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Nutritional and technological evaluation of pumpkin (*Cucurbita moschata*) fruits and seeds as affected by density cultivation.

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In this study, three pumpkin *(Cucurbita moschata* L.) local cultivars namely: Kafr El-Battikh-1 (KB), Kafr Saad (KS) and El-Edua (ED) were cultivated at different plant density: one, two and three plants per the hill. Data were recorded on some main plant growth and development. Further, the resulting fruits were used to study some nutritional quality including the chemical composition, pectin, beta carotene, some minerals content in both pulp and seed kernel of the fruit. The processing of some food products such as fermented sweet bread from the pulp and chicken burger from the seed kernel were investigated. The obtained results showed that there were significant ($P<0.05$) differences among the cultivars and also among the plant densities used. The fruits harvested from plants grown individually per hill were the best among the others in terms of chemical composition and minerals. The content of pectin and beta carotene contents were also significantly ($P<0.05$) different among the cultivars. The bread and burger were prepared from pumpkin pulp and seed kernel by partially replacing ratios 10, 20, 30 and 40%. The best results were obtained for bread and burger samples supplemented with 10% and 20% replacement ratio, whether fruit pulp or seed kernel.

Keywords: β- carotene, Seed kernel oil, Sensory evaluation, bread, Burger.

INTRODUCTION

Pumpkins (*Cucurbita moschata, Cucurbita maxima, Cucurbita mixta, Cucurbita pepo*) have been found in several countries such as Argentina, Mexico, China, India, Korea and Brazil which using for traditional medicine as pumpkin seeds and flesh are rich in carotenoids, minerals, antioxidant vitamins, and proteins, as well as, low in calories. Pumpkin seeds are a good source of phytosterols, polyunsaturated fatty acids and zinc which often eaten as a snack, also it can prevent chronic diseases**.** The *moschata* species contains varieties that produce long and oblong fruits. Mature fruits have tan rather than orange skin. The growth and productivity of several vegetable crops including cucurbits such as muskmelon, watermelon and squash are affected by plant density (Roderiguez et al., 2007; Stevenson et al., 2007). The effects of plant density on fruit size and yield result from the competition between plants for the necessary natural resources. So, the size of harvested crop could be adjusted by manipulating density to meet the needs of the market which affected greatly the yield. It is possible to assist spreading pumpkin among consumers through the production of small and medium-sized fruits with carefully attention to nitrogen requirements by increasing the number of plants per area (Cushman et al., 2004; Kwon et al., 2007).

Nutritional composition of pumpkin fruit pulp

The physical properties such as TSS, TTA, P^H of pumpkin fruits vary according to different varieties and fruit weight. Overall TSS of pumpkin (*Cucurbita moschata*) ranged from 1-15°B, while the titratable acidity in pumpkin ranges from 0.01-0.26%. However, the mean pH value ranged from 4.27-7.79, but the average value of 6.77 in pumpkin (*Cucurbita moschata*) fruits (Noelia et al., 2011; AlJahani et al., 2017).

The pumpkin fruits contains 70-86% edible portion, 85-90% water, 0.7- 1.50% ash, 0.98 - 2.10% protein, 0.3-0.6% fat, 1.4-3.5% starch, 1.1-2.7% dietary fibers and energy 179-190 KJ per 100 g fresh weight. The minerals content (mg per 100 g of edible portion) present in pumpkin pulp are found in ranges: calcium: 10-46.35; phosphorous: 30-44.05; iron: 0.44-0.84; magnesium: 38; sodium: 5-6; potassium: 139-355.22; copper: 0.05; manganese: 0.05; zinc: 0.26 and sulphur: 16. The pumpkin (*Cucurbita moschata*) fruits were reported to contain total sugars ranging from 1.36 to 4.90 g/100 g, while the reducing sugars were ranged 1.01-2.44 g/100g with an average amount of 1.69%. On the other hand the pectin content in pumpkin (*Cucurbita moschata*) fruit varied from 1.14-8.30% (Usha et al., 2010; El-Demery, 2011; Noelia et al., 2011).

The carotenoids are responsible for giving color to many vegetables and fruits; it is found in pumpkins which reduce the incidence of some diseases symptoms. It was responsible of yellow to orange colour in the pumpkin flesh. The major carotenoid in pumpkin (>80%) is β-carotene (1.32-4.79 mg/100 g D.W.), with lesser amounts of cis α-carotene, lycopene and lutein (Wang et al., 2012; Adubofuor et al., 2016).

Pumpkin fruits are considered as a new agent to fight diabetes by increasing the level of serum insulin in the blood as well as improving the tolerance of glucose, because it contains active polysaccharides. Pumpkin leaves are consumed as a kind of vegetables in addition to the consumption of pulp in the processing of different types of jam, pies, purees and soups (Dari and Mahunu 2010; Abou-Zaid et al., 2012).

1.2 Nutritional Composition of pumpkin seed

Pumpkin fruits are variable in weight, shape, color, and size, having a thick edible flesh covered with reasonably hard flesh and seeds are found in a central cavity of fruit, which interspersed between a net such as a mucous network. Pumpkin seeds are semi-flat, characterized by a typical oval with a conical tip while the kernels of their colors is oilve-green, nut flavored, buttery in texture and sweet, so it can be used as a snack and desserts preparations. Generally, pumpkin fruit is allowed to mature completely to obtain a good quality seeds (Karanja et al., 2013; Devi et al., 2018).

The 100 g of dried pumpkin seeds is contained 49.05 g crude oil, 30.23 g proteins, 10.71 g carbohydrates, 559 Kcal energy, 10 mg cholesterol, 16 g dietary fiber, 1.9 µg vitamin C, 35.10 mg vitamin E, 0.153 mg riboflavin, 7 mg sodium, 8.09 mg potassium, 46 mg calcium, 1.343 mg copper, 8.82 mg iron, 9.4 µg selenium, 7.8 mg zinc and 9.00 µg *β*-carotene. Pumpkin seed oils are considered as a very rich source of essential fatty acids (linoleic acid). High and low linoleic acid contents from these oils suggest that they can be a source of edible oils (Maheshwari et al., 2015).

Elinge et al., (2012) analyzed the components of pumpkin seeds and the results obtained were; moisture (5%), crude fat (38%), crude protein (27.48%), available carbohydrate (28.03%), ash (5.5%), calorific value (564 kcal/100 g), and crude fiber (1%). Elemental analysis shows that potassium was the most abundant (273 mg/100g) and manganese was least (0.06 mg/100g). They can be consumed regularly without causing any side effects on human health.

Pumpkin (*Cucurbita maxima*) whole seeds and kernels contained 39.25, 27.83, 4.59, 16.84% and 39.22, 43.69, 5.14, 2.13% crude protein, crude oil, ash, crude fiber, respectively. Pumpkin seeds contained 41.59% oil, 25.4% protein, 5.20% moisture, 5.34% crude fiber, 2.49% ash and 25.19% total carbohydrate. Stearic (8.67%), palmitic (10.68%) oleic (38.42%) and linoleic (39.84%) acids were the abundant fatty acids (Alfawaz, 2004; Ardabili et al., 2011).

