J. Food and Dairy Sci., Mansoura Univ., Vol. 8 (2): 103 - 110, 2017

Enhancing Antioxidant Activities of Cupcakes by Using Pumpkin Powder During Storage

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ABSTRACT

The main objective of the present study was to evaluate the addition of pumpkin powder as a source of natural antioxidants to cupcakes to minimize lipid oxidation and extend the shelf-life. Two concentrations of pumpkin powder (5 and 10%) were added to cupcakes, all different cupcakes formula were baked at 180 ◦C for 25-30 min then cooled before evaluation, packaged in poly ethylene bags and stored at temperature 5ºC. The sensory evaluation, color characteristics and baking quality for different cupcake samples was estimated. On the other hand some menials, total carotenoids, total phenols and antioxidant activity (%) of the pumpkin powder and pumpkin cupcake were determined. Also, fats were extracted from cupcakes made from pumpkin powder every two week for six weeks and antioxidant activities of fortified cupcakes were evaluated by the determination of acids, peroxide, P-anisidine values and thiobarbituric (TBA) among six weeks storage. The results recorded that weight increased significantly ($P \leq 0.05$) in fortified cupcake with 5 and 10% pumpkin powder which reached 51.63±0.28 and51.71±0.31 *gm*, respectively when compared with control which reached 48.42±0.34*gm*. The result showed that fortified cupcakes with 10% pumpkin powder had the highest level of total carotenoids, total phenols and antioxidant activity% which reached 0.408 *mg/100g*, 0.722 *mg/g* and 11.69%, followed by fortified cupcakes with 5% pumpkin powder which reached 0.359 *mg/100g*, 0.720 *mg/g* and10.47%, respectively, while control recorded 0.306 *mg/100g*, 0.624 *mg/g* and 8.22%, respectively. The results showed that peroxide value decreased significantly ($p \leq 0.05$) in fortified cupcakes 5% and 10% pumpkin powder which recorded 4.40 + 0.10 and 4.03 + 0.57 *meq/kg*, respectively than control which reached 7.13+ 0.32 *meq/kg* after 6 weeks under storage. Lipids extracted from fortified cupcakes with 5 and 10 % pumpkin powder recorded significant decreases ($p \leq 0.05$) in TBA values which reached 0.32+0.03 and 0.28+0.01, respectively than control without pumpkin powder which reached 0.40+0.02 after 6 weeks under storage.

Keywords: Antioxidant activities - carotenoids - total phenols - pumpkin powder -cup cakes

INTRODUCTION

Pumpkin is from genus Cucurbita of the family Cucurbitaceae. It includes squash There are three common types of pumpkin worldwide, namely Curcurbita pepo, Curcurbita maxima and C. moschata (Lee *et al., 2003).* Pumpkin (*Cucurbita maxima*) of the Cucurbitaceous family (*Argentina*) is grown in subtropical Florida and tropical countries and it is a good source of carotene, pectin, mineral salts, vitamins and other constituents which are beneficial to health.

Pumpkin can also be processed into flour, which has a longer shelf-life. This flour could be used due to its flavour, sweetness, deep yellow-orange color and considerable amount of dietary fiber. It could be used to supplement cereal flours in bakery products, soups, sauces, instant noodle and also as a natural coloring supplement for food *(*Judita *et al .,* 2014; Fito, *et al.,* 2001*;* Torreggiani & Bertolo, 2001 and Torres, *et al.,* 2007).

The yellow-orange characteristic color of pumpkin is due to the presence of caroteniods. Its young leaves, tender stem and flowers are also cooked and consumed. Besides, being nutritionally rich the fruit also many medicinal properties such as diuretic, tonic and calm thirst. Caroteniods are the primary source of vitamin A for most of the people in the developing countries (Boileau, *et al., 1999)* where vitamin A deficiency is still common (*Chakarvarty, 2000 and* Mudasir & Anju, 2013).

Carotenoids, with their highly reactive conjugated double bonds, act as free radical traps or antioxidants and may play an important role in quenching of toxic radicals. In view of the vital physiological functions of carotenoids, much attention has been focus on the determination of these pigments in foods as well as in human blood (Ahamad *et. al.,* 2007). To obtain dried product, juice, cake, pomace, filling material in pie, soup and bread, Pumpkins are being processed. Pumpkin used with a coloring agent, flavoring, and with the function of thickener (Norfezah *et al.,2011).*

Cakes are the most consumed bakery product owing to unique products and are always used in festivals as well as in joyous celebrations (Hafez, 2012; Hussain, and Al-Oulabi, 2009; Zhang, *et al.,* 2012 and Ahmed, 2014). Cakes usually made from a higher extraction soft WF caused deficient in phytochemicals and fibers (Rodríguez*, et al.,* 2006).

