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Impact of addition some important herbs on the texture profile analysis of pan bread

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Abstract

In this study, Fenugreek seeds and some herbs which known from previous studies (Camel grass, Ammi and Roselle) were used to manufacture of pan bread, as a therapeutic assistant for renal patients. Manufacturing pan bread was modified by replacing wheat flour (72% extraction) by 7.5% of the previous four herbs and seeds, based on the sensory evaluation performed. The chemical composition of the processed product was as well as the effect of replaced flour 72% extraction with these materials on the mechanical properties by used texture profile analyzer were estimated. Texture properties such as Firmness, Cohesiveness, Gumminess, Chewiness, Springiness and Resilience for control and treated samples such as (T_1) replacement by 7.5% Fenugreek, (T_2) replacement by 7.5% Camel grass, (T_3) replacement by 7.5% Ammi and (T_4) replacement by 7.5% Roselle from wheat flour 72% extraction. The results showed that the highest value of Firmness was in (T_4) 13.18 compared to control sample (8.95), and the Cohesiveness was 0.63 in (T_3) followed by (T_2) 0.61, and the highest Gumminess was observed in control sample (35.01N) and the lowest in (T_3) was 12.69 N. For the Chewiness, the highest value was in control sample (272.70mJ) and the lowest value in (T_3) was 99.70 mJ. The Springiness was higher value in (T_2) 10.30 mm, while the lowest value was in the control sample (7.79 mm). As for Resilience the highest value was in the (T_3) 0.27 and lowest value was in (T_4) 0.11. It could be noticed that the replacement of wheat flour (72% extraction) with 7.5% of the previous studied materials did not affect the mechanical properties, and all the samples were acceptable for nutrition on organoleptic characteristics.

Keywords: Herbs, renal patients, texture properties, pan bread, sensory evaluation.

Introduction

Fenugreek (*Trigonella foenum-graecum*) is a legume and it has been used as a spice throughout the world to enhance the sensory quality of foods. It is known for its medicinal qualities such as antidiabetic, anticarcinogenic, hypocholesterolemic, antioxidant, and immunological activities. Beside its medicinal value, it is also used as a part of various food product developments as food stabilizer, adhesive, and emulsifying agent. More importantly, it is used for the development of healthy and nutritious extruded and bakery product, **Wani and Kumar (2016).**

The fenugreek considered as one of the leading functional foods in the market with anecdotal traits ranging from ameliorating diseases to improving health, **Rayyan, *et al.* (2010).**

The whole fenugreek seed powder (5% in the diet) proved its effectiveness in restoring normal plasma values of urea, creatinine, alkaline phosphatase and glucose, as well as re-increasing the total antioxidant status, inhibiting lipid peroxidation and alleviating histopathological changes in the injured kidneys, **Nouira *et al*. (2013).**

A number of plant species, including (camel grass) *Cymbopogon schoenanthus,* are traditionally used for the treatment of various diseases. C. schoenanthus is currently, traded in the Saudi markets, and thought to have medicinal value. **Hashim *et al*. (2016).**

One important medicinal plant, *Cymbopogon schoenanthus*, locally known as Sakhbar, Izkhir or Athkhar traditionally named as camel grass, is a desert species that grows in dry stony places. In Saudi traditional medicine, it is mainly used as a diuretic to inhibit kidney stone formation and as an anti-infectious agent in urinary tract infections, **Al-Ghamdi *et al.* (2007).** The camel grass is an effective renal antispasmodic and diuretic agent, **Sabry *et al.* (2014).**

Ammi visnaga is a widely distributed Ancient Egyptian medicinal plant used for treatment of several diseases including urolithiasis (kidney stones), **Akshaya *et al.* (2015).**

Ammi visnaga L. or Khella is traditionally used as treatment for kidney stones as a tea preparation from Egypt. Khella is used to relieve the pain and help the stone pass through the ureter, **Vanachayangkul (2008).**

Ammi visnaga, known as Khella, is an annual or perennial herb that belongs to the family Apiaceae (Umbelliferae). Khella is native to the Mediterranean and is cultivated in Egypt. *A. visnaga* is antiasthmatic; diuretic; lithontriptic and vasodilator. It is an effective muscle relaxant and has been used for centuries to alleviate the excruciating pain of kidney stones, **Chevallier (1996).**

Hibiscus sabdariffa Linn., also known as roselle, is used in folk medicine as an anti-inflammatory agent. Urinary tract infection is a common problem in long-term care facilities. Potential application of roselle drink as a functional supplement for Urinary tract infection in human, **Chou *et al*. (2016).**

