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QUALITY CHARACTERISTICS OF GLUTEN FREE CAKE PRODUCED FROM CASSAVA, PUMPKIN AND POTATO FLOURS

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ABSTRACT

This investigation aimed to produce gluten free cake for celiac patients. Cake samples were prepared from cassava, pumpkin, potato flours and their mixture of (1:1:1). Chemical composition and amylogram characteristics of investigated flours were determined. Prepared cake samples were evaluated for their water activity, proximate chemical analysis, physical characteristics (weight, volume and specific volume), color parameters, staling rate and sensory characteristics. Cassava, pumpkin, potato flours have good nutritional and functional characteristics could be used alone and in their mixture of 1:1:1 in preparing gluten free cake samples with good nutritional values, cake volume, high freshness and more sensory acceptable for consumer.

Keywords: Cake, Cassava, free gluten, potato, pumpkin.

INTRODUCTION

Many attempts have been made by researchers to produce gluten free (GF) products, thus products not containing gluten cereals. The GF products are used for people with celiac disease i.e., for those persons who suffer from gluten intolerance. Celiac disease is an autoimmune disorder of the small intestine that occurs in genetically predisposed people of all ages (Dvorakova *et al.,* 2012). The illness causes chronic inflammation and the progressive disappearance of the villi, leading to the malabsorption of important nutrients such as Fe, Ca, folic acid and KEDA vitamins. The illness can only be managed through strict avoidance of gluten forming protein in diet through the patient's lifelong (Alamprese *et al.,* 2006). Many alternative ingredients have been tested to produce GF foods i.e., spaghetti from quinoa (Caperuto *et al.,* 2001), pizzas from potato and rice (O'Brien *et al.,* 2002), biscuits from rice, corn, potato and soya (Schober *et al.,* 2003), white bread from rice, corn and cassava (Lopez *et al.,* 2004), egg pasta analogues from buckwheat (Alamprese *et al.,* 2006), couscous from rice with each chickpea or pea or bean (Benatallah *et al.,* 2008), Egyptian bread from rice, corn starch, defatted soy and chickpea flours (Hegazy *et al.,* 2009), pasta from amaranth, quinoa and buckwheat (Schoenlechner *et al.,* 2010), bread from rice and buckwheat (Torbica *et al.,* 2010), bread from maize (Brites *et al.,* 2010), crackers from buckwheat (Canadanovic-Brunet, 2011), cake from faba bean and lupin flours (Abou-Zaid *et al.,* 2011) and bread from buckwheat and corn (Dvorakova *et al.,* 2012). Cassava roots contain mainly starch and soluble carbohydrates. It is a staple food for about 200 to 300 million person worldwide (Alexis and Jean, 2010). Alexis and Jean (2010) stated the composition of cassava as follows: carbohydrate, protein, lipid and ash contents ranged from 94.62 to 94.70, 1.80 to 1.84, 1.00 to 1.01 and 2.49 to 2.53 % on dry weight basis, respectively. Pumpkins (*Cucurbita moschata*) are sweet when fully mature with yellow or orange flesh rich in carotene, vitamins, minerals and dietary fiber (Sirohi *et al.,* 1991). Pumpkins are consumed in many ways i.e., fresh, cooked, stored frozen, canned (Figueredo *et al.,* 2000), dried (Yusipov *et al.,* 1992), fermented (Miyazaki *et al.,* 1996) and jam (Teotia, 1992). Pumpkin can be milled into flour with good flavor, sweetness and yellow-orange color. It is used with cereal flour for making bakery products, soups, sauces, instant noodle and as a natural coloring agent in pasta (See *et al.,* 2007). Pumpkin can be found in many shapes, sizes and colors. Agriculture, food-processing, pharmaceutical as well as feed industry have all taken growing interest in pumpkin fruit and pumpkin-derived products in the past few years because of the nutritional and health protective value of the proteins and oil from the seeds as well as the polysaccharides from the fruit. Pumpkin is a good source of carotene, pectin, mineral salts, vitamins and other substances that are beneficial to health. These facts lead to the processing of pumpkin into various food products. It has been used to supplement cereal flours in bakery products, soups, sauces, instant noodle, spice as well as a natural coloring agent in pasta and flour mixes. They are rich in carotene, pectin, mineral salts, vitamins and other substances beneficial to health, (Lee et al., 2005, Jun et al., 2006 and Sojak and Głowacki, 2010). Potato is a starchy food crop. Four important vitamins present in potato, namely: C, B1, B2 and B3 (Abbasi *et al.,* 2011). Polyphenols, also are the principal antioxidant being beneficial in the biological systems. There are many products resulted from potatoes i.e. crisps, French fries and other fried products (Abbasi *et al.,* 2011).