Food residues could be incorporated into cake making such as carrot leaves *(*Santos, *et al.,* 2014 *and Gómez, et al.,* 2010) watermelon rinds and sharlyn melon peels powders (Al-Sayed, and Ahmed, 2013). By enriching cake with pumpkin and thus carotene, it will be very helpful in enhancing the carotene intake of consumers, *(*Gopalan *et al.,* 1989).

The main objective of the present study was to evaluate the addition of pumpkin powder as a source of natural antioxidants to cupcakes to minimize lipid oxidation and extend the shelf-life.

MATERIALS AND METHODS

Material

Ingredients of cupcakes

Pumpkin fresh was obtained from farmer of Aga, El Dakahlya , Egypt.

Wheat flour (*Ttritucum vulgars*) 72% extraction was obtained from the North Flour Mills Company, Gharbiya, Egypt.

Shortening :(Rawaby consider refined palm oil, 100% pure vegetables oil) was obtained from Safola Egypt Company, 10th Ramadan City, Egypt.

Skim milk, vanilla, sugar, eggs and baking powder were purchased from local market in Mansoura city.

Methods

Preparation of pumpkins powder.

Pumpkins were cleaned, washed with distilled water, peeled, and cut into slices, the slice materials were soaked in boiling water for 15 min, then cooled with distilled water and dried in an air oven dryer 40-50 ºC for 24 hr, finally milled in order to pass through 30 mesh sieve according to *Mahagoub, (2008)*.

Preparation of cupcakes.

Control cupcakes sample were prepared of ingredient, with wheat flour (72% extraction) (250.0*g*) sugar (125.0*g*) salt (3.50 *g*) skimmed milk powder (25.0*g*) Shortening (53.50*g*) fresh whole egg (110.0*g*) baking powder (12.50 *g*) vanillia (2.01*g*) according to the method described by Khalifa *et al*., (2015) .The fortified cupcakes were prepared using the same formula expect for wheat flour (72%) with pumpkin flour at 5 and 10 % (Table 1). All Different cupcakes formula were baked at 180 ◦C for 25-30 *min* then cooled on racks for about one hour before evaluation and packaged in poly ethylene bags and stored at fridge temperature 5ºC according to *AACC, (2002)*. The organoleptically evaluation for different blends of cupcake was estimated by twenty experienced panelists. Also, Fats were extracted from cupcakes every two weeks for six weeks in n-hexan at room temperature for 48 hr. The extract was filtrated and evaporated from the solvent. Fats which extracted from cupcake were kept in deep freezer and analyzed for further determinations.

Table 1. Cupcakes formula from wheat flour, pumpkin powder.

Samples Ingredients (%)	Control	Cupcake 5% pumkin Powder	Cupcake10% pumkin powder
Wheat flour (72% extraction)	100	95	90
Pumpkin powder	-	5	10

Sensory evaluation.

Sensory characteristics of cupcake samples were evaluated according to *Hoojjat and Zabik, (1984*) by 20 panelists. Each panelist was asked to assign scores 0-20 for color, taste, odor, texture, appearance and overall acceptability.

Determinations of color.

Color of cupcake samples was measured according to the method described by Sapers and Douglas, (1987).

Baking qualities of cupcakes.

Volume (cm^3) and weight (*gm*) of three cupcake samples of each treatment were estimated. Specific volume (gm/cm^3) was calculated by dividing of the volume to weight according to the method described in *AACC, (2000*).

Gross chemical composition.

Moisture, ash, crude fat, crude fiber and crude protein contents were determined according to *AACC, (2000)*. Carbohydrates content was calculated by difference.

Determination of minerals

The ash sample powder was dissolved in 1% hydrochloric acid. iron, zinc, calcium, copper and selenium were determined by using Atomic Absorption Spectrometry according to Luten *et al., (*1996*)*.

Determination of carotenoids and antioxidant activity (%):-

Carotenoids and antioxidant activity % were determined according to the methods of AOAC, (2007) at Central lab. of Food Technolpgy Research Institute Arric. Rec. cent. Egypt.