The compound presents in *Hibiscus sabdariffa* as quercetin had effect on the vascular endothelium causing oxide nitric release, increasing renal vasorelaxation by increasing kidney filtration. Therefore, the diuretic effect of Hibiscus sabdariffa may be mediated by nitric oxide release, **Alonso *et al.* (2012).** *Hibiscus sabdariffa* decreased calcium crystal deposition in the kidneys. The antilithic effect of Hibiscus sabdariffa may be related to decreased oxalate retention in the kidney and more excretion into urine, **Woottisin *et al.* (2011).**

In developing functional bakery products such as bread, it is important to develop a product with physiological effectiveness and consumer's acceptance in terms of appearance, taste and texture, **Siró *et al*. (2008).**

Bread is an important staple food made from wheat flour, salt and yeast, and consumed worldwide, **Fan *et al*. (2006).** Nowadays consumers prefer to eat healthier foods in order to prevent non-communicable diseases. For this reason industry and researchers are involved in optimizing bread making technology to improve the variety, quality, taste and availability of food products such as bread, **Hathorn *et al*. (2008)**.

Among the ingredients that could be included in bread formulation there are herbs and spices, which are important part of the human diet, **Badr (2015).**

Pan bread is one of the most widely consumed grain products in the world. Whole wheat flour pan bread is preferred by more consumers because of its high dietary fiber and bioactive substances, which not only reduce cholesterol levels but also decrease the risk of colon cancer, **Okarter and Liu (2010).**

Bread is the main staple in many countries worldwide and is mainly prepared from refined wheat flour. Nutritionally, the wide array of white breads provide energy, proteins, minerals and micronutrients, **Acosta *et al.* (2014).** Pan bread or sandwich bread usually has a thin crust and a crumb with regular porosity, thin- walled cells and a typical structure different from other types of bread. Its texture is soft and elastic thanks to the presence of fat, monoglycerides, milk powder, sugar in the formula of pan bread. Concerning the bread-making process, pan bread is baked in pans with or without a cover leading to a typical process of crust formation. However, this product has a short shelf life and stales rapidly depending on different factors: the bread-making process, storage conditions (room temperature, relative humidity, storage with or without crust) and baking conditions, **Besbes *et al.* (2014).**

The texture profile analysis estimated that Hardness is defined as the maximum peak force during the first compression cycle, also known as firmness. Cohesiveness is determined as the ratio of the positive force area during the second compression to that during the first compression. Springiness (also called elasticity) is associated with the height that the sample recovers during the time that elapses between the end of the first cycle and the start of the second cycle. Resilience is a measurement of how the sample recovers from deformation both in terms of speed and forces derived. Chewiness, the energy which was needed to chew the solid-like food stuff into the state that could be swallowed, was calculated by the product of hardness, cohesiveness and springiness, **Correa *et al.* (2010).** Textural properties of doughs in composite bread such as firmness, extensibility and stickiness, **Patil *et al.* (2016).**

Texture profiles along storage time were investigated as well, which indicated that fenugreek fiber could maintain bread quality during storage through enhancing the water holding capacity and lowering starch retrogradation (i.e. staling) rate. Add fenugreek fiber delay the hardness of the bread. Likewise, the gumminess and chewiness, which is proportional to the hardness, showed similar trend. Gumminess is proportional to hardness and cohesiveness while chewiness is proportional to hardness, cohesiveness and springiness. On the contrary, the value of cohesiveness, springiness and resilience, which mainly reflect the elasticity of the bread, **Huang *et al.* (2016).**

Therefore, this investigation aims to evaluate the effect of replacing some herbs and seeds (Camel grass, Ammi, Roselle and Fenugreek) from wheat flour (72% extraction) to produce therapeutic bread as functional foods for renal patients as well as assessment of the mechanical and sensory parameters for prepared pan bread.

Materials and Methods

Materials

Wheat flour:

Wheat Flour (72% extraction) was obtained from East Delta Mills Company. Mansoura City, Dakahlia Governorate, Egypt.

Baking Ingredients:

Instant active dry yeast, salt, sugar and shortening were purchased from local market of Mansoura City, Dakahlia Governorate, Egypt.

Seeds and Herbs:

Fenugreek (*Trigonella foenum-graecum*), Camel grass (*Andropogon Schoenanthus*), Ammi (*Ammi visnaga*) and Roselle (*Hibiscus sabdariffa*) at season 2015-2016 were purchased from local market. Mansoura City, Dakahlia Governorate, Egypt.

