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PHYSICOCHEMICAL CHARACTERISTICS OF PERSIMMON PUREE AND ITS UTILIZATION IN CUPCAKE

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ABSTRACT: This study was carried out to investigate the chemical composition, antioxidant activity and phenolic compounds of persimmon puree and evaluate the impact of utilizing persimmon puree on some chemical, physical and organoleptic properties of cupcake. Persimmon puree was added to cupcake at a ratio of 33.3, 50, 66.6 and 83.3%. Results showed that persimmon puree contained 20% total soluble solids, 73.59 % moisture, 32.5mg/100g vitamin C, 416.5 mg/100g carotenoids. The major polyphenols identified in persimmon puree (in ppm) were Pyrogallol (183.40) , Catechol (8.34), Ellagic (6.66), Epicatechein (6.56), Benzoic (5.05), Caffeine (4.93), Caffeic acid (4.37), Chlorogenic acid (4.32), Vanillic acid (2.88), Catechein (2.77), P. Hydroxy-benzoic acid (2.61), Ferulic acid (2.05), Salycilic (2.05), P.coumaric acid (1.32), Protocatchuic acid (1.11), Alpha-coumaric (0.99) , Iso ferulic (0.73), Coumarin (0.69), Gallic (0.59) , Reversetrol 0.51, 4-Amino benzoic(0.48), 3-OH-Tyrosol (0.33), 3-4-5-Methoxy-Cinnamie (0.29) and Cinnamic (0.19). The major flavonoids detected in persimmon puree (in ppm) were Hisperidin (2.698), Rutin (0.104), Quercetrin (0.816), Luteolin (0.559), Narengin (0.534), Hispertin (0.057), Rosmarinic (0.047), Quercetin (0.026), 7-OH-ydroxy flavone (0.012), Kampferol (0.007), and Apegnin (0.007). Addition of persimmon puree to cupcake affected the organoleptic properties of cupcake samples. Cupcake containing 33.3% persimmon puree had the highest score for physical and organoleptic properties compared to control and other treatments. Therefore this treatment was analyzed for total polyphenol content, antioxidants activity, physical and sensory properties. Results showed that persimmon puree cupcake had higher contents of total phenolic, vitamin c and antioxidant activity than control sample. Moreover, persimmon puree cupcake had higher scores for the organoleptic properties than control sample. Based on the previous results, it can be concluded that utilization of persimmon puree in cupcake manufacture at a ratio of 33.3% can improve the chemical, physical and organoleptic characteristics as well as antioxidant activity of cupcake.

Key word: Persimmon puree, cupcake, chemical composition, antioxidants, polyphenols, flavonoids, cupcake properties.

INTRODUCTION

Persimmon fruit (*Diospyros kaki* L.) belongs to the Ebenaceae family. In Egypt the cultivated area with persimmon is about 11570 faddans producing about 34430 tons (EEAR, 2015). It is cultivated worldwide with 90% of the production is provided by china, Japan and Korea (Denev and Yordanov, 2013). Large numbers of cultivars are commercially produced. The major differences between cultivars are the presence of stringency and seeds (East *et al.,* 2011). Astringent cultivars require ripening (until they are soft) before being consumed, whereas non-astringent cultivars can be consumed when either a crisp apple like texture are soft peak like texture (Seong and Han, 1999; Bubba *et al.,* 2009). The persimmon is considered as a climacteric fruit, having the ability to continue ripen subsequent to harvest.