The aim of the present study was to investigate the production of gluten free cakes from each cassava, pumpkin or potato flours and their combination as well as the cake quality parameters was also evaluated.

MATERIALS AND METHODS

Materials:

Wheat flour (72%), commercial cassava flour, whole fresh egg, sucrose, shortening, milk powder, baking powder, vanilla, potato and pumpkin were purchased from local market, Cairo, Egypt.

Potato flour preparation:

Potatoes were washed, brushed, hand peeling, washing again and hand shredding. The potato slices were blanched at 80°C for 10 minutes then dried at 60°C in a hot-air dryer overnight. The dried potatoes were milled by laboratory milling then sieved through a 50-mesh screen. The resultant flour was packed in polyethylene bags and stored at – 18 °C until use.

Pumpkin flour preparation:

The fresh pumpkins were cleaned, peeled, removed of seeds, sliced into pieces 1 cm thick, and then washed in cold water. The slices were dried at 60 °C in a hot-air dryer overnight. The dried pumpkin was milled by laboratory milling then sieved through a 50-mesh screen. The resultant flour was packed in polyethylene bags and stored at – 18 °C until use.

Methods:

Cake preparation:

Cup Cakes (control samples) were prepared as described in Bennion and Bamford, (1997) with the following recipe of Wheat flour (100 g), Sucrose (85 g), shortening (55 g), whole fresh egg (85 g), milk powder (3 g), baking powder (3.8 g) and vanilla (0.6 g). Free gluten cake samples were prepared by replacing wheat flour by cassava, potato, pumpkin flours alone and mixed the aforementioned flour samples as 1:1:1. Cake samples were prepared by creaming of shortening and sugar using a kitchen machine (National Japan) at medium speed, egg-vanilla mixture was gradually added and beaten for 5 min. The different flour samples (wheat flour and cassava, potato, pumpkin flours and their mixed by 1:1:1) and baking powder mixture were gradually added to above mixture and mixed at high speed for 5 min. The batter was scaled at 110 gram in baking pans then, placed in a preheated oven and baked at 180 °C for 35 min. After baking different prepared cake samples were allowed to cool for 30 min. then packed in polyethylene bags at room temperature until analysis.

Chemical analysis:

Protein, ash and lipid contents of different flour samples and prepared cake samples were determined according to A.O.AC. (2000) Carbohydrates (nitrogen free extract) were determined by differences.

Amylograph characteristics of flour samples:

Amylograph characteristics (gelatinization (BG), gelatinization temperature (GT), and gelatinization maximum (G Max)) of wheat flour and cassava, potato, pumpkin flours and their mixture by 1:1:1 were determined according to A.A.C.C (2000) by using Amylograph-E (Brabender GmbH&Co. KG, Duisburg, Germany).

Physical characteristics:

Weight, volume and specific volume of different prepared cake samples were determined according to method of Bennion and Bamford, (1997).

Cake color:

Lightness (L), red content (a) and yellow content (b) values of crumb of different prepared cake samples were determined by using a Hunter Lab color measurement system (Hunter Lab, Colorflex, Hunter Associates laboratory, USA).

Stalling rate:

The staling rate of different prepared cake samples was determined after baking within one hour and after 2, 4 and 6 days of storage at room temperature (25±2 °C) by alkaline water retention capacity (AWRC %) according to A.A.C.C, (2000).