Preparation of raw materials:

Camel grass plant, Ammi seeds and Roselle calyces were dried and then grinded by the regular grinder and then were sifted into sieves and the impurities were removed. Fenugreek seeds were first cleaned and freed of broken particles, dust and other foreign materials and then soaked in tap water for 12 hrs at ambient temperature (25°C), with seeds to water ratio of 1:5 (w/v). The non-imbibed water was discarded then the soaked fenugreek seeds were separately spread on four wet jute bags, covered with muslin cloth and other wet jute bags. Water was sprinkled on the seeds every 12 hrs until the end of germination periods (72hrs). The germinated seeds were picked carefully with the sprouts, washed, drained, oven dried at 50°C for 24 hrs, milled and stored in name labeled polyethylene bags prior to analysis (**Mansour and El-Adawy, 1994).**

Preparation of Pan bread:

The pan breads were manufactured by the method of **El-Porai *et al.* (2013).**The ingredients for the present work were: 100 g wheat flour, 1.5 g instant active dry yeast, 2.0 g salt, 2.0 g sugar, 3.0 g shortening and water (according to farinograph test). All ingredients were placed in a mixing bowl at 28 ±2.0 ºC and mixing for 6 min, after mixing, the formulated dough was rounded manually by folding for 20 times, then the bulk dough was leaved to rest for 10 min. The prepared dough (120 g) was placed in lightly greased a baking pan (5 x 9 x 8 cm). The dough were proved for 80 min in a cabinet at 30± 0.5 ºC and 85%relative humidity then baked for 20 min at 250ºC in an electrical oven. Before measurements, the baked breads were cooled for 60 min at room temperature (25± 2.0 ºC) and then packed in polyethylene bags and stored for 6 days at room temperature (25± 2.0 ºC).

Table I. The percentage of ingredients used in formula preparation of pan breads

No. of Treatments	Wheat flour (72%)	Fenugreek	Camel grass	Ammi	Roselle
Control	100	-	-	-	-
T_1	92.5	7.5	-	-	-
T_2	92.5	-	7.5	-	-
T_3	92.5	-	-	7.5	-
T_4	92.5	-	-	-	7.5

Control pan bread 100g wheat flour (72%).
(T_1): Fenugreek pan bread 7.5g fenugreek powder + 92.5wheat flour (72%).
(T_2): Camel grass pan bread 7.5g camel grass powder + 92.5 wheat flour (72%).
(T_3): Ammi pan bread 7.5g Ammi powder+ 92.5 wheat flour (72%).
(T_4): Roselle pan bread 7.5g Roselle powder + 92.5wheat flour (72%).
Un published data were done to select the best ratio of replacement were used.

METHODS:

Chemical composition:

Moisture, ash, crude protein, fat and crude fiber contents were determined in raw materials and samples according to the methods outlined in **A.O.A.C. (2000)**.

Available carbohydrates were calculated by difference as mentioned as follows:

Available carbohydrates = 100 – (% protein + % fat + % ash + %crude fiber).

Sensory evaluation:

Pan bread samples were evaluated organoleptically by 15 trained panelists according to **Kulp *et al*. (1985).** The tested characteristics were; taste (20), aroma (20), mouth feel (10), crumb texture (15), crumb color (10), crust color (10), break and shred (10) and symmetry shape (5).

Mechanical properties:

Texture profile analysis (TPA):

Texture profile analysis was performed using a texturometer **(Brookfield, CT3-4500, Massachusetts, USA)** equipped with a cylinder probe **(TA-AACC36)** with 36mm diameter probe. Pan bread slices were cut as blocks with different dimensions and were 20%compressed twice to give a two bite texture profile curve. Duplicate measurements were made for each sample, one slice block of bread for each measurement. Trigger load and test speed were 10 kg and 4.0 mm/s, respectively. The evaluated parameters were hardness, adhesiveness, resilience, cohesiveness, springiness, gumminess and chewiness as calculated by the texturometer software as mentioned by **Jensen *et al.* (2010) and McGregor (2015).**

Statistical analysis:

The obtained results were evaluated statistically using SAS program that the analysis of variance as reported by **McClave and Benson (1991).**

Results and Discussions

Data in **Table (1)** represent the proximate chemical composition of wheat flour (72%) of protein, fat, ash, crude fiber and total carbohydrates contents on (dry weight basis) and moisture content.

Table 1. Chemical composition of wheat flour (72%) (On dry weight basis), (Mean ± SE)

Components %	Wheat flour (72%)
Moisture	11.42±0.07
Protein	12.10±0.09
Fat	1.81±0.01
Ash	0.62±0.01
Crude fiber	1.65±0.01
Available carbohydrates	83.82±1.88

Data in **Table (2)** represent the proximate chemical composition of herbs of protein, fat, ash, crude fiber and total carbohydrates contents (on dry weight basis) and moisture contents. The result of fenugreek is in agreement with **Saeed *et al.* (2013)**, but the result of camel grass is disagreement with **Mahmud *et al.* (2002).** The result of ammi is disagreement with **Chahal *et al*. (2017).** Also, the result of roselle is disagreement with **Mohmed (2007).**