In recent years pumpkin seed oil has received considerable attention due to its health-protective and nutritional value. Montesano et al., (2018) also reported that pumpkin seed oils are vegetable oil with interesting nutritional value, related to the presence of carotenoids, phytosterols, mono unsaturated fatty acids, poly unsaturated fatty acids, which can be used as a functional component in different areas such as cosmetics, nutraceuticals and also can be incorporated into food formulations to benefit human health.

Generally, pumpkin seeds considered an industrial-agricultural waste, are a very essential source of compounds having a biological effect with interesting medicinal benefits. Several studies have focused on the health characteristics of pumpkin seed oil against many diseases, including cancer, diabetes and hypertension. It also shows anti-inflammatory, antioxidant and antibacterial properties (Bardaa et al., 2016; Medjakovic et al., 2016; Wang et al., 2017).

With increased public awareness in sustainable agriculture, clean and efficient energy and waste management technologies, pumpkin seeds have the opportunity to capture a new and emerging market share in the snack food industry. These reports from several studies suggested that pumpkin seeds have the potential to be developed as novel value added product, which could be consumed as food, having a rich source of oil and nutrients. So, it gives new opportunity to explore the possibilities for the production technologies for the different value added products to combat wastages of pumpkin seeds (Devi et al., 2018; Montesano et al., 2018).

The aim of this investigation was to study the effect of plant density and cultivar on growth, fruit characteristics and yield in addition to nutritional quality (chemical composition, pectin, beta carotene, some minerals) of three pumpkin cultivars cultivated with different plant density in the hill. Processing of sweet fermented bread, chicken burger from the best sample in maturity, taste index (ED 1 plant), as well as, chemical composition, sensory evaluation and physical properties of the resulted products were also determined.

MATERIALS AND METHODS

2.1 Materials

The study was carried out in the Experimental Farm of Vegetable crops Department and the Laboratory of Food science and Technology Department, Faculty of Agriculture, Assiut University, Egypt. Seeds of the local pumpkin cultivars (landraces) Kafr Saad and Kafr El-Battikh were obtained from farmers in Damietta province, while seeds of El-Edua were obtained from farmers in ElMinia province. Seeds used in the whole course of this study were from the same seed lots. Seeds were planted at 90 cm in row spacing (Abdel-Rahman et al., 2012) on March 2017. Planting was done on the northern side of ridges 3 m wide and 4 m long. Thinning to one or two or three plants per hill was practiced at the two true-leaf stage. Land preparation and all cultural practices were done as recommended for production of pumpkins (Hassan, 2004).

2.1.1 Pumpkin pulp and seeds samples preparation

Ripe pumpkin fruits (one or two or three plants) were cut, peeled, remove the seeds and sliced; drying the pumpkin pulp under vacuum at 50°C for 24 hours in an electrical oven and grounded to obtain meal or flour (which will used in preparing of fermented sweet bread, as well as, moisture was determined) then stored in a freezer at -4°C until analysis. The collected whole seeds were air dried in laboratory at 25°C for 72 hours then hand dehulled, the obtained kernels were grounded to obtain meal (which will used in preparing of chicken burger) by an electrical grinder and used for analysis or stored as mentioned above. The chemical composition of materials used in preparing sweet fermented bread and chicken burger are shown in Table (1).

2.2 Methods

2.2.1 Plant growth and development

Data were recorded for average content of reduced sugar (mg/100g) of fresh leaves 25 days after planting (A.O.A.C 2000), female flowers per plant, number of fruits per hill and average plant length (cm) 120 days after planting.

2.2.2 Physical properties

P^H value, Total soluble solids (T.S.S) and Total titratable acidity (T.T.A) content were analyzed according to their methods recorded by A.O.A.C (2000), as follows: for P^H: ten grams of pumpkin samples (10 g) were mixed with distilled water (100ml) to obtain the slurry then pH measured using PH meter. T.S.S was measurement by using an Abbe refractometer (Carl Zeiss, Jena Germany) which sucrose used for calibration. Total acidity was measured by titrating 10 ml of P^H slurry using (phph) as indicator with NaOH o.1N solution and the results of T.T.A were expressed as % citric acid**.** The fruit weight was recorded by kg.

.2.3 Maturity and taste index

Maturity and taste index were calculated using the equations proposed by Nielsen (2003) and Navez, et al., (1999) as follow:

Maturity = Brix degree/ Acidity.

Taste index = [(Brix degree) / (20 x Acidity)] + Acidity.

Table (1): Proximate analysis (g/100g D.W)* results for wheat flour, chicken breast used in preparing of fermented sweet bread and chicken burger.

Materials	Moisture	Ash*	Oil*	Protein*	Crude fiber*	Total carbohydrates*	Energy* (Kcal/100 g)
Wheat flour (72%extraction)	12.12	0.63	1.57	12.85	0.82	84.13	402.05
Chickenbreast meat	72.87	6.94	10.57	65.38	1.38	15.73	419.57

2.2.4 Proximate composition

Ash, crude oil, moisture, crude protein, crude fiber, reducing sugars and starch were determined as described in the A.O.A.C methods 2000. The means were reported as a result of triplicate determinations for each sample. The difference method according to Pellet and Sossy (1970) was used to determine total carbohydrates as follows: Carbohydrate % = 100 – (protein % + ash % + lipid % + crude fiber %). Energy was calculated using value of 4 k.cal/g for protein, carbohydrates and 9 k.cal/g for oil as described by Livesy (1995). The contents of K, Na, Mg, Ca and Fe in the studied samples were analyzed by Inductively Coupled Plasma Emission Spectrometry (ICP-OES) iCAP6200 (Isaac and Johnson 1985). Total phosphorus content was determined by spectrophotometer (Jackson 1967) after wet ashing following method described in A.O.A.C (2000).

2.2.5 Fatty acid composition of pumpkin seed oil

2.2.5.1 Preparation of fatty acid methyl esters

The fatty acids methyl esters were prepared from oil (which extracted by n-hexane) samples using 5ml 3% H_2So_4 in absolute methanol and 2ml benzene according to Rossel (1983).

2.2.5.2 Fatty acid methyl esters identification by gasliquid chromatography

The fatty acids methyl esters were analyses using Perkin-Elemar gas chromatograph (model F 22) with a flame ionizing detector (FID) in the presence of carrier gas (nitrogen). The separation was carried out at 190-230ºC (temperature rate 4ºC/min) on a (3m x 3mm) glass column, packed with diethylene glycol succinate (DEGS) on chromosorb w, 80-100 mesh. The detector and injector temperatures were 220ºC. The hydrogen, nitrogen and air flow rate were 30, 30 and 300 ml /min.; respectively. The speed of chart was 1cm/min. The peaks were identified by comparison with standard methyl esters by means of their proportional retention times under identical conditions. The quantitative determination was performed through measuring the peak areas with an integrator.

2.2.6 Determination of pectin

The pectin content was determined by Dische (1947). Add 0.3 mg of the sample, 0.1 mL water, 40 mL 4 M sulfamic acid (pH 1.6), 2.4 mL sulfuric acid and 100 mL 0.1% w/v carbazole to a glass tube. Boiling the solution for 22min, then mixed thoroughly and the absorbance of both blank and sample or standard (galacturonic acid with concentration 20, 40, 60, 80 and 100 mg/ L) was read at 525 nm using UV–Visible spectrophotometer Shimadzu model UV 1601 version 2.40. The pectin content was caculated as mg of galacturonic acid /100 g sample D.W.