Fractionation and identification of phenolic compounds.

Phenolic compounds were determined by HPLC, fractionated and identificated according to the method of Goupy *et al.,* (1999).

Evaluation of fats extracted from cupcakes.

Acid and peroxide values were determined in each oil sample according to the method described in AOAC, (2000). P-Anisidine value was performed according to the methods of AOCS, (1998). Thiobarbituric (TBA) value was performed according to the methods previously stated by Ottolenghi, (1959); Kikuzaki and Nakatani, (1993).

Statistical analyses

The treatment means were compared using the least significant difference test (LSD) at 5% level of probability as outline by *(Waller and Duncan, 1969)*.

RESULTS AND DISCUSSION

Sensory evaluation of fortified cupcakes with pumpkin powder:-

The results in Table (2) show the sensory properties of cupcakes fortified with 5 and 10% pumpkin powder in comparing with cupcakes without pumpkin powder (control). Data show that cupcakes contained 5 and 10% pumpkin powder recorded 94.00±2.72 and 96.00 ±2.55, respectively in overall acceptability when compared with cupcake without pumpkin powder (control) which reached 96.00±2.55.

Table 2. Sensory evaluation of fortified cupcakes with pumpkin powder.

Samples	Color (20)	Taste (20)	Odor (20)	Texture (20)	Appearance (20)	Overall acceptability (100)
Control	19.25^a±0.93	19.36^a±0.77	19.60^a±0.91	19.11^a±0.57	19.50^a±0.56	92.00^a±2.91
Cupcake 5% pumpkin powder	19.33^a±0.75	19.55^a±0.85	19.55^a±0.66	19.13^a±0.51	19.53^a±0.54	94.00^a±2.72
Cupcake 10% pumpkin powder	19.81^a±0.91	19.64^a±0.95	19.50^a±0.85	19.23^a±0.62	19.77^a±0.51	96.00^a±2.55

Each value is the mean + SE.

***a, b and c means in the same row with different superscripts are different significantly (P< 0.05).**

The results show that sensory evaluation can be varied by various levels of cupcake ingredients added in cupcake preparation. Cupcake samples fortified with 5 and 10% pumpkin powder were acceptable to most members regarding to color, taste, odor, texture, general appearance and overall acceptability. *Pongjanta et al., (2006)* reported that more than 15% of pumpkin powder substitution in sandwich bread; sweet bread and cookie formulations had too strong an effect on the physical and sensory properties of the products, while 20% pumpkin powder was optimum for butter cake, and chiffon cake. The result show that pumpkin powder increase carotenoids and also improvements in color and sensory characteristic in cupcake.

Color parameters of fortified cupcakes with pumpkin powder:-

Color values of cupcake made from wheat flour 72% and supplemented with 5 and 10 % pumpkin powder were measured in crust and crumb by luminosity, red intensity and yellow intensity values and they are presented in Table (3). The results reveal that luminosity, red intensity and yellow intensity values in crust were decreased significantly ($P \leq 0.05$) in cupcake made from wheat flour 72% and treated with 5 % pumpkin powder which reached (54.47±0.01, 19.39±0.03 and 38.89±0.03), for cupcake supplemented with 10 % pumpkin powder which reached (49.98±0.06, 20.08±0.04 and 37.16±0.02) when compared with control which recorded (55.63±0.03, 19.24±0.02 and41.28±0.02) respectively.

On the other hand, the results show that (red intensity and yellow intensity values) in crumb increased significantly ($P \leq 0.05$) in cupcake made from wheat flour 72% and treated with 5 % pumpkin powder which reached (5.23 ± 0.01 and 34.48 ± 0.04) and 10 % pumpkin powder which reached (6.25±0.05 and 35.97±0.02) when compared with control which reached (3.65 ± 0.03 and 32.01 ± 0.06) respectively.

Carotenoids are the natural plant pigments responsible for the orange color of pumpkin (Murkovic *et al.,* 2002). pumpkin are rich in carotene as natural coloring, pectin, mineral salts, vitamins and other substances beneficial to health (Djutin, 1991).

The color of dried pumpkin is an important quality factor which reflects the sensory attractiveness and the quality of the powders *(Quek et al., 2007). Nawirska et al., (2009)* reported that parameters a, b and L should gain high values to obtain the best color of dried pumpkin slices. It was proved that pumpkin exposure to heat and oxygen leads to α- and β-carotene degradation followed by increase of cis isomers resulting in loss of yellowness (less observed as fading).