Table 2. Chemical composition of herbs (on dry weight basis), (Mean ± SE)

Components %	Fenugreek	Camel grass	Ammi	Roselle	LSD at 5%
Moisture	6.86±0.06^{d}	3.36±0.01^{e}	14.33±0.09^{a}	8.19±0.08^{c}	1.430
Protein	27.2±0.30^{a}	11.14±0.03^{b}	8.04±0.08^{c}	11.64±0.02^{b}	2.571
Fat	7.15±0.11^{a}	0.61±0.02^{d}	2.40±0.01^{b}	0.52±0.01^{d}	0.524
Ash	4.50±0.05^{c}	16.34±0.17^{a}	10.35±0.09^{b}	9.45±0.08^{b}	2.156
Crude fiber	7.90±0.15^{c}	15.80±0.09^{b}	30.35±0.92^{a}	7.20±0.06^{c}	3.222
Available carbohydrates	53.25±1.13^{d}	56.11±1.88^{c}	48.86±0.87^{e}	71.19±2.14^{b}	4.792

Data in **Table (3)** shows the proximate chemical composition of different pan breads prepared by replacing of 7.5% wheat flour (72% extraction) with the studied herbs and seeds powder. The largest moisture content was noticed in the Ammi 7.5% sample and the lowest was in the control sample. There were no significant differences. The heighst value of protein content was in Fenugreek7.5% sample but the lowest value was in Ammi 7.5% sample. There were no significant differences. The heighst value of fat content was in Fenugreek7.5% sample but the lowest value was in control sample. There were no significant differences. The heighst value of ash content was in Ammi 7.5% sample but the lowest value was in control sample. There were significant differences. The biggest value of crude fiber content was in Camel grass 7.5% sample but the smallest value was Fenugreek7.5% sample and in control sample. There were no significant differences. Also, the largest value of Total carbohydrates content was in control sample but the smallest value was in Fenugreek7.5% sample. There were no significant differences. The results of the control sample were close to **Boita *et al*. (2016)** results except the moisture content was different. Also, results are in agreement with the result obtained by **Ahmed (2013).**

Table 3. Chemical composition of produced pan bread replaced 7.5% of wheat flour (72% extraction) by different herbs (on dry weight basis), (Mean ± SE)

Components %	Treatments					LSD at 5%
	Control	T_1	T_2	T_3	T_4	
Moisture	31.55±0.91^{b}	32.15±0.95^{b}	33.29±0.88^{b}	36.24±0.92^{a}	32.11±0.78^{b}	3.230
Protein	13.12±0.21^{b}	16.30±0.32^{a}	13.10±0.22^{b}	12.61±0.15^{b}	12.89±0.19^{b}	2.521
Fat	2.53±0.02^{b}	3.12±0.02^{a}	2.59±0.05^{b}	2.66±0.03^{b}	2.57±0.03^{b}	0.424
Ash	1.98±0.02^{d}	2.57±0.03^{c}	3.17±0.03^{b}	4.26±0.05^{a}	2.52±0.02^{c}	0.556
Crude fiber	1.33±0.01^{b}	0.96±0.01^{c}	1.85±0.01^{a}	1.40±0.01^{b}	1.33±0.01^{b}	0.325
Available carbohydrates	81.04±3.55^{a}	77.05±3.14^{b}	79.29±3.50^{a}	79.07±3.17^{a}	80.69±4.11^{a}	3.788

(T_1): Fenugreek pan bread 7.5g fenugreek powder + 92.5wheat flour (72%).
(T_2): Camel grass pan bread 7.5g camel grass powder + 92.5 wheat flour (72%).
(T_3): Ammi pan bread 7.5g Ammi powder+ 92.5 wheat flour (72%).
(T_4): Roselle pan bread 7.5g Roselle powder + 92.5wheat flour (72%).

Table 4. Texture profile analysis of produced pan bread replaced 7.5% of wheat flour (72% extraction) by different herbs