2.2.7 Determination of β- carotene by HPLC

The method of Tee and Lim (1991) was used to determine β-carotene. A known weight of sample (5g) was hydrolyzed with 5 ml of 100% KOH and 20 ml of 95% (v/v) ethanol (HPLC grade), then refluxed for 30 min. The n-hexane was used to extract the hydrolysate and pass into anhydrous sodium sulphate for drying aims. The extraction of samples was repeated for three times. After that sample extracts were filtered through 0.45µm nylon membrane filter (Whatman, Maidstone, England) then analyzed using HPLC (reversed phase) with µ Banda Pak C18 (3.9 x 300 mm) column and the mobile phase acetonitrile-methanol-ethyl acetate (88:10:2). The detection and quantification of β-carotene eluted was done using a UV-Visible detector attached to the 600 controller model HPLC (Waters, Milford, MA, USA). The identification and quantification of the isolated β-carotene was calculated by retention time (rt) and peak areas of appropriate standard (β-carotene).

2.2.8 Preparation and evaluation of Fermented sweet pan bread supplemented with pumpkin pulp flour

Fermented sweet bread was manufactured by Bathie (2000) method. The bread was supplemented with 10%, 20%, 30% and 40% pumpkin pulp flour of El-Edua 1 plant (ED 1plant) sample which was chosen based on taste index and maturity results. The basic ingredients were: wheat flour, water, sugar, vegetable oil, fresh whole egg, baking powder, salt and dried yeast. The percentages of ingredients are shown in Table (2). The fermented sweet bread was manufactured as follows**:** Mix the flour, water together and then mix with the other ingredients to form dough, put in pans, fermented for 135 minutes at 30ºC ± 2 with relative humidity 80-85% then baked for 25 minutes at 180ºC in an electrical oven. When baking is finished the surface should be dark brown. Before evaluation, bread were removed from the oven and cooled. The sensory evaluation of sweet bread samples was carried out subjective characteristics that is, color of crust (10), color of crumb (10), graining of crumb (10), texture (10), taste (10), odor (10) and total score (60). The products were scored by the judges from the staff of Food science and Technology department, Faculty of Agriculture, Assiut University, according to the method described by AACC,(2000). (1986).

2.2.9 Preparation of Chicken Burger supplemented with whole pumpkin seeds kernel meal

Control chicken burger was prepared according to Mikhail et al., (2014) with the formula presented in Table (3). The supplemented burgers processed by replacing the chicken meat with 10%, 20%, 30% and 40% whole pumpkin seeds kernel meal of the El-Edua 1 plant (ED 1plant) sample which was chosen based on taste index and maturity results**.** The burger formulations ingredients were blended in Braun Cutter Machine, then from the blended meat mixture, formed into burger of about 100 g weight, 9 cm diameter and 1.3 cm in thickness.

2.2.9.1 Cooking of chicken burger samples

Samples of chicken burger were cooked, then cooking loss, cooking yield, shrinkage were determined and calculated according to the following equations as described by El-Magoli et al., (1996); Ou and Mittal (2006) and Jama et al., (2008):

Cooking loss =

[(raw sample weight – cooked sample weight) ÷ raw sample weight] × 100.

Cooking yield (%) = (cooked weight/ raw weight) × 100.

$$\text{Shrinkage (\%)} = \frac{(\text{raw thickness}-\text{cooked thickness}) + (\text{raw diameter}-\text{cooked diameter}) \times 100}{\text{raw thickness} + \text{raw diameter}}$$

2.2.9.2 Sensory evaluation of burger samples

Burger samples in pouches coded with different numbers were presented to the judges from the staff of Food science and Technology department, Faculty of Agriculture, Assiut University, who were asked to assigning a score for color (10), odor (10), tenderness (10), taste (10), texture (10) appearance (10) and overall acceptability (10) of cooked samples as described by AMSA (1995) method.

Table (2): Formulation of fermented sweet bread containing pumpkin pulp flour.

Ingredients	Control	10%	20%	30%	40%
Wheat flour 72% (g)	113.75	102.375	91.00	65.875	54.50
Pumpkin pulp flour (g)	---	11.375	22.75	34.125	45.50
Water (ml)	27.50	27.50	27.50	27.50	27.50
Baking powder (g)	3.38	3.38	3.38	3.38	3.38
Sugar (g)	28.38	28.38	28.38	28.38	28.38
Salt (g)	1.14	1.14	1.14	1.14	1.14
Vegetable oil (ml)	21.12	21.12	21.12	21.12	21.12
Fresh whole egg (g)	22.50	22.50	22.50	22.50	22.50
Dried yeast	3.38	3.38	3.38	3.38	3.38

The weight (g) for bread was determined individually within two hours after baking the average was recorded, while the displacement method with clover seeds was used to determine the volume (cm3). Specific volume (cm^3/g) was calculated using the following Equation: Specific loaf volume (cm^3/g) = Volume (cm3)/Weight (g) (AACC, 2000).

Table (3): Formulation of chicken burger containing whole pumpkin seeds kernel meal.

Ingredients (g)	Control	10%	20%	30%	40%
Minced chicken breast meat	875	787.5	700	612.5	525
Whole pumpkin seeds kernel meal	---	87.5	175	262.5	350
Fresh onion	100	100	100	100	100
Salt	15	15	15	15	15
Black pepper	5	5	5	5	5
Allspice	5	5	5	5	5

2.2.10 Statistical Analysis

A statistical analysis system was used to analysis of variance (ANOVA) for a completely randomized design in subjection the experimental data (SAS, 2000).

RESULTS

3.1 Plant growth and development

The pumpkins cultivars KB, KS and ED grown as three plants per hill showed significantly decreased reduced sugar contents in the leaves of 25-day-old pumpkin as compared to those grown single or two plants / hill (Table 4A). The leaves of plants grown as two plants/hill had the highest contents. There were significant differences also among cultivars. Clearly, cvs KB and KS had greater amounts of reduced sugar contents than ED except when grown as 3 plants/ hill. Likewise, the pumpkin cultivars KB, KS and ED grown as three plants per hill showed significantly decreased number of female flowers compared to those grown as single or two plants / hill (Table 4B). The pumpkins grown as one plants/hill gave the highest number of opened female flowers per plant. Significant differences were detected among cultivars. Obviously, cvs KB and ED had greater number of opened female flowers/plant than cv KS. Apparently, the reducing sugar contents in the leaves of 25-day-old pumpkin plants exhibited rather similar propensity. As indicated by Mohamed et al., (2012.), reduced sugar content has been shown to elevate during the transition of pumpkins from vegetative to flowering state. It can typify the ready to flower pumpkins from those recalcitrant ones. It is suggested; therefore, that availability of simple photosynthetic assimilates is crucial during flower anthesis and fruit set (Abdel-Rahman et al., 2012). In line with their finding, the present study showed a magnificent lowered reduced sugar contents in pumpkins leaves as the plants suffered competition due to higher planting density. Level of reduced sugar contents was shown to affect the female flower production that increase with availability of carbohydrates. Thus reduced sugar contents can provide meaningful insight on pumpkin development and fruiting.