Table 3. Color parameters of fortified cupcakes with pumpkin powder.

Samples	Crust			Crumb		
	L*	a*	B*	L*	a*	b*
Control	55.63±0.03^{a}	19.24±0.02^{c}	41.28±0.02^{a}	73.56±0.01^{a}	3.65±0.03^{c}	32.01±0.06^{c}
Cupcake 5% pumpkin powder	54.47±0.01^{b}	19.39±0.03^{b}	38.89±0.03^{b}	70.30±0.02^{b}	5.23±0.01^{b}	34.48±0.04^{b}
Cupcake 10% pumpkin powder	49.98±0.06^{c}	20.08±0.04^{a}	37.16±0.02^{c}	70.31±0.01^{b}	6.25±0.05^{a}	35.97±0.02^{a}

Each value is the mean + SE.
***a, b and c means in the same row with different superscripts are different significantly (P< 0.05).**
L*(luminosity) ,a*(red intensity), and b*(yellow intensity)

Baking quality of fortified cupcake with pumpkin powder:-

The results show that baking quality of cupcake made from wheat flour (72%) and supplemented with 5 and 10 % pumpkin powder were measured in weight, volume and specific volume as presented in Table (4). Results record that weight increased significantly ($P \leq 0.05$) in fortified cupcake with 5 and 10% pumpkin powder which reached (51.63±0.28 and 51.71±0.31 *gm*) respectively when compared with control which reached (48.42±0.34*gm*). Also specific volume significantly increased ($P \leq 0.05$) in fortified cupcake with 5 and 10% pumpkin powder which reached (1.98±0.23 and 2.05±0.17) respectively as compared to the control which reached (1.97±0.21).

Grigelmo-Miguel *et al.,* (1999) showed that pumpkin could be processed into flour to be incorporated in baked products as wheat–pumpkin composite flour blend for fiber enrichment and other functional purposes.

Table 4. Baking quality of fortified cupcake with pumpkin powder.

Samples	Weight (gm)	Volume (cm)	Specific volume
Control	48.42±0.34 ^{a}	95.5±0.14^{a}	1.97±0.21^{a}
Cupcake 5% pumpkin powder	51.63±0.28^{c}	102.5±0.18^{b}	1.98±0.23^{b}
Cupcake 10% pumpkin powder	51.71±0.31^{b}	106±0.11^{c}	2.05±0.17^{c}

Each value is the mean + SE.
***a, b and c means in the same row with different superscripts are different significantly (P< 0.05).**

Chemical composition of pumpkin powder and pumpkin cupcakes.

Data in Table (5) show the chemical composition of pumpkin powder and fortified cupcake with 5 and 10% pumpkin powder, results show that moisture content of pumpkin was 48.74 + 0.09 %. Protein content of fortified cupcake 5 and 10 % pumpkin was a higher content than control which reached 14.33 + 0.45, 15.19 + 0.10 and 15.67 + 0.20 %, respectively. This could be due to pumpkin powder contained high amount of protein which reached 8.18 % in comparing control

without pumpkin powder. Ash content increased in cupcake fortified with 10 % pumpkin powder as recorded 4.02 + 0.15 *%* and cupcake fortified with 5 % pumpkin powder recorded 3.01 + 0.32 *%* comparing with control (2.20 + 0.11%).

Reviewing to the data in the same Table, the fiber content was higher in cupcake fortified with 10 % pumpkin powder (6.50 + 0.30 *%*) and cupcake fortified with 5 % pumpkin powder (4.38 + 0.45 *%*) than that of control which recorded 1.70 + 0.12 *%.* The results show that increasing of fiber related to the addition of pumpkin powder, this is contain a higher amounts of fiber which reached 14.94 + 0.03 *%.* The powder produced with different pretreatment might affect the powder properties such as, moisture content, particle size, bulk density, tapped density, water activity and color (*Prajapati et al., 2011*). The presence of moisture content in a powder can also affect the powder density and its flow ability *(Tze et al., 2012).*

Pumpkin contains chemicals, including tetra cyclic triterpens, saponins, proteins, fibers, polysaccharides (Bombardelli and Morazzoni, 1997). Pumpkin is also a rich source of fibre and β-carotene - an immediate precursor of vitamin A. Fibre addition to foods is an alternative to compensate for the existent deficiency in the diet *(PLA et al., 2007). See et al., (2007)* recorded that adding pumpkin flour at different levels (5 %-15%) in cake composite increased ash and crude fiber and decreased fat and protein.