	Results	Control	T_1	T_2	T_3	T_4
Cycle 1	Hardness (N)	79.00	22.87	32.32	20.17	46.13
	Deformation at Hardness (mm)	8.95	11.00	12.59	9.20	13.18
	% Deformation at Hardness	19.90%	20.00	20.00	20.00	20.00
	Hardness work (mJ)	241.40	117.80	216.40	88.40	341.70
	Recoverable Deformation (mm)	4.50	5.30	5.98	5.34	4.78
	Recoverable Work (mJ)	28.40	19.60	34.90	24.10	36.00
	Total Work (mJ)	269.80	137.40	251.20	112.50	377.70
	Load at target (g)	79.00	22.87	32.32	20.17	46.13
	Deformation at target (mm)	8.95	11.00	12.59	9.20	13.18
	% Deformation at target	19.90	20.00	20.00	20.00	20.00
	Adhesive Force (N)	0.03	0.02	0.03	0.28	0.06
	Adhesiveness (mJ)	0.40	0.00	0.00	0.40	0.60
	Resilience	0.12	0.17	0.16	0.27	0.11
	Stringiness Work Done (mJ)	0.40	0.00	0.10	0.30	0.00
Cycle 2	Hardness (N)	63.95	20.80	28.71	17.16	36.51
	Hardness work (mJ)	107.00	71.20	131.50	55.70	133.40
	Cohesiveness	0.44	0.60	0.61	0.63	0.39
	Recoverable deformation (mm)	3.97	4.83	5.59	5.03	3.81
	Recoverable work (mJ)	21.00	15.80	28.10	18.60	23.50
	Total work (mJ)	128.00	87.00	159.60	74.20	156.90
	Springiness (mm)	7.79	9.61	10.30	7.85	9.69
	Springiness index	0.87	0.87	0.82	0.85	0.74
	Gumminess (N)	35.01	13.83	19.64	12.69	18.1
	Chewiness (mJ)	272.70	132.90	202.30	99.70	174.60

(T_1): Fenugreek pan bread 7.5g fenugreek powder + 92.5wheat flour (72%).
(T_2): Camel grass pan bread 7.5g camel grass powder + 92.5 wheat flour (72%).
(T_3): Ammi pan bread 7.5g Ammi powder+ 92.5 wheat flour (72%).
(T_4): Roselle pan bread 7.5g Roselle powder + 92.5wheat flour (72%).

Data in **Table (4)** and **Figs. (1, 2, 3, 4 and 5)** present the texture profile analysis of pan bread and compare the replacements of Fenugreek, Camel grass, Ammi and Roselle at 7.5% with the control sample. For cycle (1) the hardness of the control sample is the greatest value among all the samples which is about 79.0 N. Also as seen from both **Table (4)** and **Fig. (4)** that, the Ammi pan bread sample has the smallest hardness about 20.17N. One can see that the Roselle pan bread has the highest value among the replacement samples which is about 46.13N, as shown in **Fig. (5).** On the other hand data in **Table (4)** noticed that the deformation of the control sample is lowest value among the other samples which it was 8.95mm. Also, the deformation of the Roselle pan bread sample is the highest value which is about 13.18mm, due to the Roselle pan bread sample has hard structure among other samples. This result is an a good agreement with the structure of this sample after baking. It is clear from **Table (4)** that the hardness work done of T_4 sample has the greatest value among all samples which is about 341.70mJ. Also, the T_3 sample has the lowest hardness work done which is about 88.40mJ. The recoverable deformation for all samples is nearly the same which covers the range from 4.50 to 5.98mm.

Also, the adhesive force has the lowest value for T_1 sample about 0.02N and has the highest value for T_3 sample which is about 0.28N. Data in the same table noticed that the adhesive forces for control and T_2 samples are nearly the same which they are about 0.03N. **Table (4)** displays that the T_1 and T_2 samples have 0.00mJ adhesiveness, where the control and T_3 samples have the same adhesiveness which is about 0.40mJ and the T_4 sample has the largest adhesiveness of about 0.60mJ. While the resilience of T_3 sample was the largest one which is about 0.27. For cycle (1) the stringiness work done for the control sample is the highest one which is about 0.40mJ and 0.00mJ for T_1 and T_4. For cycle (2), the second compress after deformation of the first load, the hardness of the control sample is still has the highest value which is about 63.95N. While the lowest hardness among samples is related to the T_3 sample which is about 17.16N, in similar behavior to cycle (1). It is noticed that the behavior of all samples for hardness is similar for both cycles. The behavior for hardness work done for cycle (2) is differed than that of cycle (1) which has a highest value (133.40mJ) for T_4 sample and has the lowest value was 55.70mJ for T_3 sample.

On the other hand the hardness work done for cycle (2) is lower in magnitude than that the value associated with the same samples for cycle (1). This result is due to the fact that, the samples are deformed after compressed by the load in cycle (1). For cycle (2) the cohesiveness associated with the T_3 sample was 0.63 presents the highest value and the lowest value which is 0.39 is related to the T_4 sample. The recoverable deformation for cycle (2) has a lowest value (3.81mm) and is associated with T_4 sample and an enhancement value which is 5.59mm is related to the T_2 sample. The recoverable work done in cycle (2) has its largest value which is 28.10mJ and is related to T_2 sample, the smallest value was 15.01mJ which is associated with T_1sample. In cycle (2) the springiness were the highest value (10.30mm) which is attributed to the T_2 sample and has its lowest value (7.79mm) related to the control sample. In cycle (2) the springiness index was lowest value (0.74) associated with the T_4 sample which it was 0.87 related to the control and T_1 sample. One can noticed that the springiness index for all samples is nearly the same except the T_4 sample. In cycle (2) the gumminess has its biggest value of about 35.01N which is associated with the control sample, and has its lowest value of about 12.69N which is related to the T_3 sample. Finally, the chewiness for the control sample shows the highest value (272.70mJ) while, the lowest value was 99.70mJ related to the T_3 sample.