There were significant differences in the number of fruits/ plant among the three plant density treatments (Table 4C). The number of fruits per plant was progressively declined as the plant density increased from 1 to 3 plants/ hill. The largest number of fruits was produced by the cv KB followed by KS. Plant density also significantly affected the vine length (Table 4 D). The longest plants were those grown as 2 plants/ hill while the shortest vine was observed for pumpkins grown as 3 plants/ hill. The longest plants were found for cv KB and those having the shortest vine were from the cv ED. The above depicted results clearly demonstrate that planting intensity greatly influence pumpkin growth, development and fruiting characteristics, possibly through imposing an elevated competition among plants for nutrients (Abdel-Rahman et al., 2012).

Pumpkin fruit pulp

3.2.1 Physical properties and chemical composition of pumpkin fruit pulp

There were significant differences in the fruit weight (Table 5) response to planting density which lowest fruit weight was produced by the plants grown as 3 plants/ hill and the greatest weight was obtained from pumpkins planted as 1 plants/ hill.

The smallest fruits were found for cv ED. As shown in Table 5 the pH was ranged from 4.39 to 6.80 for the studied samples. It is clear that there were a significant (P<0.05) differences in the pH between the three studied cultivars.

Table (4): The growth, development and fruit characteristics of three pumpkin local cultivars grown at different plant density summer season 2017.

Cultivar	Plant density(1)			
	1 plant	2 plant	3 plant	Mean
	1st season			
A-Average content of reduced sugar (mg/100g) of fresh leaves (25 days from sowing)				
Kafr El-Battikh	34.3a	37.6a	23.4a	31.8
KafrSaad	33.2b	36.6b	22.5b	30.8
El-Edua	32.2c	34.9c	22.2b	29.7
Mean	33.2	36.4	22.7	30.8
LSD 0.05(2)	0.4			
B-Number of opened female flowers per plant				
Kafr El-Battikh	11.2a	10.5a	5.6a	9.1
KafrSaad	10.2c	9.4c	5.0c	8.2
El-Edua	10.7b	9.9b	5.4b	8.7
Mean	10.7	9.9	5.3	8.7
LSD 0.05(2)	0.1			
C- Number of fruits per plant				
Kafr El-Battikh	2.53a	2.38a	2.14a	2.35
KafrSaad	2.19c	2.09c	1.84c	2.04
El-Edua	2.38b	2.24b	1.99b	2.20
Mean	2.37	2.24	1.99	2.20
LSD 0.05(2)	0.02			
D- Average plant length (cm) at 120 days after planting date				
Kafr El-Battikh	444.3a	489.4a	324.9a	419.5
KafrSaad	429.1b	473.7b	318.0b	406.9
El-Edua	418.2c	461.7c	309.9c	396.6
Mean	430.5	474.9	317.6	407.7
LSD 0.05(2)	2.7			

(1)Means within column followed by same letter (s) are not significantly different. (2)To compare means of same cultivar grown on different plant density.

Table (5): Physical properties of pumpkin fruit pulp cultivars grown at different plant density.

Analysis	Cultivar	Plant density (per hill)			Mean
		1 plant	2 plant	3 plant	
Fruit weight (kg)	Kafr El-Battikh 1	7.79	4.69	1.85	4.78a
	KafrSaad	7.50	4.91	1.91	4.77a
	El-Edua	5.41	3.51	1.78	3.57b
Mean		6.90a	4.37b	1.85c	4.37
TSS (brix%)	Kafr El-Battikh 1	9.60	9.40	8.50	9.17 b
	KafrSaad	10.30	10.02	8.30	9.54 a
	El-Edua	9.70	9.20	7.60	8.83 c
Mean		9.87 a	9.54 b	8.13 c	9.18
pH	Kafr El-Battikh 1	6.80	6.70	6.72	6.74 a
	KafrSaad	4.43	4.51	4.39	4.44 c
	El-Edua	5.91	6.02	5.96	5.96 b
Mean		5.71 b	5.74 a	5.69 c	5.71
T.T.A (g/100g D.W)	Kafr El-Battikh 1	0.41	0.49	0.52	0.47 a
	KafrSaad	0.27	0.24	0.31	0.27 b
	El-Edua	0.13	0.16	0.16	0.15 c
Mean		0.27 a	0.30 b	0.33 a	0.30
Taste index	Kafr El-Battikh 1	1.58	1.45	1.34	1.45 c
	KafrSaad	2.18	2.31	1.65	2.05 b
	El-Edua	3.81	2.99	2.51	3.10 a
Mean		2.52 a	2.25 b	1.83 c	2.2
The maturity	Kafr El-Battikh 1	23.30	19.26	16.32	19.63 c
	KafrSaad	38.29	41.23	26.69	35.40 b
	El-Edua	73.49	56.44	46.91	58.95 a
Mean		45.02 a	38.98 b	29.97 c	37.99

Mean followed by the same letter are not significantly different at the 0.05 level by Duncan's multiple range test.

For TSS and TTA, the KS 1 plant, 2 plant samples recorded the highest values of TSS: 10.30 and 10.02%, while the KB 3 plant sample has the highest value of TTA: 0.52 comparing with the other samples. On the other hand the ED 1 plant sample recorded the highest values of taste index and the maturity 3.81, 73.49%, respectively, as compared with other plant densities.

The results in Table 5 are in accordance with previous study (Noelia et al., 2011), which revealed that the physical properties of pumpkin fruits were variable with fruit weight which varying from 1.52-7.75 kg according to different cultivars.

The results in Table (6) showed a significant ($P<0.05$) difference in the contents of moisture, ash, protein, oil which ranging from 85.70-91.36%, 6.29-8.89%, 9.37-11.65% and 1.12-1.58%, respectively, for all the studied samples. The ED 1 plant, KB 3 plant samples significantly ($P<0.05$) had the highest contents of crude fiber (4.95%), total carbohydrates (79.91%), respectively. Reducing sugars, starch, the caloric value contents was significantly ($P<0.05$) ranged from 12.02-21.92%, 46.26-52.18% and 344.64-366.64 kcal/100 g, respectively. From the above mentioned data it is clear that the significant differences were due to different plant density and cultivars. The results for chemical analysis are in consistent with Noelia et al., (2011).

Pectin, Beta-carotene and Mineral composition of pumpkin fruit pulp

From data in Table (7) the highest pectin, beta carotene contents were found significantly ($P<0.05$) in ED 1 plant (11.49 mg galactutonic acid/100g D.W), KB 1 plant (2.89 mg/100g D.W) samples, respectively. The minerals contents (mg/100g D.W) were significantly ($P<0.05$) found to be different. Potassium was the highest (1924.34 - 2465.53) followed by phosphorus (440.90-450.06) and sodium (51.02-65.01), while magnesium, calcium and iron were found in reasonable quantities, with significant differences as a result of different plant density between the cultivars. It is noted from Table 7 that most of the mineral elements, pectin, beta carotene with the highest values were found in the 1 plant density, which confirming that 1 plant density was the best among the others. Our results are in the same range as previous studies (Noelia et al., 2011; Adubofuor et al., 2016).