Table 5. Chemical composition of pumpkin powder and pumpkin cupcakes on dry weight basis.

Chemical composition *%*	pumpkin	Control	Cupcake 5% pumpkin powder	Cupcake 10% pumpkin powder
Moisture	48.74 + 0.09^{a}	20.26+0.25^{c}	21.70+0.34^{b}	22.16+0.20^{b}
Protein	8.81 + 0.45^{c}	14.33+0.45^{b}	15.19+0.10^{ab}	15.67+0.20^{a}
Fat	4.05+ 0.005^{b}	13.00+0.72^{a}	14.04+1.0^{a}	14.72+0.42^{a}
Ash	11.97 + 0.02^{a}	2.20+0.11^{d}	3.01+0.32^{c}	4.02+0.15^{b}
Fiber	14.94+0.03^{a}	1.70+0.12^{d}	4.38+0.45^{c}	6.50+0.30^{b}
Carbohydrate	60.20 + 0.04^{c}	68.74+1.02^{a}	72.12+1.30^{d}	59.08+0.86^{b}

Each value is the mean + SE.

***a, b and c means in the same row with different superscripts are different significantly (P< 0.05).**

Some minerals content (mg/100g) of pumpkin powder and pumpkin cupcakes.

Results in Table (6) show that Fe and Ca was a high content in pumpkin powder and cupcakes fortified with 5 and 10% pumpkin powder which reached 48.67, 54.93, 54.61,54.61 and 60.18, 53.80 (*mg/100g*) respectively. Pumpkin is a good source of carotene, pectin, mineral salts, vitamins and other substances that are beneficial to health *(Jun et al., 2006).* Pumpkins are rich in carotenes, minerals, vitamins, pectin and dietary fiber (*Boileau, et al., 1999*).

Table 6. Some minerals content (mg/100g) of pumpkin powder and pumpkin cupcakes.

Minerals content (mg/100g)	pumpkin powder	Control	Cupcake 5% pumpkin powder	Cupcake 10% pumpkin powder
Si	7.626	0.426	0.242	0.382
Fe	48.67	33.99	54.61	60.18
Zn	2.18	1.12	1.24	1.54
Ca	54.93	42.17	43.86	53.80
Cu	0.79	0.21	0.171	0.18

Total carotenoids (mg/100g), total phenols (mg/g) and antioxidant activity%.

Total carotenoids, total phenols, antioxidant activity and some minerals of pumpkin powder and fortified cupcakes with 5 and 10 % pumpkin powder, tabulated in Table (7). The results show that pumpkin powder was a high content of total carotenoids, total phenols and antioxidant activity which recorded 2.7 *mg/100g*, 5.70 *mg/g* and 32.44%, respectively.

The results show that fortified cupcakes with 10% pumpkin powder had the highest level of total carotenoids, total phenols and antioxidant activity % which reached (0.408 *mg/100g*, 0.722 *mg/g* and 11.69%), followed by fortified cupcakes with 5% pumpkin powder which reached (0.359 *mg/100g*, 0.720 *mg/g* and10.47%) respectively, while control were (0.306 *mg/100g*, 0.624 *mg/g* and 8.22%) respectively.

Data indicated that a high amount of carotenoids, total phenols and antioxidant activity% in the fortified cupcakes specially containing 10% pumpkin powder. These result in accordance with *(Ally, 2001*). The major source of vitamin A in the diet is carotenoids especially beta carotene *(Ahamad et. al., 2007*). Pumpkins are rich in β-carotene, which could prevent attack from certain types of cancers (*See et al., 2007*). The result showed that cupcakes fortified with pumpkin powder were increasing carotenoids, total phenols, antioxidant activity and also improvements nutritional quality of cupcake.

Table 7. Total carotenoids (*mg/100g*), total phenols (*mg/g*) and antioxidant activity%.

Sample	Pumpkin powder	Control	Cupcake5% pumpkin powder	Cupcake10% pumpkin powder
Total carotenoids (*mg/100g*)	2.7	0.306	0.359	0.408
Total phenols (*mg/g*)	5.70	0.624	0.720	0.722
Antioxidant activity by DPPH%	32.44	8.22	10.47	11.69

Phenolic compound of pumpkin powder and pumpkin cupcakes.