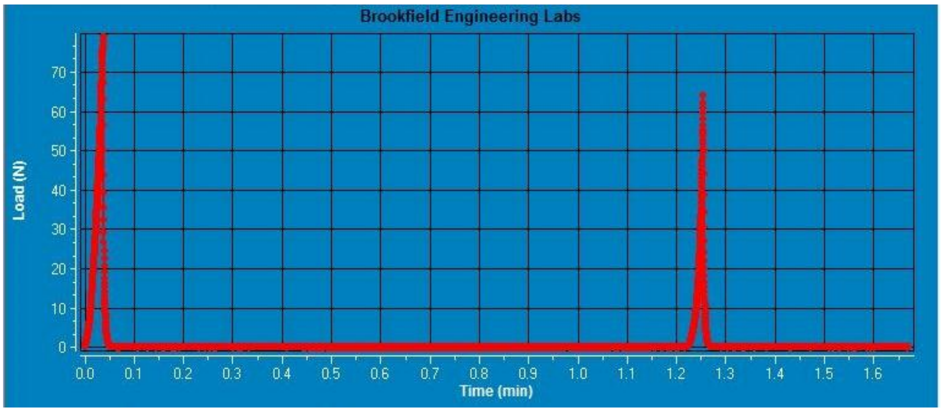

Fig. (1): The force load in Newton (N) versus time in minutes (min) for texture profile analysis of the Control sample.

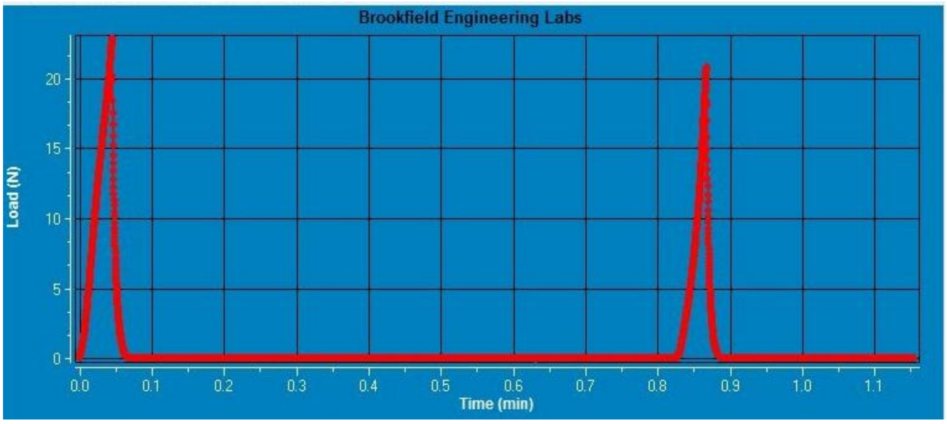

Fig. (2): The force load in Newton (N) versus time in minutes (min) for texture profile analysis of Fenugreek sample.

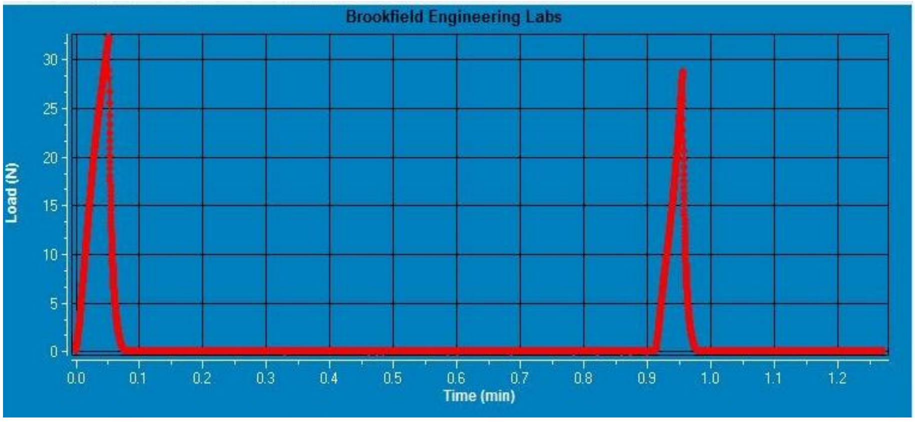

Fig. (3): The force load in Newton (N) versus time in minutes (min) for texture profile analysis of Camel grass sample.