Nowadays it is considered as a popular fruit due to its unique flavour and taste and its

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significant health benefits. Persimmon could be consumed as fresh or processed products. Its various products can be obtained from persimmon such as dried fruits, jams, juices, jelly, candy, wine, vinegar and it can be used in the ice- cream and toffee manufacturing (Gao *et al.,* 2010; East *et al.,* 2011; Karaman *et al.,* 2014 ; Jiménez-sánchez *et al.,* 2015; Oksuz *et al.,* 2015). The contents of primary and secondary metabolites such as sugars, organic acids, carotenoids and polyphenols are vary significantly in different cultivars of persimmon (Veberic *et al*., 2010). Flavour and sensory characteristics, but also to the nutritional properties and beneficial health effects of persimmon fruit related to the chemical composition of persimmon fruit (Veberic *et al.,* 2010). It is commonly known that the contents of individual sugars as well as the sugar/acid ratio directly correlate with the sweetness of persimmon fruit (Schwieterman *et al*., 2014). The colour of persimmon fruit in different cultivars varies from yellow and orange to deep red which resulted from the different contents of carotenoids (Zhou *et al*., 2011). Persimmon fruits with high concentration of carotenoids and polyphenols have potential effects on preventing cardiovascular diseases (George Redpath, 2008). Thabit (2010) showed that the moisture content in persimmon fruits ranged from 72.05 to 82% (on fresh weight basis). Ito (2000) reported that the concentration of total soluble solids ranged from 18.0 to 20.8% in astringent persimmon fruits and 16.2% in non-astringent persimmon fruits. Lyon *et al.* (2008) found that the pH value of fuyu persimmon cultivars was 6.06 at harvest, while it was 5.97 for fruit stored at 18° C for two weeks. Attia *et al.* (2013) found that total acidity of persimmon fruit ranged between 0.14 and 0.30%. Denev and Yordanov (2013) found that commercial harvest stage, total sugar content varied between 9.6 and 14.4 g/100g and increased slightly to 11.5-16.5 g/100g of the maturation. Glucose and fructose were found to be predominant sugars. Gorinstein *et al.* (2011) reported that ascorbic acid content in persimmon fruit ranged between 12.6 to 50 mg/100g (on fresh weight basis). Forbus *et al.* (2011) showed that total carotenoids ranged from 212.0-265.6 mg/100g and can be as higher as 1400-2330 mg/100g (Thabit, 2010). Turk (2012) found that alcohol insoluble solids ranged between 1.22 and 4.33%. Celik and Ercisli (2008) showed that the colour of persimmon puree were L=33.2 to 89.3 a=7.67 to 18.1 and b = 20.3 to 60.5. The variation between chemical and physical properties may be due to variation in variety, climatic conditions and harvesting season. Gorinstein *et al.* (2000) determined Na (4.94), K (198.2), Fe (99.2), Mn (101.2), Cu (9.3), Zn (13.9) mg/100 g in fresh persimmon. Ksouri *et al.* (2009) and Veberic *et al.* (2010) reported that persimmon contained Rutin, Quercetrin, Quercetin and Hesperidin which valued as much as 0.066 or 98.34,0.645 or 63.20, 0.224 or 23.82,15.94 mg/kg, respectively. Oksuz *et al.* (2015) found that total phenolic content was 428.62 mg, Gallic acid/100 mg (dry weight). Suzuki e*t al.* (2015) reported that persimmon has different total phenolic compound depending on cultivars, parts and solvents extraction. The fruit is a good source of carbohydrates, vitamin A, vitamin C, minerals, dietary fiber, tannins, polyphenols, flavonoids and carotenoids (Butt *et al.,* 2015).

The aim of the present investigation was to characterize the physical, chemical and bioactive compounds of persimmon puree and evaluate the effect of utilizing persimmon puree on some quality parameters of cupcake.

MATERIALS AND METHODS

Materials

Plant material and chemicals

Fresh persimmon fruits were purchased from the local market in Zagazig city, Sharkia Governorate, Egypt. Wheat flour (72% extraction) was obtained from Cairo East Co. of Milling, Cairo, Egypt. Baking ingredients such as sugar (sucrose; a commercial grade), salt, botteled water, shortening, fresh whole egg, baking powder and vanilla were obtained from local supermarket in Zagazig City, Sharkia Governorate, Egypt. Acetic acid, methanol, and acetonitrile used in the HPLC analysis were purchased from Merck (Darmstadt, Germany). Standard phenolic and flavonoid compounds and Folin-Ciocalteu's phenol reagent were obtained from Sigma Chemical Co.