The main phenolic compounds identified in pumpkin powder and cupcakes fortified with 5 and 10% pumpkin powder are presented in Table (8). Results show that the predominant phenolic compounds in pumpkin powder were pyrogallol , e-vanillic, catechol, gallic and caffeine (284.78, 108.94, 31.84, 19.49 and 13.19 *ppm,* respectively). Data in Table (8) show that phenolic compounds in fortified cupcakes with 5 and 10% pumpkin powder was higher content in pyrogallol, gallic, catechol , vanillic , e-vanillic, benzoic, ellagic and salycilic (46.36 vr 76.34, 0.84 vr1.30, 4.98 vr 4.41, 3.57vr2.14, 13.71vr 28.22, 5.50 vr 5.56, 16.79 vr 8.67 and 2.05 vr 1.42 *ppm*) than control which reached (9.16, 0.65, 2.71, 0.52, 9.76,---, 3.38 and 0.42 *ppm*) respectively. Phenols are very important plant constituents because of their scavenging ability on free radicals due to their hydroxyl groups *(Heim et al., 2002*). Several studies showed good correlation between the phenols and antioxidant activity. Deep-coloured vegetables and fruits are known to be good sources of phenolics, including flavonoid and anthocyanin, and carotenoids *(*Qian *et al.,* 2004; Sass-Kiss *et al.,* 2005 and Trappey *et al.,* 2005).

Table 8. Phenolic acids of pumpkin powder and pumpkin cupcakes.

Phenolic compounds*(Ppm)*	Pumpkin powder	Control	Cupcake 5% pumpkin powder	Cupcake 10% pumpkin powder
Pyrogallol	284.78	9.16	46.36	76.34
Gallic	19.49	0.65	0.84	1.30
4-Amino-benzoic	0.70	0.06	0.71	0.16
Protocatchuic	8.01	3.07	1.74	6.95
Catechein	7.34	3.92	1.36	2.57
Catechol	31.84	2.71	4.98	4.41
Epicatechein	4.62	0.14	1.02	0.29
P-OH-benzoic	2.83	0.69	1.52	-----
Caffeine	13.19	0.73	0.57	0.93
Chlorogenic	2.76	7.66	1.23	1.12
Vanillic	2.24	0.52	3.57	2.14
Caffeic	1.85	0.06	------	0.19
P-Coumaric	1.72	0.06	0.32	0.50
Ferulic	2.14	0.43	0.54	0.70
Iso- ferulic	0.83	0.09	0.66	0.28
Reversetrol	------	------	-----	-------
e-vanillic	108.94	9.76	13.71	28.22
Alpha-coumaric	0.65	0.16	0.60	----
Benzoic	6.35	----	5.50	5.56
Ellagic	16.79	3.38	7.05	8.67
3,4,5-methoxy-cinnamic	4.55	0.37	2.88	0.62
Coumarin	0.57	0.15	1.16	0.59
Cinnamic	0.70	0.03	0.09	0.04
Salycilic	1.03	0.42	2.05	1.42

Effect of storage on moisture content of pumpkin powder and pumpkin cupcake

From Table (9), it could be noticed that moisture content decreased by increasing storage time in all samples. Results show that moisture content was observed between the control which recorded 16.00 + 0.4% and cupcake fortified with 5% pumpkin powder which recorded 17.00 + 0.3 % and cupcake fortified with 10% pumpkin powder which reached 7.96 + 0.58, respectively after 6 weeks under storage. Results show that a high amount of moisture was observed in cupcake fortified with 10% pumpkin powder; this is due to the addition of pumpkin powder which was a rich source of carotene as natural antioxidant. Pumpkin powder is the major product of pumpkin fruit in processing, since it can be stored for a long time and used in manufacturing of formulated foods (Que *et al.,* 2008; Kha *et al.,* 2011 and Jackson *et al.,* 2016).

Table 9. Effect of storage on moisture content of pumpkin powder and pumpkin cupcake.

Moisture content	Control	Cupcake 5% pumpkin powder	Cupcake 10% pumpkin powder
Zero	$20.26+0.25^{b}$	$21.70+0.34^{a}$	$22.16+0.20^{a}$
2week	$18.66+0.57^{c}$	$20.20+0.05^{b}$	$21.50+0.17^{a}$
4week	$18.0+0.80^{b}$	$19.06+0.02^{ab}$	$20.0+0.10^{a}$
6 week	$16.00+0.4^{b}$	$17.00+0.3^{ab}$	$17.96+0.58^{b}$

Each value is the mean + SE.