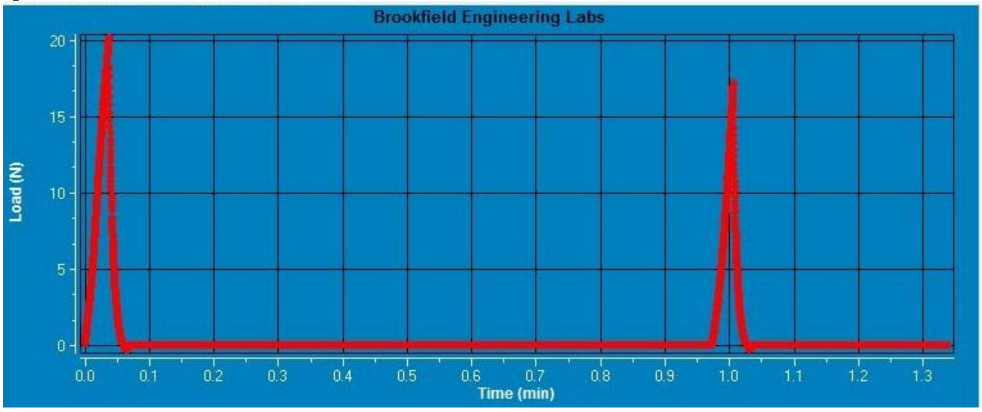

Fig. (4): The force load in Newton (N) versus time in minutes (min) for texture profile analysis of Ammi sample.

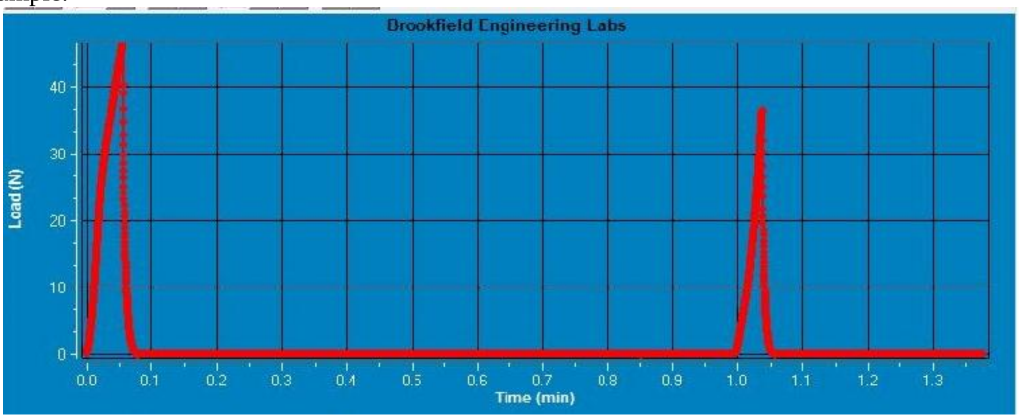

Fig. (5): The force load in Newton (N) versus time in minutes (min) for texture profile analysis of Roselle sample.

Table 5. Texture profile analysis (TPA) of pan bread replaced 7.5% of wheat flour (72%) by different herbs.

Treatments	**Parameters**					
	Firmness (N)	**Cohesiveness**	**Gumminess (N)**	**Chewiness (mJ)**	**Springiness (mm)**	**Resilience**
Control	**8.95**	**0.44**	**35.01**	**272.70**	**7.79**	**0.12**
T_1	**11.00**	**0.60**	**13.83**	**132.90**	**9.61**	**0.17**
T_2	**12.95**	**0.61**	**19.64**	**202.30**	**10.30**	**0.16**
T_3	**9.20**	**0.63**	**12.69**	**99.70**	**7.85**	**0.27**
T_4	**13.18**	**0.39**	**18.01**	**174.60**	**9.69**	**0.11**

(T_1): Fenugreek pan bread 7.5g fenugreek powder + 92.5wheat flour (72%).
(T_2): Camel grass pan bread 7.5g camel grass powder + 92.5 wheat flour (72%).
(T_3): Ammi pan bread 7.5g Ammi powder+ 92.5 wheat flour (72%).
(T_4): Roselle pan bread 7.5g Roselle powder + 92.5wheat flour (72%).