Methods

Preparation of persimmon puree

Fresh persimmon fruits were washed and peeled. Fruits were cut into slices and blended in a mixer (Panasonic MK-H4-W, Malaysia).The puree was put in double jacket and heated at 60°C for 20 min. The resultant puree was cooled in water bath (Matsuo *et al.,* 2004).

Preparation of cupcakes

Cupcake was prepared according to the method outlined by AACC (2002). The shortening (120 g) was melted and mixed with sugar (225 g) and salt (5 g) using electric mixer (Panasonic MK-H4-W, Malaysia). The whole egg (175 g) was mixed with vanillia (5 g) and whipped until smooth like-cream texture was formed. Wheat flour (250 g) was mixed with baking powder (10.5 g) and added gradually together with water (250 ml) to the whipped egg mixture. This mixture was beaten gently until homogenous dough is formed using hand mixer. Persimmon puree was added as a substitute of the sugar solution in a ratio of 33.3%, 50%, 66.6% and 83.3% as indicated in Table 1. After getting appropriate texture, the dough was poured into paper cups mounted in cupcake tray and backed at 180˚C ± 5˚C for 30 - 35 min. The baked cupcakes were allowed to cool down at room temperature, packed into aluminum foil and stored at room temperature.

Assessments

Chemical composition

Total soluble solids, total sugars, reducing sugars, non-reducing sugars, moisture, acidity, pH, vitamin C, alcohol insoluble solids, carotenoids and minerals of persimmon puree were determined according to AOAC (2005). Carbohydrates content was calculated by difference according to FAO (2003).

Determination of specific volume of cupcake

The weight (g) of baked cupcakes was determined individually within one hour after baking and the average was calculated. The volume (cm^3) of different substituted cupcakes was determined by rape seeds displacement method according to AACC (2002). Specific volume (cm^3/g) of cupcake was calculated by dividing cupcake volume by cupcake weight.

Preparation of methanol extract

Persimmon fruits were subjected to simple process of solid and liquid separation (Lu *et al.,* 2010). After the core of the persimmon fruit was removed, the remaining materials were centrifuged at 5,000 rpm for 10 min. The supernatant decanted and put in round flask and freeze-dried at -70^{o}C.

Preparation of the extracts for antioxidant activities

The freeze-dried material was extracted with methanol for two days at room temperature. Antioxidant activity, total phenolic content and total flavonoid content of methanol extract were determined. Sugar analysis of persimmon was carried out according to the method of Lu *et al.* (2010).

DPPH radical scavenging activity

The DPPH radical scavenging activities in the methanol extracts of all samples were measured by the method described by Lee *et al.* (2006) with a slight modification. Briefly, sample extracts (0.1 ml) at various concentrations were added to both 0.49 ml of methanol and 0.39 ml of a DPPH methanolic solution (1 mM). The mixtures were vigorously vortexed and incubated for 30 min at room temperature in the dark. The absorbance of mixtures was determined by using a Beckman DU650 Spectrophotometer (Beckman Coulter, Fullerton, CA, USA). BHT was used as the reference. The scavenging activity was expressed as a percentage using the following formula:

DPPH radical scavenging activity (%) = (1-absorbance of sample/absorbance control) × 100

Determination of total phenolic content

The total phenolic content of the methanolic extract was determined using the Folin-Ciocalteau method (Meda *et al.,* 2005). Briefly, each sample (500 µl) was added to 250 µl 2 N Folin-Ciocalteau reagent. After 5 min, 500 µl of 7% Na_2Co_3 solution was added with mixing. After 1 hr at room temperature, the absorbance at 750 nm (Beckman Coulter DU650) was measured. The standard curve for total phenolic was made using gallic acid solutions (0, 50, 100, 250, and 500 mg/l) with the same procedure as mentioned above. The results were expressed as mg gallic acid equivalents (GAE/g extract).