Pumpkin seeds

3.3.1 Chemical composition of pumpkin seed kernel

The results in Table (8) illustrated a significant ($P<0.05$) differences in all the chemical composition properties as a result of different cultivars and plant density, where the ED 2 plant; ED 1 plant; KB 2 plant; ED 3 plant; KS 1 plant had the highest values of moisture (7.20%); ash (5.95%); protein (33.15%); oil (41.35%) and crude fiber (3.50%), respectively, as compared with other seeds kernel samples. The total carbohydrates, caloric value were significantly ($P<0.05$) ranged from 18.18-22.10% and 561.30-574.03 kcal/100g, respectively, in the studied samples. The contents of the chemical composition of the seeds kernels were within the values reached by the researchers in previous studies (Elinge et al., 2012; Maheshwari et al., 2015).

Pectin, beta-carotene and mineral composition of pumpkin seed kernel

The results in Table (9) showed that the contents of pectin were not significantly ($P<0.05$) different due to plant density, but there were significant differences as a result of different cultivars and ranged from 1.10 to 1.28 mg galacturonic acid/100g D.W.). For the beta-carotene KB 1 plant gave the highest content (0.86 mg/100 g D.W) among the rest of the seeds kernel samples. The mineral elements contents (mg/100g D.W) were significantly ($P<0.05$) different between the cultivars. The potassium component was highest with values (490.69 - 586.21) followed by phosphorus (500.62 - 540.04) and magnesium (240.86-302.80). The calcium was found in different values between the cultivars where the highest content was ED 3 plant (72.06 mg) and the smallest KS 2 plant (66.01 mg). There were also reasonable amounts of sodium and iron in the studied samples. As shown from the data in Table 8, the 1 plant density, regardless of the cultivar, gave the highest values, which is the best. Such data were agreement with Alfawaz, (2004) and Ardabili et al., (2011) who reported similar results on chemical analysis like us.

Fatty acid composition of pumpkin seed kernel oil

The fatty acids compositions of pumpkin seed kernel oil from three cultivars grown at different plant density are reported in Table (10). From these results it could be noticed that the abundant fatty acids were linoleic, oleic and palmitic make up more than 82.00 % of the total fatty acids in pumpkin seed kernel oil. The linoleic acid represented the highest percentage of total fatty acids in all the studied oils, followed by oleic then palmitic and stearic acid. The contents of fatty acids were similar in every cultivar at different plant density under study. In addition the total unsaturation fatty acids were ranged from 69.27 to 75.04% in these oils. In comparison to previous studies, the differences in fatty acid quantities may be due to the cultivars, the environmental and agricultural factors.

Table (6): Chemical composition and Physical properties of pumpkin fruit pulp cultivars grown at different plant density (g/100g D.W.)*.

Analysis	Cultivar	Plant density (per hill)			Mean
		1 plant	2 plant	3 plant	
Moisture	Kafr El-Battikh 1	85.70	86.90	90.30	87.63 c
	KafrSaad	86.60	87.67	90.76	88.34 b
	El-Edua	88.60	90.21	91.36	90.06 a
Mean		86.97 c	88.26 b	90.81 a	88.68
Ash*	Kafr El-Battikh 1	6.29	6.63	6.35	6.42 c
	KafrSaad	8.86	7.97	7.33	8.05 b
	El-Edua	8.89	8.37	8.02	8.43 a
Mean		8.01 a	7.66 b	7.23 c	7.63
Protein*	Kafr El-Battikh 1	9.39	9.46	9.37	9.41 c
	KafrSaad	9.70	9.81	9.88	9.80 b
	El-Edua	11.65	11.35	11.31	11.44 a
Mean		10.25 a	10.21 b	10.19 c	10.22
Oil*	Kafr El-Battikh 1	1.44	1.15	1.05	1.21 c
	KafrSaad	1.52	1.22	1.12	1.29 b
	El-Edua	1.58	1.53	1.32	1.48 a
Mean		1.51 a	1.30 b	1.16 c	1.32
Crude fiber*	Kafr El-Battikh 1	3.85	3.43	3.32	3.53 c
	KafrSaad	4.07	3.84	3.82	3.91 b
	El-Edua	4.95	4.84	4.59	4.79 a
Mean		4.29 a	4.04 b	3.91 c	4.08
Total carbohydrates*	Kafr El-Battikh 1	79.03	79.33	79.91	79.42 a
	KafrSaad	75.85	77.16	77.85	76.95 b
	El-Edua	72.93	73.91	74.76	73.87 c
Mean		75.94 c	76.80 b	77.51 a	76.75
Reducing sugars*	Kafr El-Battikh 1	12.02	13.96	14.56	13.51 c
	KafrSaad	19.54	21.49	21.92	20.98 a
	El-Edua	16.22	16.56	17.21	16.66 b
Mean		15.93 c	17.34 b	17.89 a	17.05
Starch*	Kafr El-Battikh 1	51.14	50.64	52.18	51.32 a
	KafrSaad	46.31	46.26	47.39	46.65 c
	El-Edua	48.86	49.28	49.65	49.26 b
Mean		48.77 b	48.73 b	49.74 a	49.08
The caloric value (kcal/100 g)*	Kafr El-Battikh 1	366.64	365.51	366.57	366.24 a
	KafrSaad	355.88	358.86	361.00	358.58 b
	El-Edua	344.64	354.81	356.16	351.87 c
Mean		355.72 b	359.73 a	361.24 a	358.90

Mean followed by the same letter are not significantly different at the 0.05 level by Duncan's multiple range tes

Table (7): Pectin (mg galacturonic acid/100G D.W.), beta-carotene (mg beta-carotene/100g D.W.) and mineral composition (mg/100g D.W.) of pumpkin fruit pulp cultivars grown at different plant density.

Analysis	Cultivar	Plant density (per hill)			Mean
		1 plant	2 plant	3 plant	
Pectin	Kafr El-Battikh 1	6.85	6.77	6.38	6.67 c
	KafrSaad	7.61	7.57	6.98	7.39 b
	El-Edua	11.49	11.33	11.09	11.30 a
Mean		8.65 a	8.56 b	8.15 c	8.45
Beta-carotene	Kafr El-Battikh 1	2.89	2.35	2.31	2.52 a
	KafrSaad	2.16	2.34	2.48	2.33 b
	El-Edua	2.41	2.23	2.07	2.24 b
Mean		2.49 a	2.31 ab	2.29 b	2.36
K	Kafr El-Battikh 1	2374.23	2200.46	1968.24	2183.20 b
	KafrSaad	2214.69	2005.51	1924.34	2048.18 c
	El-Edua	2465.53	2296.65	1956.87	2239.68 a
Mean		2351.48 a	2167.54 b	1952.04 c	2157.02
P	Kafr El-Battikh 1	440.90	440.92	440.90	440.91 c
	KafrSaad	448.56	447.92	448.50	448.33 b
	El-Edua	450.06	450.01	450.06	450.04 a
Mean		446.51 a	446.28 b	446.49 a	446.43
Na	Kafr El-Battikh 1	60.19	60.10	60.18	60.16 b
	KafrSaad	64.26	65.01	64.86	64.71 a
	El-Edua	51.28	51.02	51.22	51.17 c
Mean		58.58 a	58.71 a	58.75 a	58.68
Mg	Kafr El-Battikh 1	18.62	18.68	18.60	18.63 b
	KafrSaad	16.52	16.48	16.54	16.51 c
	El-Edua	21.28	21.27	21.20	21.25 a
Mean		18.81 a	18.81 a	18.78 a	18.80
Ca	Kafr El-Battikh 1	16.68	16.38	16.48	16.51 c
	KafrSaad	17.79	17.86	17.90	17.85 b
	El-Edua	35.25	35.02	35.12	35.13 a
Mean		23.24 a	23.08 b	23.17 ab	23.16
Fe	Kafr El-Battikh 1	2.69	2.70	2.66	2.68 b
	KafrSaad	2.86	2.86	2.87	2.86 a
	El-Edua	1.73	1.69	1.70	1.71 c
Mean		2.43 a	2.42 ab	2.41 b	2.42

Mean followed by the same letter are not significantly different at the 0.05 level by Duncan's multiple range test.