***a, b and c means in the same row with different superscripts are different significantly (P< 0.05).**

Effect of pumpkin powder on some indices of lipids extracted from fortified cupcakes during storage.

The development of free fatty acid content in oils is usually considered to be one of the main parameters used in evaluating the quality oil (El-Sayd, 1995). From Table (9), it is noticed that acid value increased by increasing storage time in all samples. Different results were observed in acid values between the control without pumpkin which reached 2.97+0.06 mg KOH/gm oil and those of fortified with 5% and 10% pumpkin powder which reached 2.40+0.11 and 2.03+0.15 *mg KOH/gm oil* respectively, after 6 weeks

of storage. The effect of pumpkin powder during storage period on PV values of lipids extracted from fortified cupcakes samples are shown in Table (9). Results show that peroxide value significantly decreased ($p \leq 0.05$) in cupcakes fortified with 5% and 10% pumpkin powder (4.40 + 0.10 and 4.03 + 0.57 *meq/kg,* respectively) than those of control which reached 7.13+ 0.32 *meq/kg* after 6 weeks of storage.

P-anisidine values which reflect the effect of pumpkin powder on the formation of 2- alkenes cupcake stored for 6 weeks, and the data obtained recorded in Table (9). The results revealed that alkenals formation increased by increasing time storage in all samples. The increase was lower in cupcake samples fortified with 5 and 10% pumpkin powder (2.0 + 0.01 and 1.53 + 0.15, respectively) than those of control which reached 2.8 + 0.02. The results showed that cupcakes fortified with 5 and 10% pumpkin powder were the best as they caused a significant decrease ($p \leq 0.05$) in P-anisidine , This could be attributed to the presence of namely carotenoids and phenolic compounds in pumpkin powder (Velioglu *et al*., 1998).

Malondialdehyde (MDA) is a degradation product generated from lipid peroxidation (oxidative degradation of polyunsaturated fatty acids in cell membrane). The reaction of MDA with TBA has been widely adopted as a sensitive assay method for lipid peroxidation (Ohkawa *et al*., 1978). Data in Table (9) show that lipids extracted from fortified cupcakes with 5 and 10 % pumpkin powder recorded a significant decrease ($p \leq 0.05$) in TBA values (0.32+0.03 and 0.28+0.01, respectively) than those of control without pumpkin powder which reached 0.40+0.02. The results showed that pumpkin powder could play an important role in improving the antioxidant activity in cupcake during storage for 6 weeks.

Table 10. Effect of pumpkin powder addition on some indices extracted from fortified cupcakes during storage.

Samples		Control	Cupcake 5% pumpkin powder	Cupcake 10% pumpkin powder
Acid values	Zero	1.44+0.06^{a}	1.44+0.04^{a}	0.73^{a}+1.41
	2week	2.05+0.49^{a}	1.70+0.20^{a}	1.53+0.05^{a}
	4week	2.76+0.51^{a}	1.86+0.15^{b}	1.80+0.40^{b}
	6 week	2.97+0.06^{a}	2.40+0.11^{b}	2.03+0.15^{c}
Peroxide values	Zero	3.34+0.39^{a}	3.34+0.09^{a}	3.34+0.10^{a}
	2week	4.50+0.36^{a}	3.86+0.52^{a}	3.20±0.10^{b}
	4week	5.05+0.04^{a}	4.03+0.15^{b}	3.76+0.13^{b}
	6 week	7.13+0.32^{a}	4.40+0.10^{b}	4.03+0.57^{b}
P-Anisidine	Zero	0.73+0.05^{a}	0.73+0.15^{a}	0.76+0.06^{a}
	2week	0.13+0.21^{a}	1.03+0.23^{a}	0.90±0.10^{a}
	4week	2.16+0.15^{a}	1.43+0.02^{b}	1.06+0.05^{c}
	6 week	2.8+0.02^{a}	2.0+0.01^{b}	1.53+0.15^{c}
TBA	Zero	0.09+0.01^{a}	0.09+0.01^{a}	0.08+0.05^{a}
	2week	0.19+0.52^{a}	0.16+0.01^{ab}	0.13+0.02^{b}
	4week	0.21+0.02^{a}	0.20+0.02^{a}	0.18+0.02^{a}
	6 week	0.40+0.02^{a}	0.32+0.03^{b}	0.28+0.01^{b}

Each value is the mean + SE. *a, b and c means in the same row with different superscripts are different significantly (P< 0.05).