Table 1. Substitution of sugar solution by different added levels of persimmon puree

Sample	Persimmon puree (g)	Sugar solution (g)	Substitution of sugar solution by persimmon puree (%)
Control	-	250	-
T1	100	150	33.30%
T2	150	100	50.00%
T3	200	50	66.60%
T4	250	-	83.30%

T1=cupcake containing 33.3% persimmon puree, T2=cupcake containing 50% persimmon puree,T3=cupcake containing 66.6% persimmon puree and T4=cupcake containing 83.3%persimmon puree.

Determination of total flavonoid contents

The total flavonoid content was determined using a modified colorimetric method (Abeysinghe *et al.,* 2007). The diluted extract (1ml) was added to a test tube containing 7 ml of methanol after addition of 2 ml of 90% diethylene glycol. The reaction mixture was initiated by adding 0.1 ml of 4 M sodium hydroxide. After heating for 30 min at 50^{o}C, the reaction mixture was incubated at room temperature for 30 min. The absorbance of the solution was measured at 420 nm (Beckman Coulter DU650). Total flavonoid content was determined using a standard curve of rutin (0, 10, 25, and 50 mg/l) and then expressed as mg rutin equivalents (RE/g extract).

Identification and quantification of phenolic and flavonoid of the persimmon puree compounds by HPLC

The phenolic and flavonoid compounds of the persimmon puree samples were identified according to the method described by Goupy *et al*. (1999) and Mattila *et al.* (2000) by using HPLC instrument (Hewlett Packard series 1050, USA) composed of column C18 hypersil BDS with particle size 1 mm. The separation was carried out by gradient duties using methanol and acetonitrile as a mobile phase (50 : 50 *V/V*). The flow rate was 1 ml/ min. Quantification was carried out using standards of phenolic and flavonoid compounds. This assay was conducting in Agricultural Res. Center Laboratory, Cairo, Egypt.

Colour Measurement

Colour attributes (L^*, a^*, and b^*) of Persimmon purees cupcake were measured according to See *et al.* (2007) using hunter Lab colour flex EZ spectrophotometer. L^* value defines lightness, a^* value denotes the red/green colour and b^* value the yellow/blue colour.

Organoleptic Properties

The organoleptic properties of cupcakes were 10 panelists according to AACC (2000).Cupcake samples were left to cool at room temperature for 1 hr., after baking, then cut with a sharp knife and subjected to panel test. The score was as follows 10: flavour, 10: texture, 10: colour, 10: taste, and 10: overall acceptability.

Statistical Analysis

All data were statistically analyzed using the general linear models procedure of the statistical analysis system SAS (1998). Significances of differences were defined at $p < 0.05$.All experiments as well as related analysis results were repeated three times and all obtained data are expressed as an average .In addition, this statistical analysis was used for sensory evaluation of persimmon cupcake.

RESULTS AND DISCUSSION

Chemical Composition of Persimmon Puree

The chemical composition of persimmon puree was determined and the obtained results are presented in Table 2. Total soluble solids content of the persimmon puree was 20.12° brix. This is in agreement with that obtained by Attia *et al*. (2013) who found that total soluble solids content of persimmon cultivars ranged from 17.8

Table 2. Chemical and physical characteristics of persimmon puree (fresh weight basis)

Properties	Persimmon puree
Total soluble solids	20.12° brix
Total sugars	15.50 %
Reducing sugars	13.80 %
Non – Reducing sugars	1.70 %
Moisture	73.59%
Titratable acidity (as citric acid)	0.15%
pH	5.82
Vitamin C	32.50 mg/100g
Alcohol insoluble solids	1.79 %
Carotenoids	416.50 mg/100g
Colour (Hunter values)	L^* = 45.33
	a^* = 17.35
	b^* = 25.19

to 22.6% depending on the variety. Total, reducing and non-reducing sugars content of persimmon puree were 15.5%, 13.8% and 1.7%, respectively. These results are in agreement with those obtained by Denev and Yordanov (2013) who found that commercial harvest stage; total sugar content varied in the range of 9.6 and 14.4 g/100g and increased slightly to 11.5- 16.5 g/100g at the maturation. Glucose and fructose were found to be the predominant sugars.