Table (8): Chemical composition of pumpkin seed kernel from three cultivars grown at different plant density (g/100g D.W.)*.

Analysis	Cultivar	Plant density (per hill)			Mean
		1 plant	2 plant	3 plant	
Moisture	Kafr El-Battikh 1	4.22	4.67	4.53	4.47 c
	KafrSaad	5.33	5.20	6.43	5.65 b
	El-Edua	6.93	7.20	7.01	7.05 a
Mean		5.49 b	5.69 ab	5.99 a	5.72
Ash*	Kafr El-Battikh 1	4.55	5.30	5.21	5.02 b
	KafrSaad	5.00	5.06	4.89	4.98 b
	El-Edua	5.95	5.83	5.80	5.86 a
Mean		5.17 b	5.40 a	5.30 ab	5.29
Protein*	Kafr El-Battikh 1	33.14	33.15	33.05	33.11 a
	KafrSaad	30.48	30.10	30.27	30.94 b
	El-Edua	31.00	31.10	31.05	30.28 c
Mean		31.54 a	31.34 a	31.46 a	31.44
Oil*	Kafr El-Battikh 1	40.13	40.25	40.10	40.16 b
	KafrSaad	39.06	39.51	39.40	39.32 c
	El-Edua	41.24	41.17	41.35	41.25 a
Mean		40.14 b	40.31 a	40.28 a	40.24
Crude fiber*	Kafr El-Battikh 1	2.95	2.72	2.16	2.61 b
	KafrSaad	3.50	3.23	3.36	3.36 a
	El-Edua	2.34	2.56	2.38	2.43 b
Mean		2.93 a	2.84 a	2.63 b	2.8
Total carbohydrates*	Kafr El-Battikh 1	19.23	18.58	18.18	18.66 c
	KafrSaad	21.96	22.10	22.08	22.05 a
	El-Edua	19.47	19.34	19.42	19.41 b
Mean		20.22 a	20.01 ab	19.89 b	20.04
The caloric value (kcal/100g)*	Kafr El-Battikh 1	570.65	569.17	565.82	568.55 b
	KafrSaad	561.30	564.39	564.00	563.23 c
	El-Edua	573.04	572.29	574.03	573.12 a
Mean		568.33 a	568.62 a	567.95 a	568.3

Mean followed by the same letter are not significantly different at the 0.05 level by Duncan's multiple range test.

Table (9): Pectin (mg galacturonic acid/100g D.W.), beta-carotene (mg beta-carotene/100g D.W.) and mineral composition (mg/100g D.W.) of pumpkin seed kernel from three cultivars grown at different plant density.

Analysis	Cultivar	Plant density (per hill)			Mean
		1 plant	2 plant	3 plant	
Pectin	Kafr El-Battikh 1	1.16	1.15	1.16	1.16 b
	KafrSaad	1.10	1.09	1.10	1.10 c
	El-Edua	1.28	1.28	1.26	1.27 a
Mean		1.18 a	1.17 a	1.17 a	1.17
Beta-carotene	Kafr El-Battikh 1	0.86	0.85	0.85	0.85 a
	KafrSaad	0.82	0.80	0.80	0.81 b
	El-Edua	0.70	0.70	0.69	0.69 c
Mean		0.79 a	0.78 b	0.78 b	0.78
K	Kafr El-Battikh 1	586.21	585.80	586.00	586 a
	KafrSaad	570.02	572.21	575.09	572.44 b
	El-Edua	492.26	490.69	492.30	491.75 c
Mean		549.50 b	549.57 b	551.13 a	550.06
P	Kafr El-Battikh 1	505.73	505.72	505.70	505.72 b
	KafrSaad	500.64	500.62	500.62	500.63 c
	El-Edua	540.04	540.00	540.03	540.02 a
Mean		515.47 a	515.45 b	515.45 b	515.46
Na	Kafr El-Battikh 1	20.18	20.02	20.10	20.10 b
	KafrSaad	21.30	21.32	21.29	21.30 a
	El-Edua	18.85	18.83	18.80	18.83 c
Mean		20.11 a	20.06 b	20.06 b	20.08
Mg	Kafr El-Battikh 1	302.80	300.69	301.20	301.56 a
	KafrSaad	296.51	296.01	294.41	295.64 b
	El-Edua	240.86	240.90	241.01	240.92 c
Mean		280.05 a	279.20 b	278.87 b	279.37
Ca	Kafr El-Battikh 1	68.52	68.02	68.60	68.38 b
	KafrSaad	66.08	66.01	66.07	66.05 c
	El-Edua	72.03	72.01	72.06	72.03 a
Mean		68.87 a	68.68 b	68.91 a	68.82
Fe	Kafr El-Battikh 1	5.65	5.48	5.62	5.58 c
	KafrSaad	7.25	7.29	7.24	7.26 a
	El-Edua	6.08	6.05	6.01	6.05 b
Mean		6.33 a	6.27 b	6.29 ab	6.30

Mean followed by the same letter are not significantly different at the 0.05 level by Duncan's multiple range test.

Table (10): Fatty acid composition of pumpkin seed kernel oil from three cultivars grown at different plant density (%).

Fatty acid (F.A)	Carbon: chain	Kafr El-Battikh 1			KafrSaad			El-Edua		
		1 plant	2 plant	3 plant	1 plant	2 plant	3 plant	1 plant	2 plant	3 plant
Palmitic	16:0	13.40	13.56	13.02	12.20	12.40	12.06	11.50	11.20	11.10
Heptade canoic	17:0	0.27	0.24	0.26	0.24	0.26	0.25	0.23	0.24	0.22
Stearic	18:0	6.30	6.00	6.30	7.18	7.20	7.01	6.94	6.92	6.86
Arachidic	20:0	1.17	1.01	1.07	0.84	0.87	0.86	1.22	1.16	1.17
Behenic	22:0	0.05	0.05	0.06	0.12	0.12	0.13	0.06	0.06	0.06
Lignoceric	24:0	0.10	0.11	ND	0.09	0.10	ND	0.11	ND	0.11
Total saturated		21.29	20.97	20.71	20.67	20.95	20.28	20.06	19.58	19.52
Plmitoleic	16:1	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11
Heptade cenoic	17:1	0.19	0.18	0.19	0.18	0.17	0.18	0.17	0.17	0.17
Oleic	18:1	24.18	24.44	24.06	24.50	24.06	24.59	26.09	26.03	26.18
Linoleic	18:2	44.53	44.62	44.72	49.21	49.39	49.27	48.02	48.21	48.29
Linolenic	18:3	0.09	0.09	0.08	0.17	0.16	0.18	0.10	0.12	0.10
Gadoleic	20:1	0.18	0.18	0.17	0.20	0.21	0.21	0.19	0.20	0.19
Total uns.		69.27	69.61	69.32	74.36	74.09	74.53	74.68	74.84	75.04
T.s./ T. uns		0.31	0.30	0.30	0.28	0.28	0.27	0.27	0.26	0.26

Table (11): Sensory properties and physical evaluation of fermented sweet bread processed from wheat flour and its blends with ED 1plant pumpkin pulp flour (PPF).

