed oils. Gurjar and Raj (2022) reported that control cookies had higher sensory properties than cookies prepared with mango seed oil. Atta and Ismaiel (2020) reported that biscuits prepared with pumpkin oil seeds had lower sensory properties than control biscuits.

No significant (P > 0.05) differences in sensory properties were observed between betifore prepared with oil extracted by cold extraction and betifore prepared with oil extracted by hot extraction.

Table (6): Sensory properties of betifore prepared with different levels of seed oils extracted by cold and hot extractions

Treatment	Appearance	Texture	Color	Flavor	Mouth feeling	Overall acceptability
Control	6.90 [a]	7.24[a]	7.28[a]	7.53[a]	6.90[a]	7.26[a]
Type of oil						
Apricot	6.98[a]	7.37[a]	7.56[a]	7.56[a]	7.22[a]	7.38[a]
Pumpkin	6.65[a]	7.37[a]	7.24[a]	7.24[a]	7.22[a]	7.28[a]
Mango	6.13[b]	6.64[b]	6.60[b]	6.60[b]	6.54[b]	6.49[b]
LSD	0.34	0.25	0.34	0.33	0.25	0.23
Extraction method						
Cold	6.61[a]	7.27[a]	7.30[a]	7.30[a]	7.09[a]	7.14[a]
Hot	6.38[a]	6.98[a]	6.97[a]	6.96[a]	6.89[a]	6.96[a]
LSD	0.28	0.30	0.33	0.34	0.21	0.19
Concentration of oil %						
25	7.55[a]	7.30[a]	7.34[a]	7.34[a]	7.23[a]	7.27[a]
30	7.34[a]	7.07[a]	7.16[a]	7.16[a]	6.98[a]	7.04[a]
40	7.20[a]	7.01[b]	6.90[b]	6.90[b]	6.70[b]	6.74[b]
LSD	0.36	0.25	0.22	0.22	0.25	0.23

Means ± standard deviations in the same column with different letters are significantly different (P ≤ 0.05)

The appearance of betifore prepared with seed oils was not affected ($P > 0.05$) by increasing the concentration of seed oils. No significant ($P > 0.05$) differences in all other sensory properties of betifore were observed by increasing the concentration of seed oils up to 30%. However, betifore prepared with seed oils at 40% had lower ($P > 0.05$) sensory properties than other concentrations. Gurjar and Raj (2022) reported that cookies prepared with 25% mango seed oil had a higher appearance, texture, taste, and overall acceptance than controls. At higher concentrations of mango seed oil, cookies had lower sensory properties. Abdel-Razik *et al*. (2012) reported that the crust color, crumb color, flavor, eating quality, and overall acceptability of muffins decreased with the increase in mango seed oil replacement.

From the above results, it could be concluded that high-quality betifore can be produced by replacing the shortening in the betifore with 25, 30, and 40% oil extracted by cold and hot extraction from apricot, pumpkin, and mango seeds respectively.

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الاستخدام المحتمل لزيوت بعض البذور الغير مستغلة كمكونات وظيفية في صنع البيتي فور

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تم استبدال السمن في البيتي فور بالزيوت المستخلصة من بذور المشمش واليقطين والمانجو بالاستخلاص البارد والساخن بنسبة ٢٥ ، ٣٠ ، ٤٠٪ وتم تقييم التركيب التقريبي ، ورقم البيروكسيد ، ورقم الحامض ، والخصائص الفيزيائية ، ولون القشرة ، والخصائص الحسية للبيتي فور وكان رقم البيروكسيد ورقم الحامض لزيوت بذور المشمش واليقطين والمانجو ٥,٥٩ مليمكافيء أكسجين/كجم زيت و ٠,١٦ ملجم هيدروكسيد البوتاسيوم/جم زيت ؛ ٢٠,٣ مليمكافيء أكسجين/كجم زيت و ٠,١٢ ملجم هيدروكسيد البوتاسيوم/جم زيت و ٣,٦٩ مليمكافيء أكسجين/كجم زيت و ٣,٧٤ ملجم هيدروكسيد البوتاسيوم/جم زيت على التوالي وكان قيمة رقم البيروكسيد، ورقم الحامض للاستخلاص على الساخن أعلى من الاستخلاص البارد. لم يتأثر التركيب التقريبي للبيتي فور بنوع الزيوت وطرق الاستخراج وتركيز الزيوت وكان بيتي فور مجموعة المقارنة متبوعًا ببيتي فور اليقطين أعلى في رقم البيروكسيد وأقل في رقم الحامض من بيتي فور المشمش والمانجو ووزن البيتي فور لم يتأثر باستبدال زيوت هذه البذور وكان البيتي فور المحضر بزيت بذور المانجو متبوعًا بزيت بذور اليقطين وزيت بذور المشمش أعلي في كل من thickness, width, spread ratio and spread factor من بيتي فور مجموعة المقارنة والبيتي فور المحضر بزيت بذور المشمش كان له قيم (lightness (L *، (redness (a *، (yellowness (b * أعلى من مجموعة المقارنة والبيتي فور المحضر من زيوت البذور الزيتية الأخرى وكانت الخواص الحسية لبيتي فور مجموعة المقارنة مماثل للبيتي فور المحضر بزيت بذور المشمش وزيت اليقطين وكانت الخواص الحسية لبيتي فور المانجو أقل من بيتي فور المجموعة المقارنة والبيتي فور المحضر بزيوت بذور المشمش واليقطين. . أشارت النتائج إلى أن زيوت بذور المشمش واليقطين والمانجو، كمنتج ثانوي، ويمكن استخدامها لتحل محل الدهون في منتجات المخابز لإنتاج منتجات عالية الجودة وذات قيمة مضافة.