CONCLUSION

It could be concluded that the addition of pumpkin powder at level 5 and 10% improves the quality attributes of cupcakes and extend the self-life due to the presence of natural antioxidant, carotenoids and phenolic compounds.

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تحسين النشاط المضاد للأكسده للكب كيك أثناء التخزين بإستخدام بودره اليقطين

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استهدفت هذه الدراسة تقييم أثر إضافة بودرة القرع العسلي كمصدر طبيعي للكاروتينات و الفينولات المضادة للأكسدة إلى الكب كيك من أجل تقليل أكسدة الدهون وإطالة العمر الزمني ورفع القيمة الغذائية، حيث تم اضافه تركيزين من بودره اليقطين (5 و 10٪) إلى الكب كيك، ثم الخبيز علي درجه حراره 180° مئوية لمدة 25-30 دقيقة والتبريد ،ثم تعبئتها في أكياس من البولي الاثيلين وتخزينها على درجة 5°م وتم التقييم الحسي لعينات الكب كيك. أيضا تم استخلاص الدهون من خلطات الكب كيك المدعمة باليقطين 5و10% كل اسبوعين لمده ست اسابيع. تمت دراسة التقييم الحسي وخصائص اللون وجودة الخبز للكب كيك المدعم باليقطين . ايضا تم تقدير بعض المعادن والكاروتينات و الفينولات والنشاط المضادة للأكسدة لمسحوق اليقطين وللكب كيك المدعم ببوده اليقطين .كما تم تقييم الدهون المستخلصة من الكب كيك المدعم بمسحوق اليقطين أثناء التخزين لتقييم النشاط المضاد الأكسدة للكاروتينات. عن طريق الرطوبة، رقم الحامض ورقم البيروكسيد ,والبارانسدين والثيوباربيوتريك أثناء التخزين لمده 6اسابيع. سجلت النتائج أن الوزن حقق زيادة معنوية ($P \leq 0.05$) في الكب كيك المدعم بمسحوق القرع 5 و 10٪ (51,63±0,28و51,71+0,31 جم) على التوالي بالمقارنة مع الكنترول (48,42 ± 0,34جم). وأظهرت النتائج أن الكب الكيك المدعم بمسحوق اليقطين10٪ حقق نسب مرتفعة من الكاروتينات , الفينولات والنشاط المضادة للأكسدة والتي بلغت (0,408 ملجم / 100جم و 0,722 ملجم / جم و11,69٪)، تليها الكب كيك المدعمة 5٪ بمسحوق اليقطين (0,359 ملجم / 100جم و 0.720ملجم / جم و 10,47٪) على التوالي، في حين كان الكنترول (0,306 ملجم / 100جم و 0,624 ملجم / جم و8,22٪) على التوالي. اشارت النتائج ان رقم البيروكسيد انخفض معنويا $p \leq 0.05$ في عينات الكب كيك المدعمة 5و10% باليقطين (4,40+0,10و4,03+0,57) علي التوالي بالمقارنة بالكنترول (7,13+0,32) بعد التخزين لمده 6 اسابيع. واوضحت النتائج ان الدهون المستخلصة من الكب كيك المدعم بمسحوق اليقطين5و10% سجلت انخفاض معنويا في قيم الثيوباربيوتريك التي (0,32+0,03 و 0,28+0,01) علي التوالي بالمقارنة بالكنترول (0,40+0,02)بعد ست اسابيع من التخزين وتوصي الدراسة 1- باستخدام مسحوق بودره اليقطين اثناء اعداد الكيك في المنزل لما له من فوائد عديده انها مضاد للاكسده طبيعي لاحتوائه علي البيتا كاروتين والفينولات وهذا مفيد صحيا للاطفال والكبار, واطال عمر الكيك دون اكسده للدهون بالإضافه إلى تحسين الخواص الحسيه.2- توجيه اهتمام شركات صناعه الكيك بإضافة بودره اليقطين الي الكيك لإطالة عمره الزمني ولتحسين خواصه الحسيه وللاستفاده الصحيه من النشاط المضاد للاكسده0