Bread sample	Crust color	Crumb		Texture	Taste	Odor	Total score	physical evaluation		
		Color	Graining							
	(10)	(10)	(10)	(10)	(10)	(10)	(60)	Volume (ml)	Weight (g)	Specific Volume (ml/g)
WF100% (Control)	9.23	9.13	8.63	8.95	8.99	8.61	53.54	613.00	184.67	3.32
90% WF + 10%PPF	8.85	8.36	8.30	8.64	8.19	8.55	50.89	604.00	187.37	3.22
80% WF + 20%PPF	8.77	8.10	8.16	8.10	8.32	8.45	49.90	589.00	192.31	3.06
70% WF + 30%PPF	7.98	7.98	7.95	7.98	8.43	7.95	48.27	576.00	194.62	2.96
60% WF + 40%PPF	7.34	7.35	7.39	7.35	8.26	7.95	45.64	547.00	197.09	2.78
F Value	0.63	0.62	0.28	0.43	0.14	0.11	9.40	2012.10	38.60	0.06
LSD 0.05	3.02	2.58	2.75	2.98	2.67	3.12	3.03	1.82	2.60	2.74

WF: Wheat flour. PPF: Pumpkin pulp flour (ED 1plant).

Table (12): Chemical composition (% D.W.)* of fermented sweet bread processed from wheat flour and its blends with pumpkin pulp flour (PPF).

Bread samples	Moisture	Ash*	Oil*	Protein*	Crude fiber*	Total carbohydrates*	Energy* (Kcal/100 g)
WF100% (Control)	26.46	1.11	8.45	10.19	0.60	79.65	435.41
90% WF + 10%PPF	25.99	1.78	8.49	10.24	0.92	78.57	431.65
80% WF + 20%PPF	26.47	2.39	8.61	10.38	1.24	77.38	428.53
70% WF + 30%PPF	25.44	3.20	8.56	10.54	1.86	75.84	422.56
60% WF + 40%PPF	24.84	4.18	8.72	10.61	2.03	74.46	418.76
F Value	268.54	272.07	136.42	50.05	152.57	2581.43	55494.5
LSD 0.05	0.1378	0.2068	0.0917	0.1452	0.146	0.1104	0.0764

WF: Wheat flour. PPF: Pumpkin pulp flour (ED 1plant)

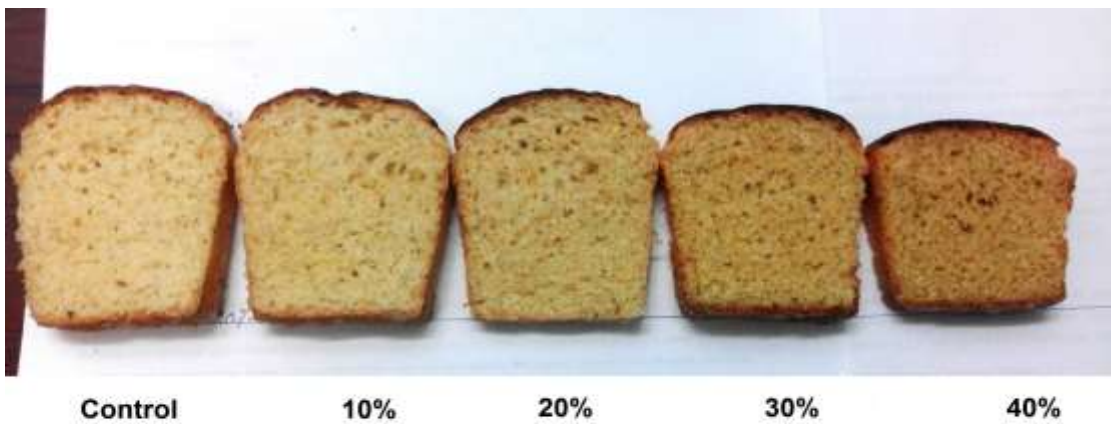

Figure. (1): The fermented sweet bread processed from wheat flour and its blends with ED 1plant pumpkin pulp flour (PPF) at 10, 20, 30, 40% replacement ratios.

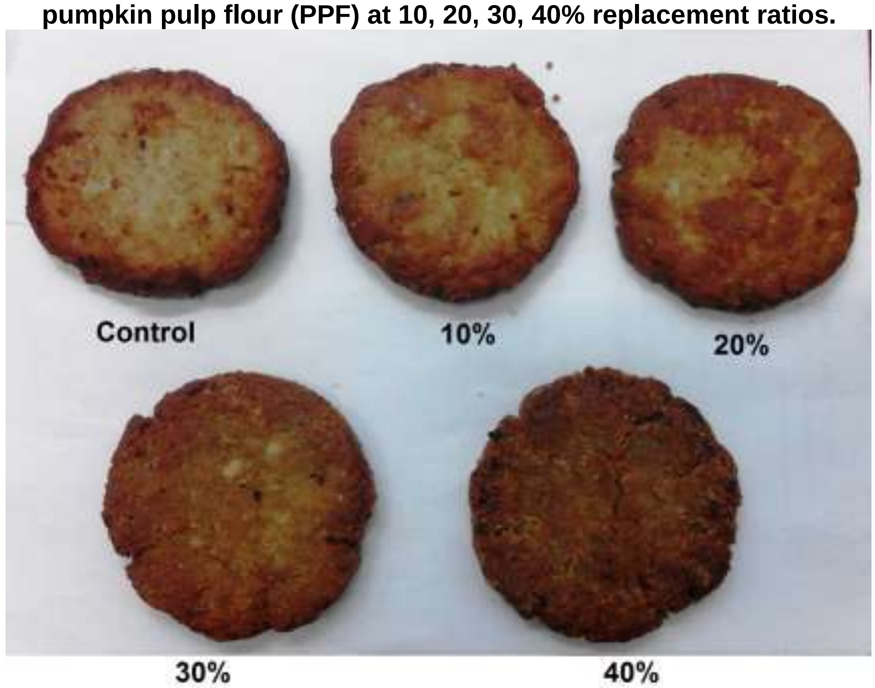

Figure. (2): The chicken burger made from chicken breast meat and its mixtures with ED 1plant whole pumpkin seed kernel meal (WPSKM) at 10, 20, 30, 40% replacement ratios.

Table (13): Sensory evaluation and physical properties of supplemented chicken burgers.