Sensory evaluation:

Cake samples were assessed for their sensory attributes after baking by ten member's preference taste panels from the staff of Food Science and

Technology Dept., Faculty of Agric., Cairo University, Egypt. They were asked to score the internal characteristics of cake samples i.e. cell uniformity, grain, texture, crumb color, flavor and overall acceptability using the respect sheet according to A.A.C.C, (2000).

Statistical analysis

Data were expressed as the means ± SD. Statistical analysis was carried out using one – way analyses of variance, ANOVA (Rao, and Blane, 1985).

RESULTS AND DISCUSSION

Proximate chemical composition of Cassava, Pumpkin and Potato flours:

The results of proximate analysis of Wheat, Cassava, Pumpkin and Potato flours are summarized in Table (1). The highest value of protein was recorded for potato followed by wheat, pumpkin and cassava flours (12.55, 9.55,7.40 and 5.57%, respectively). On the other hand, pumpkin flour had the highest values of ether extract and ash contents (3.78 and 6.05%, respectively), where the same parameters for wheat, cassava and potato flours were 1.15, 0.55 and 0.92, 2.71% and 0.47, 4.28%, respectively. Nitrogen free extract of the cassava, pumpkin and potato flours were 82.32, 72.14 and 74.78%, respectively where wheat flour was recorded value of 88.75%. The aforementioned data were in the same line with those obtained by See et al., (2007), Abbasi et al., (2011) and Ugwuona et al., (2012).

Table (1) Proximate analysis of different flours used in preparing gluten free cake (on dry weight basis**).**

Flour sample	Constituents (%)				
	Moisture	Protein	Ether extract	Ash	Nitrogen free extract
Wheat	13.55±0.25^{a}	9.55±0.25^{b}	1.15±0.15^{b}	0.55±0.15^{d}	88.75±55^{a}
Cassava	8.47±0.29^{c}	5.57±0.26^{d}	0.92±0.07^{b}	2.71±0.14^{c}	82.32±0.64^{b}
Pumpkin	10.61±0.20^{b}	7.40±0.49^{c}	3.78±0.35^{a}	6.05±0.26^{a}	72.14±0.64^{d}
Potato	7.91±0.21^{d}	12.55±0.60^{a}	0.47±0.08^{c}	4.28±0.15^{b}	74.78±0.89^{c}

Data are the mean ± SD, n = 3, Means followed by different superscripts within columns are significantly different (p≤0.05).

Amylogram characteristics of cassava, pumpkin, potato flours and their mixture:

The data in Table 2 show the amylogram characteristics of wheat flour and cassava, pumpkin, potato flours and their mixture (1:1:1) used in preparing cake samples. wheat flour was the highest in the beginning of gelatinization (transition temperature, BG) (71.5°C), comparing to 64.1, 33.30 and 58.60°C for cassava, pumpkin and potato flours, respectively, on the other hand, temperature of beginning gelatinization of mixture of the investigated flours (cassava, pumpkin and potato) was 55.40°C. The differences in the values of beginning gelatinization temperature could be related to the differences of starch content and its gelatinization and pasting characteristics of investigated flours, (Zhang et al., 2005). About gelatinization temperature wheat and potato flours was recorded the highest value being 88.7 and 81.50°C, respectively, followed by cassava and pumpkin flours being 71.80 and 53.90°C, respectively. On the other hand, the same parameter of flour mixture of the investigated flours was 73.50°C. On the other hand, cassava flour recorded the highest value of maximum gelatinization as evaluated by barabender unit (B.U.) its value was 4635 B.U. followed by 3573 and 458 B.U. for potato and pumpkin flours, respectively where the flour sample prepared by mixture the three investigated flour recorded values of 1486 B.U, wheat flour recorded value of maximum gelatinization of 1000 B.U. The differences in the amylogram characteristics of investigated could be related to the differences of protein content of investigated flours as aforementioned reported in Table 1 and also to the differences characteristic of their starch content. These results were related to the result of Babajide and Olowe, (2013), as they reported that, amylogram characteristics of flour is a function of several parameters such as size, shape, conformational characteristics, hydrophilic and hydrophobic balance in the molecule, carbohydrate associated with proteins, thermodynamic properties of the system and the solubility of starch molecules. In the same time differences in swelling power and solubility of starch in the investigated flours could be the other affected factor in the differences of amylogram characteristics, (Kantanka and Acquistucci, 1996). In conclusion, according to the amylogram characteristics of investigated flours it could be utilized these flours in many food products especially bakery products e.g. cake.