Moisture content of persimmon puree was 73.59% (Table 2). Titratable acidity determined as citric acid was 0.15%. Similar values has been reported by Attia *et al*. (2013) who found that total acidity of persimmon fruit ranged between 0.14 and 0.30%.

Concerning pH value of persimmon puree from the results presented in Table 2, the pH value was found to be 5.82. This is in agreement with the result obtained by Homnava *et al*. (2014) who stated that pH value of different varieties of fresh persimmon was in the range of 5.5 to 6.08.

It is well known that the predomination vitamin in persimmon fruit is vitamin C, existing in two vitamins- ascorbic acid and dehydro-L ascorbic acid. Giordani *et al.* (2011) stated that 100-150 g of fresh persimmon supplies the recommended daily amount. Vitamin C content in persimmon puree was 32.5 mg/100g. This is in accordance with the results obtained by Gorinstein *et al*. (2011) who found that ascorbic acid content in persimmon fruit ranged between 12.6 and 50 mg/100g and lower than those reported by Thabit (2010) who found that ascorbic acid content was ranged from 55.59 to 59.71 mg/100 g in flesh of persimmon cultivars.

Alcohol insoluble solids content in persimmon puree presented in Table 2 is 1.79%. Turk (2012) found that alcohol insoluble solids ranged between 1.22 and 4.33%.

Carotenoids give the fruit its characteristic reddish- orange colour consisting of β- carotene, Ɣ-carotene and β- cryptoxanthin (Veberic *et al.,* 2010). Carotenoids content in persimmon puree were 416.5 mg/100g. Lower values were reported by Forbus *et al.* (2011) who showed that total carotenoids ranged from 212.0 to 265.6 mg/100g., whereas higher concentration (1400-2330 mg/100g) was reported by Thabit (2010).

Results presented in Table 2 show that the colour attributes of persimmon puree were L^* = 45.33 a^* = 17.35 and b^*= 25.19. These results are

in agreement with those reported by Celik and Ercisli (2008) who showed that the colour of persimmon puree were L^*= 33.2 to 89.3 a^* = 7.67 to 18.1 and b^* = 20.3 to 60.5 depending on the variety of persimmon.

Phenolic compounds in persimmon puree

Suzuki *et al*. (2015) indicated that persimmon has different total phenolic compound depending on cultivars, parts, and solvents extraction. Sattar *et al*. (2013) reported that the amounts of phenolic compounds in persimmon extracts from 5 cultivated genotypes were different, because phenolic content of plants depends up on both quantitatively and qualitatively on their genetic information. The different of phenolic compounds may be affected by a variety and environments contents including light, temperature, humidity, drought, and agronomic conditions factors, in the different harvest regions. Results presented in Table 3 show that 24 phenolic compounds were identified from persimmon puree. The major identified and quantified phenolic compounds in persimmon puree were in decreasing order (as follow mg/kg puree) Pyrogallol (183.40), Catechol (8.34), Ellagic (6.66), Epicatechein (6.56), Benzoic (5.05), Caffeine (4.93), Caffeic acid (4.37), Chlorogenic acid (4.32). Other phenolic compound were found with low concentrations as shown in Table 3. It is worthwhile stating that Pyrogallol which was identified as the predominant phenolic compound in persimmon puree was not identified by several authors in persimmon fruit (Hudina *et al.,* 2008; Vebric *et al.,* 2010). Total phenolic compounds in persimmon fruit (without skin) has been reported by Gorinstein *et al*. (2015) for Triumph variety (115 mg/100 g) and for Fuio variety (121 mg/100 g). Oksuz *et al.* (2015) found that total phenolic content was 428.62 mg gallic acid/100 mmol dry weight basis).