Burger sample	Sensory evaluation								Physical properties		
	Color (10)	Odor (10)	Tenderness (10)	Taste (10)	Texture (10)	Appearance (10)	Overall Acceptability (10)	Total score (70)	Cooking Loss (%)	Shrinkage (%)	Cooking yield (%)
Control (100% CBM)	8.90	8.84	8.65	8.65	8.90	8.52	8.75	61.21	21.54	15.96	78.43
90% CBM + 10%WPSKM	8.63	8.26	8.58	8.52	8.30	8.30	8.30	58.89	19.52	15.65	79.46
80% CBM + 20% WPSKM	8.20	7.82	8.10	8.30	8.10	8.10	8.00	56.62	18.05	13.59	80.87
70% CBM + 30% WPSKM	7.16	7.37	7.29	7.25	7.29	7.16	7.50	51.02	15.74	10.68	84.72
60% CBM + 40% WPSKM	6.65	6.35	6.30	6.30	6.00	6.50	6.50	44.60	14.45	7.77	85.42
F Value	2.80	3.46	2.89	3.03	2.05	1.24	1.09	46.91	11.15	12.09	26.56
LSD 0.05	1.82	1.69	1.87	1.82	2.46	2.41	2.60	3.08	2.69	3.16	1.90

CBM: chicken breast meat WPSKM: whole pumpkin ED 1plant seed kernel meal.

Table (14): Chemical composition (% D.W.)* of supplemented chicken burgers.

Burger samples	Moisture	Ash*	Oil*	Protein*	Crude fiber*	Total carbohydrates*	Energy* (Kcal/100 g)
Control (100% CBM)	56.87	5.10	13.64	58.44	4.74	18.08	428.84
90% CBM + 10%WPSKM	53.32	4.70	16.12	56.36	4.35	18.47	444.40
80% CBM + 20% WPSKM	52.94	4.77	18.70	53.74	4.04	18.75	458.26
70% CBM + 30% WPSKM	51.41	4.81	21.00	52.04	3.50	18.65	471.76
60% CBM + 40% WPSKM	49.22	4.86	22.28	50.26	3.24	19.36	479.00
F Value	1462.29	39.82	3558.36	2849.36	199.55	162.82	72403.2
LSD 0.05	0.1909	0.1768	0.159	0.1648	0.123	0.1198	0.2017

CBM: chicken breast meat. WPSKM: whole pumpkin ED 1plant seed kernel meal.

All major fatty acids have been identified by many authors (Achu et al., 2006; Stevenson et al., 2007; Szterk et al., 2010).

Sensory evaluation, chemical composition of sweet fermented bread made from pumpkin pulp flour

The physical characteristics of bread samples processed from wheat flour and its mixtures with 10, 20, 30 and 40 percent of ED1 PPF are showed in Table (11) and Fig. (1). It was found from Table (11) that the loaf weight was increased in all ED1 PPF bread as a result of the amount of ED1 PPF present in the flour blend. On the other hand the loaf volume, specific volume of fortified bread with these ratios was lower when compared with 100% wheat flour fermented bread. Our results are in the same range as Mettler and Seibel (1993) who reported that the dilution of gluten was causing the reduction of loaf volume but the high water retention causing the increase in bread weight.

The sensory properties of the fermented bread as influence by the incorporation of 10%, 20%, 30% and 40% fortified ED1 PPF are presented in Table (10). The results showed that both fortified bread improved all studied sensory characteristics. Also, the best scores of all studied sensory attributes were recorded for 10% and 20% fortified bread with ED1 PPF. The crust color, crumb properties, texture, taste, odor, over all acceptability scores of control bread and 10%, 20%, 30%, 40% ED1 PPF breads were different. Incorporation of ED1 PPF recorded lower scores for all quality attributes of fortification 10%, 20%, 30% and 40% than the control. The color of the fermented sweet bread was affected by the addition of ED1 PPF as shown in Fig. (1).

The gross chemical composition of fermented sweet bread samples is presented in Table (12). The moisture content of bread samples was ranged from 24.84 to 26.47%. The ash, oil, protein, crude fiber contents was significantly (P<0.05) increased in the fortified bread with ED1 PPF as compared with control, these results may be due to higher content of ash, oil, protein and crude fiber in ED1 PPF compared to wheat flour so the addition of ED1 PPF to sweet fermented bread caused that increase. The data revealed that all fortified bread with ED1 PPF had lower energy and total carbohydrates comparing with the control.

Sensory evaluation, physical properties and chemical composition of chicken burger supplemented with whole pumpkin seed kernel meal.

Sensory attributes of cooked burger under study are reported in Table (13) and Fig. (2). There are no significant (P<0.05) differences between the control chicken burger and the samples supplemented by 10%, 20% - 30% of WPSKM in terms of odor, tenderness, taste and texture as well as over acceptability. On the other hand the control, 10% and 20% burger samples possessed the best color between the studied samples. The total score which expresses consumer acceptability was highest for burgers containing 10%, 20% supplemented burgers, with values 58.89 and 56.62, respectively, as compared with 61.21 for control (100% chicken breast meat). Frying the burger in oil caused a decrease in the weight of the burger and consequently decreasing in cooking loss which ranging from 11.15 -19.52% for supplemented burger, comparing with 21.54% for control. The shrinkage value of burger (as a result of changes in diameter, thickness after cooking) was decreased in supplemented burger ranged from 7.77-15.65% comparing with 15.96 for control. Consequently, the cooking yield was increased as a result of decreasing in shrinkage, cooking loss values was found in quantities from 79.46 to 85.42% for supplemented burgers samples, compared to 78.43% for control. This is agreement with the findings of Abbas (2016). From the above mention data there were significant (p<0.05) differences between the 40% supplemented sample and control burger in all parameters which confirms that this ratio is undesirable and gave poor results

The chemical composition (on a dry weight basis) of cooked chicken burgers with and without WPSKM is shown in Table (14). The results revealed that all the samples contained significantly (P<0.05) high protein (50.26–58.44%), oil (13.64–22.28%), total carbohydrates (18.08-19.36%) contents, and consequently higher energy content (Kcal/100g) in treated burgers (444.40-479.00) comparing with the control (428.84). It was observed that the increase in the amount of WPSKF in the burger blends have been a significant decrease in ash and crude fiber. This is consistent with previous studies (Mikhail et al., 2014)

CONCLUSION

The pulps and seeds of pumpkins are important and useful for human health. Therefore, this research is concerned with the knowledge of the nutritional and technological importance of pulp and seeds of pumpkin as well as their quality as a result of cultivating with different plant density in the hill. The results of this study revealed that cultivation of the pumpkin fruits as one or two plant/hill in order to collectively maintain horticultural cropping, plant growth and development. For the nutritional quality, one plant density was significantly the best in terms of chemical, mineral composition, pectin and beta-carotene comparing with other plant densities. The results of the physical, sensory properties of the processed products showed that addition fruit pulp or seed kernel to sweet bread or chicken burger gave good results to the consumer, which confirms the importance of these fruits from a nutritional point of view. On the other hand, the results of chemical composition for bread and burgers were present with reasonable contents. Therefore it is possible to cultivate the pumpkin fruits with one or two plant densities in hill in order to maintain the nutrients in fruit, as well as, using these fruits in production of various food products with good quality and desirable characteristics that will be accepted by consumer such as sweet bread and burgers.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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