Table (2) Amylogram characteristics of different flours and their mixture used in preparing cake samples

Flour sample	Amylogram parameters		
	Temp. of beginning gelatinization (^{O}C)	Gelatinization temp. (^{O}C)	Maximum gelatinization (B.U.)
Wheat	71.5	88.7	1000
Cassava	64.1	71.8	4635
Pumpkin	33.3	53.9	458
Potato	58.6	81.5	3573
Mixture*	55.4	73.5	1486

***: Mixture of cassava, pumpkin and potato flours (1:1:1)**

Water activity and proximate composition of prepared cakes:

Water activity values and proximate composition of different prepared cake samples are given in Table (3). Values of water activity of prepared cakes from cassava, pumpkin, potato and their mixture were 0.860, 0.813, 0.868 and 0.850, respectively, cake samples prepared from wheat flour recorded value of 0.855. The lowest values of water activity for cake prepared from pumpkin could be due to the high content of sugar in pumpkin flour, where the highest water activity of potato cake could be related to the highest protein content of potato flour. The results of proximate analysis of prepared cake samples were presented in the same table, about the moisture content of prepared cake samples there is no significant differences in moisture content of prepared cake samples prepared from cassava, pumpkin and potato flours and the value is around 19.33%, on the other hand, cake sample prepared from the mixture of the aforementioned flours with ratio of 1:1:1 had a significant lowest ($p \leq 0.05$) moisture content of 14.98%. About the protein and ash contents of prepared cake samples it could be noticed that, the highest values of protein and ash contents were recorded for potato cake (19.21% and 2.52%), followed by pumpkin cake (17.14% and 2.02%) and cassava cake (15.47% and 1.43%), where the cake samples prepared with the mixture of investigated flours have protein and ash contents of 17.57% and 1.77%, respectively. The ether extract values of prepared cake samples from cassava and mixture flours were 27.11% and 27.58%, respectively with non significant differences ($p \geq 0.05$), on contrary pumpkin and potato cakes have values of 29.95% and 25.74% with significant differences ($p \leq 0.05$). From the same table the nitrogen free extract of prepared cake samples were 55.98, 50.87, 52.53 and 53.06% from cassava, pumpkin, potato and mixture flours, respectively. From the literature the protein content of wheat cake samples was around 10% on dry basis, (Hussein and Abd El-Razik, 2005, Risk *et al.,* 2006 and Ugwuona *et al.,* **2012**), where the increased protein content of prepared cake samples from investigated flours beside of this protein was free gluten is of health benefit to consumer as protein is needed for physiological functioning and reducing protein-energy malnutrition, (**Ugwuona *et al.,* 2012**). From the same table prepared cake samples from 100% wheat flour as control sample have values of 9.15, 27.55, 0.65 and 62.65% for protein, ether extract, ash and nitrogen free extract, respectively.