Flavonoid compounds in persimmon puree

Results presented in Table 4 show the content of flavonoid compounds in persimmon puree. Flavonoids, including flavanones, flavones, flavanols and anthocyanins are the most important aromatic secondary metabolites and their consumption has been linked to the protection against cancer, heart disease and oxidants (Hertog *et al*., 2012).The concentration of Rutin, Quercetrin, Quercetin, Hisperidin were 0.104, 0.816, 0.026 and 2.698 mg/kg, respectively. These results were higher than those obtained by Ksouri *et al*. (2009) or Veberic *et al.* (2010) who reported that Rutin, Quercetrin, Quercetin and Hisperidin were 0.066 or 98.34, 0.645 or 63.20, 0.224 or 23.82, 15.94 mg /kg, respectively. Concerning the results from Table 4; Luteolin, Rosmarinic, Narengin, Hispertin, Kampferol, Apegnin, 7-Hydroxy flavone were 0.559, 0.047, 0.534, 0.057, 0.007, 0.007, and 0.012 mg/kg., respectively.

The Effect of Persimmon Puree on Physical and Sensory Properties of Cupcake

Specific volume of cupcake

Cupcakes were prepared by adding different quantities of persimmon puree (33.3, 50, 66.6 and 83.3%) in order to improve the nutritional and antioxidants activity of cupcakes. Table 5 shows the weight, volume and specific volume of resultant cupcakes. The volume of cupcake containing 33.3% persimmon puree was found to be the highest among the other cupcakes. The specific volume (cm^3/g) of control cupcake was 1.17 which was increased by138% as a result of addition 33.3% persimmon puree. Addition of higher quantity of persimmon caused a pronounced reduction in specific volume and this may due to the compactnent of the texture as a result of addition of high quantity of persimmon puree.

From the previous results it could be concluded that cupcake containing 33.3% persimmon puree (T1) had the highest score of physical than control and other treatments. Therefore, this treatment was further analyzed in respect to total phenolic content, vitamin C content, antioxidants activity, physical and sensory properties and was compared to control. Table 6 shows that T1 has the maximum value of taste compared to the control which had the minimum value of taste, while T3 and T4 had the lowest values than T2. Concerning to flavour results in Table 6 show that T1 contained the highest value of flavour compared to the control, whileT3 and T4 had low value than T2. On the other hand, texture in T1 had the highest value compare to the control while T3and T4 had low value than T2. Results in Table 6 shows that T1 had the highest value for colour compared to the control while T2 and T4 had low value than T3. On the other hand, overall

Table 3. Identification of phenolic compounds in persimmon puree (mg/kg) by HPLC

Phenolic compound	Concentration
Pyrogallol	183.40
Catechol	8.34
Ellagic acid	6.66
Epicatechin	6.56
Benzoic acid	5.05
Caffeine	4.93
Caffeic acid	4.37
Chlorogenic acid	4.32
Vanillic acid	2.88
Catechin	2.77
P. Hydroxy-benzoic acid	2.61
Ferulic acid	2.05
Salycilic acid	2.05
P. coumaric acid	1.32
Protocatchuic acid	1.11
Alpha-coumaric acid	0.99
Iso ferulic acid	0.73
Coumarin	0.69
Gallic acid	0.59
Reversetrol	0.51
4-Amino benzoic acid	0.48
3-hydroxytyrosol	0.33
3-4-5-trimethoxycinnamie acid	0.29
Cinnamic acid	0.19
Total phenolic compounds	241.17

Table 4. Identification of flavonoid compounds in persimmon puree (mg/kg) by HPLC