Table (3) Water activity and proximate analysis of different prepared cake samples (on dry weight basis)**.**

Cake samples	Parameters (%)					
	Water activity	Moisture	Protein	Ether extract	Ash	Nitrogen free extract
Wheat	0.855±0.025^{b}	14.85±55^{b}	9.15±0.55^{d}	27.55±0.45^{b}	0.65±0.35^{d}	62.65±0.75^{a}
Cassava	0.860±0.005^{a}	19.34±1.27^{a}	15.47±0.42^{c}	27.11±0.35^{b}	1.43±0.24^{c}	55.98±0.82^{b}
Pumpkin	0.813±0.024^{b}	19.64±0.15^{a}	17.14±0.20^{b}	29.95±0.26^{a}	2.02±0.15^{b}	50.87±0.28^{d}
potato	0.868±0.023^{a}	19.02±0.10^{a}	19.21±0.50^{a}	25.74±0.38^{c}	2.52±0.21^{a}	52.53±0.69^{c}
Mixture*	0.850±0.022a^{b}	14.98±0.70^{b}	17.57±0.59^{b}	27.58±0.63^{b}	1.77±0.33^{bc}	53.06±1.34^{c}

***: Mixture of cassava, pumpkin and potato flours (1:1:1)**
Data are the mean ± SD, n = 3, Means followed by different superscripts within columns are significantly different ($p \leq 0.05$).

Color parameters of different prepared cake samples:

Color as a matter of visual perception is an important consideration in food product development because food color and appearance are usually the first impressions to register in the consumers' mind. The color parameter values of prepared cake samples were presented in Table (4). Redness (a), lightness (L) and yellowness (b) were significantly different (p≤0.05) among the prepared cake samples. Results in Table 4 show wheat and cassava cakes and cakes from mixture flours were the most lightness (L) and yellowness (b) and the lowest redness (a). The pumpkin cake samples had the lowest lightness (L) value (27.4) was correlated with their content of sugar where some sugar may be caramelized and consequently decreased lightness or Maillard browning caused by the reaction between protein and the added sugar, (Ugwuona et al., 2012).

Table (4) Color parameters of different prepared cake samples.

Cake samples	Color parameter		
	L*	***a***	***b***
Wheat	51.25^{a}	10.35^{c}	23.45^{a}
Cassava	49.18^{a}	10.43^{c}	22.86^{a}
Pumpkin	27.4^{c}	11.11^{b}	12.96^{c}
Potato	38.72^{b}	14.48^{a}	19.57^{b}
Mixture*	49.18^{a}	10.43^{c}	22.86^{a}

***: Mixture of cassava, pumpkin and potato flours (1:1:1)**
Data are the mean of three replicates, Means followed by different superscripts within columns are significantly different (p≤0.05).
L* **value is a measure of lightness ranging from 0(black) to 100(white), the** ***a**** **value ranges from -100(greenness) to +100(redness) and the** ***b**** **value ranges from -100(blueness) to +100(yellowness).**

Physical characteristics of different prepared cake samples:

The weight (g), volume (cm3) and specific volume (cm3/g) of prepared cake sample were measured and the results were presented in Table (5). The highest weight of cake loaf was recorded for cassava cake (37.48g) with non significant differences (p≥0.05) with potato cake (36.37g) and cake prepared from flours mixture (38.53g), where cake samples recorded weight of 36.55g. On the other hand, the lowest weight volume was recorded for cake samples prepared from pumpkin flour (35.37g). The highest loaf volume was significantly differences (p≤0.05) recorded for wheat cake (95.75cm3) followed by cassava cake (84.66cm3) and cake prepared from flours mixture (84.66cm3) with non significant differences (p≥0.05) between them, on the other hand, volumes of potato and pumpkin cakes were significantly differences (p≤0.05) with values of 80.66 and 75.33cm3 , respectively. These results could be correlated with the results of water activity and chemical composition of prepared cake samples in table (3), where the high weight and volume could be due to increased protein content which increased the water absorption capacity, these results were in agreement with the results of See et al., (2007). From the results of specific volume of different prepared cake samples tabulated in the same table it could be reported that, there is no significant differences (p≥0.05) between prepared cake samples where the values were 2.25, 2.13, 2.22 and 2.18 cm3/g for cake prepared from cassava, pumpkin, potato flours and their mixture, respectively, on the other hand, specific volume of wheat cake samples were significantly differences (p≤0.05) between other prepared cake samples and recorded highest value of 2.62 cm3/g.

Table (5) Physical characteristics of different prepared cake samples.