Flavonoid compound	Concentration (mg/kg)
Hisperidin	2.698
Rutin	0.104
Quercetrin	0.816
Luteolin	0.559
Narengin	0.534
Hispertin	0.057
Rosmarinic	0.047
Quercetin	0.026
7-OH-ydroxy flavone	0.012
Apegnin	0.007
Kampferol	0.007
Total Flavonoid content	4.867

Table 5. Effect of adding persimmon puree on physical properties of cupcake

Sample	Treatment				
	C	T1	T2	T3	T4
Weight (g)	24	25	27	30	33
Volume (cm^3)	28	69.7	61.4	49.7	14.7
Specific volume (cm^3/g)	1.17	2.79	2.27	1.66	0.45

C= control cupcake
T 1 = cupcake containing 33.3 % persimmon puree. T2 = cupcake containing 50 % persimmon puree
T3 = cupcake containing 66.6 % persimmon puree T4 = cupcake containing 83.3 % persimmon puree

Table 6. Effect of adding persimmon puree on sensory properties of cupcake

Sample	Taste (10)	Flavour (10)	Texture (10)	Colour (10)	Overall acceptable (10)
C	7.89	7.28	7.57	7.39	7.53
T1	8.28	7.78	8.46	8.78	8.33
T2	6.85	6.92	6.42	6.64	6.71
T3	6.60	6.28	6.10	6.89	6.47
T4	6.53	5.92	6.07	6.10	6.16

C= control cupcake
T 1 = cupcake containing 33.3 % persimmon puree T2 = cupcake containing 50 % persimmon puree
T3 = cupcake containing 66.6 % persimmon puree T4 = cupcake containing 83.3 % persimmon puree

acceptablity in T1 had the highest value compared to the control while T3 and T4 had low value than T2. Moreover, sensory analysis of cupcake showed that taste, flavour, texture, color and overall acceptability scores of cupcake containing 33.3% persimmon puree were perceived by the panalists as the most acceptable one (Table 6). Therefore, treatment T1 was selected to carry on further.

Total phenolics content, vitamin C and antioxidants activity of persimmon cupcake

Table 7 shows that total polyphenols content of 33.3% persimmon cupcake was increased by 220% compared to control cupcake. Similarly, vitamin C content of persimmon cupcake was increased by 7766% compared to control cupcake. Phenolic compounds and vitamin C constitute some of the major compounds acting as free radical scavengers.

Antioxidant activity measured by DPPH is presented in Table 7. Antioxidant activity of persimmon cupcake was found to be higher than that of control cupcake. At 100 ppm DPPH, the antioxidant activity increased from 35.42% in the control cupcake to 54.48% in the persimmon cupcake. Similarly at 200 ppm DPPH the antioxidant activity increased from 42.32% of the control cupcake to 62.57% in the persimmon cupcake. The respective values at 300 ppm DPPH were 48.36% and 68.99%. The results clearly showed that, addition of persimmon puree to cupcake recipe improved its contents of polyphenols and vitamin C and improved the antioxidant activity to a prounounced extent.

Some physical characteristics of persimmon cupcake

Results in Table 8 indicate that the volume and specific volume of persimmon cupcake were higher than control cupcake. Moreover, the colour parameters show lightness (L^*) of the crust was decreased as a result of persimmon addition to cupcake recipe. Redness (a^*) and yellowness (b^*) of persimmon cupcake were lower than the control cupcake. The control cupcake was darker than the persimmon cupcake and this phenomenon may due to the browning reactions such as maillard reaction which could take place during the baking of the cupcake. As for the colour parameters of the crumb, results in Table 8 indicated that L^* and b^* were decreased whereas a^* value was increased showing that move redish colour is observed in persimmon cupcake.

Sensory evaluation of persimmon cupcake

Results in Table 9 shows that, the sensory scores of persimmon puree cupcake were higher than control cupcake, indicating that palatability of persimmon cupcake was higher than control cupcake.