Cake samples	Physical parameters		
	Weight (g)	**Volume (cm^3)**	**Specific volume (cm^3/g)**
Wheat	36.55 ± 0.85^{bc}	95.75 ± 0.75^{a}	2.62 ± 0.25^{a}
Cassava	37.48 ± 0.94^{ab}	84.66 ± 1.52^{b}	2.25 ± 0.04^{b}
Pumpkin	35.37 ± 0.99^{c}	75.33 ± 2.51^{d}	2.13 ± 0.09^{b}
Potato	36.37 ± 0.99^{bc}	80.66 ± 1.52^{c}	2.22 ± 0.10^{b}
Mixture*	38.53 ± 0.89^{a}	84.66 ± 0.57^{b}	2.18 ± 0.05^{b}

***: Mixture of cassava, pumpkin and potato flours (1:1:1)**
Data are the mean ± SD, n = 3, Means followed by different superscripts within columns are significantly different (p≤0.05).

The freshness of different prepared cake samples:

Staling is a complex phenomenon. It means all changes that occur in cake after baking. Alkaline water retention capacity (AWRC) is a simple test to follow the staling of bakery products. Higher values of AWRC mean higher freshness of the cake and vice versa. The changes in AWRC for different prepared cake samples stored at room temperature for 0,2,4and 6 days are shown in Table 6. Generally it could be noticed that, there was a gradual decrease in freshness for all prepared cake samples during storage period. The lower reduction in staling value (high freshness) was noticed in cake samples prepared from cassava flour followed by cake prepared from pumpkin flour and cake samples prepared from mixture of cassava, pumpkin and potato flours, where cake samples prepared from wheat and potato flours were the lowest in freshness in comparison to other cake samples. From the same table it could be noticed that, there are significant differences between cake prepared from cassava flour and the other cake samples prepared from pumpkin, potato and their mixture. No significant differences (p≥0.05) among cassava cake samples stored at room temperature for 0 and 2 days, while, there are significant differences (p≤0.05) for 2,4 and 6 days. Also, there are significant differences (p≤0.05) among pumpkin cake samples for 0,2,4 and 6 days. There are significant differences (p≤0.05) among potato cake samples. No significant differences among cake samples prepared from mixture of investigated flours. In the same time, the results of freshness of prepared cake samples could be correlated with the results of water activity of prepared cake samples as aforementioned noticed in the physical properties of prepared cake samples.

Table (6) Stalling rate of different prepared cake samples during storage period.

Cake samples	Storage period (days)			
	Zero	**2**	**4**	**6**
Wheat	265.55±3.45$^{b}_{a}$	245.25±5.16$^{c}_{b}$	228.75±4.46$^{c}_{c}$	225.44±2.46$^{c}_{c}$
Cassava	328.03±2.46$^{a}_{a}$	318.24±6.96$^{a}_{a}$	281.24±6.63$^{a}_{b}$	260.34±4.52$^{a}_{b}$
Pumpkin	274.92±9.59$^{b}_{a}$	258.91±4.56$^{b}_{b}$	234.68±6.06$^{c}_{c}$	225.20±4.00$^{c}_{c}$
Potato	258.91±6.50$^{b}_{a}$	246.50±4.94$^{c}_{b}$	229.25±3.68$^{c}_{c}$	230.67±1.26$^{c}_{c}$
Mixture*	272.58±6.60^{b}	261.42±8.05^{b}	251.86±8.47^{b}	239.35±1.08^{b}

***: Mixture of cassava, pumpkin and potato flours (1:1:1)**
Data are the mean ± SD, n = 3, Means followed by different superscripts within columns and subscripts within rows are significantly different (p≤0.05).

Sensory characteristics of different prepared cake samples:

Gluten free cake samples prepared from investigated flours (cassava, pumpkin, potato and their mixture 1:1:1) were sensory evaluated as shown in Table 7 in comparison to cake samples prepared from 100% wheat flour as control samples. Data in Table 7 show that there are significant differences (p≤0.05) among the different prepared cake samples. cassava cake sample was the best in all sensory properties nearest to wheat cake samples except crumb color where potato cake and cake prepared from flours mixtures have a best crumb color with non significant differences (p≥0.05) between them and wheat cake samples.

Table (7) Sensory characteristics of different prepared cake samples.

Cake samples	Sensory characteristics					
	Cell uniformity (30)	**Grain (20)**	**Texture (30)**	**Crumb color (10)**	**Flavor (10)**	**Overall acceptability (100)**
Wheat	30±0.00^{a}	20±0.00^{a}	30±0.00^{a}	10±0.00^{a}	10±0.00^{a}	100±0.00^{a}
Cassava	28.0±2.0^{a}	20.0±0.00^{a}	28.6±1.6^{a}	8.4±0.54^{b}	9.8±0.44^{a}	9.4±0.89^{a}
Pumpkin	22. 4±2.7^{b}	14.0±1.40^{c}	23.6±2.4^{b}	7.4±0.54^{c}	7.4±1.14^{b}	7.0±0.70^{b}
Potato	25.8±2.2^{a}	16.2±0.83^{b}	25.8±1.7^{b}	9.4±0.54^{a}	8.6±0.89a^{b}	8.6±0.54^{a}
Mixture*	27.0±2.4^{a}	15.4±0.54^{b}	25.0±2.2^{b}	9.8±0.44^{a}	9.0±1.22^{a}	8.8±0.44^{a}

***: Mixture of cassava, pumpkin and potato flours (1:1:1)**
Data are the mean ± SD, n = 10, Means followed by different superscripts within columns and subscripts within rows are significantly different (p≤0.05).

Regarding to the overall acceptability, cassava cake samples also were the most acceptable(9.4%) to the panelists, followed by cake samples prepared from mixture of investigated flours and potato cake samples. Generally it could be noticed that, cassava, pumpkin, potato and their mixture could be used in prepared gluten free cake samples with the high acceptable sensory characteristics in comparison cake samples from wheat flour (100% gluten).

CONCLUSION

From the results it could be concluded that, it is feasible to produce gluten free cake samples from cassava, pumpkin, potato flours and their mixture 1:1:1, with good nutritional value and high sensory characteristics nearest to cake samples from wheat flour (100% gluten). The prepared cake samples could be used for celiac patients who cannot consume diets containing gluten and other similar protein coming from wheat, rye, barley and oat.

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خصائص الجودة للكيك الخالي من الجلوتين المنتج من دقيق الكسافا – القرع العسلي – البطاطس

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تهدف هذه الدراسة إلي إنتاج كيك خالي من الجلوتين للأفراد المصابين بالحساسية من الجلوتين. تم تحضير عينات الكيك من دقيق الكسافا, القرع العسلي, البطاطس والخليط منهم بنسب ١:١:١. تم قياس التركيب الكيميائي (الرطوبة, البروتين, الدهن, الرماد والمستخلص الخالي من النيتروجين) وخصائص الأميلوجرام { درجة حرارة بداية الجلتنة (درجة حرارة التحويل), درجة حرارة الجلتنة, اللزوجة القصوي) لعينات الدقيق تحت الدراسة. في عينات الكيك المحضرة تم قياس كل من درجة النشاط المائي, التركيب الكيميائي (الرطوبة, البروتين, الدهن, الرماد والمستخلص الخالي من النيتروجين), الخصائص الطبيعية (الوزن, الحجم, الحجم النوعي), خصائص اللون, البيات والخصائص الحسية. دقيق الكسافا والقرع العسلي و البطاطس لهم من الخصائص التغذوية والوظيفية الجيدة التي تمكن من استخدامهم بمفردهم أو الخليط بنسبة ١:١:١ في إنتاج كيك خالي من الجلوتين ذو خصائص تغذوية عالية مع درجة طزاجة وقبول عام عالي لدي المستهلك.

الكلمات المفتاحية: الكيك – الكسافا – خالي من الجلوتين – البطاطس – القرع العسلي

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