Table 7. Total polyphenols, vitamin C and antioxidants activity of persimmon cupcake

Antioxidants constituents	Control	Persimmon cupcake (33.3%)
Total polyphenols (mg/g)	0.263	0.843
Vitamin C (mg/100 g)	0.003	0.236
Antioxidant activity at DPPH (100 ppm)	35.42	54.48
Antioxidant activity at DPPH (200 ppm)	42.32	62.57
Antioxidant activity at DPPH (300 ppm)	48.36	68.99

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Table 8. Physical characteristics of persimmon cupcake

	Treatment	
	Control	**Persimmon cupcake**
Weight (g)	24	25
Volume (cm^3)	35	77
Specific volume (cm^3/g)	1.4	3.08
Crust colour		
L^*	47.51	31.94
a^*	10.15	8.24
b^*	24.05	13.90
Crumb colour		
L^*	63.95	35.94
a^*	2.02	5.06
b^*	22.00	11.38

Table 9. Sensory evaluation of persimmon cupcake

Treatment	Taste (10)	Flavour (10)	Texture (10) (Sponge)	Colour (10)	Overall acceptable (10)
Control	8.066^{bc}	7.605^{d}	7.813^{c}	7.714^{c}	7.613^{b}
Persimmon cupcake with 33.3%	8.866^{a}	8.515^{a}	8.366^{a}	8.333^{a}	7.717^{a}

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الصـــفات الفيزوكيميـــائيـــة لبيوريـــــه الكـــاكـــى والاســـتفادة منه فى كيك القـوالب

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أجريت هذه الدراسة بهدف تقديرالتركيب الكيماوى والنشاط المضاد للأكسدة ومحتوى المركبات الفينولية لبيوريه الكاكى ودراسة تأثير استخدامه فى صناعة الكيك حيث تم إضافة البيورية مع محلول سكرى عند صناعة الكيك بنسبه٣٣,٣%، 50%،٦٦,٦% ،٨٣,٣% وتم تحليل عينات الكيك من حيث الخواص الحسية والطبيعية وذلك بعد التصنيع مباشرة، وأوضحت النتائج أن بيوريه الكاكى به نسبة عالية من الجوامد الصلبة الكلية (٢٠%) والرطوبة (٧٣,٥٩%) وفيتامين ج (٣٢,٥ ملجم/١٠٠جرام) وكاروتينات (٤١٦,٥ملجم/١٠٠جرام)، كذلك أظهر بيوريه الكاكى محتوى عالى من المواد الفينولية حيث تراوحت مابين ٠,١٩ الى ١٨٣,٤ ملجم /كجم وكان أهم هذه المواد هى البيروجالول، حمض السينامك، الجاليك الكلوروجنيك والكافيك كما احتوى بيوريه الكاكى على كميه كبيرة من الفلافونات حيث تراوحت مابين ٠,٠٠٧ إلى ٢,٦٩ ملجم/كجم ومن أهم هذه المواد اللوتولين، الروزماريسين وأبيجينين، كما أدى إضافه بيوريه الكاكى والمحلول السكرى إلى الكيك إلى تحسين الخواص الطبيعية والحسية لعينات الكيك وكانت أفضل معاملة تلك المحتوية على ٣٣,٣% بيوريه الكاكى والمحلول السكرى لذا تم اختيار هذه المعاملة ومقارنتها بالكنترول حيث تم تحليلهما من حيث محتوى المواد الفينولية والنشاط المضاد للأكسدة والخواص الطبيعية والحسية، ولقد أشارت النتائج إلى أن عينة الكيك المحتوية على بيوريه الكاكى كانت الأعلى فى محتوى المواد الفينولية والنشاط المضاد للأكسدة والأفضل فى الخواص الطبيعية والحسية مقارنة الكنترول، ومن خلال النتائج السابقة فانه يمكن استخدام بيوريه الكاكى مع المحلول السكرى فى صناعة الكيك بنسبه ٣٣,٣%حيث أنها حسنت من الخواص الحسية والطبيعية والكيميائية لعينات الكيك وزادت من نشاطها ضد الأكسدة .

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