Data in **Table (5)** shows the (TPA) of pan bread replaced 7.5% of wheat flour (72%) by different herbs. The firmness of T_4 sample is the greatest value (13.18). While, the lowest value for firmness is related to control sample (8.95). The cohesiveness has the highest value for T_3 sample (0.63). While, the lowest value (0.39) was attributed to the T_4 sample. Also, the gumminess has the highest value for the control sample (35.01) but the lowest value of gumminess is related to the T_3 sample (12.69). The chewiness for the control sample has the highest value (272.70). While, the lowest value for the T_3 sample (99.70). The springiness of T_2 sample was the highest value (10.30) but the lowest value is related to the control sample (7.79). The resilience of T_4 sample was the lowest value (0.11). While, the highest value (0.27) is associated with the T_3 sample.

Figs. (1, 2, 3, 4 and 5) show the variations of the force loads with the time for the texture profile analysis tests for the control, T_1, T_2, T_3 and the T_4 samples, respectively. All samples exhibit the same behavior for the two compressive cycles which include both the downstroke work and the withdrawal work. Further more that the peaks of the first compress are enhanced than that attributed to the second compress. This result is in fact due to the damage of pan bread samples of their internal structures after the first compress and as a matter of fact the second compress will have a less load and results in a short peak.This is in reality agree with the fact that the bread takes a great chew (bite) to break down its internal structure and damage it while the next chew needs less force to complete deform the bread.

The obtained result of the present work for the hardness of the control sample show a good agreement with **Abd-Elrahman (2016),** for the sample of Gemiza 11 with a small discrepancy of about 5%. The cohesiveness of the present work for the control samples exhibits an excellent agreement with **Kadan *et al*. (2001); Marttila *et al*. (2004) and Charoenthaikij *et al*. (2010).** Furthermore, the springiness of the Control sample was excellent agreement with **Charoenthaikij *et al*. (2010)** and **Bize *et al*. (2017).**

Data in **Table (6)** shows that the organoleptic characteristics of different pan bread samples of taste, aroma, mouth feel, crumb texture, crumb color, break and shred, crust color and symmetry shape. It is clear data that the highest value of control sample and the lowest value in T_4 sample. The results of control sample disagreement with **Chandel and Jood (2015).**

Table 6. Organoleptic characteristics of produced pan bread replaced 7.5% of wheat flour (72% extraction) by different herbs (Mean ± SE)

Treatments	Taste (20)	Aroma (20)	Mouth feel (10)	Crumb texture (15)	Crumb color (10)	Break and shred (10)	Crust color (10)	Symmetry shape (5)
Control	19.60±0.77[a]	19.20±0.65[a]	9.10±0.22[a]	14.40±0.33[a]	9.20±0.13[a]	9.15±0.08[a]	9.50±0.07[a]	4.62±0.01[a]
T_1	17.10±0.80[b]	14.10±0.52[c]	8.63±0.22[a]	14.20±0.35[a]	8.77±0.15[a]	9.00±0.09[a]	9.20±0.06[a]	4.42±0.01[a]
T_2	15.33±0.61[c]	16.25±0.41[b]	8.50±0.15[a]	14.50±0.25[a]	8.55±0.17[a]	7.82±0.07[b]	9.10±0.09[a]	3.12±0.03b
T_3	12.50±0.52[d]	13.50±0.45[d]	7.00±0.12[b]	12.30±0.25[b]	6.55±0.12[b]	7.77±0.08[b]	7.13±0.05[b]	3.00±0.04[b]
T_4	9.65±0.45[e]	12.00±0.44[e]	4.55±0.12[c]	6.80±0.22[c]	4.11±0.09[c]	4.80±0.06[c]	4.15±0.05[c]	2.10±0.01[c]
LSD at 5%	1.682	1.733	0.652	1.055	0.825	0.773	0.788	0.415

Conclusion

The present work performed texture profile analysis (TPA) of pan bread replaced by 7.5% Fenugreek, Camel grass, Ammi and Roselle herbs. Textural properties of pan bread samples is Hardness, Adhesiveness, Firmness, Cohesiveness, Gumminess, Chewiness, Springiness, and Resilience, were measured with a technique based on a texturometer. The results of the evaluated textural parameters exhibit good agreement with those published as mentioned in the discussions of the results.

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تأثير إضافة بعض الأعشاب الهامة على خصائص القوام لخبز القوالب

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تم في هذه الدراسة إستخدام بذور الحلبة وبعض الأعشاب المعروفة من الدراسات السابقة (الحلفابر ، الخلة والكركديه) في تصنيع منتج خبز القوالب الذي يمكن التغذية عليه كمساعد علاجي لمرضى الكلى حيث تم إجراء التحليل الكيميائي للمواد الخام المستخدمة في التصنيع وتصنيع خبز القوالب بإستبدال دقيق القمح (إستخلاص ٧٢%) بنسبة ٧,٥% من الأعشاب السابقة وبذور الحلبة وذلك بناءا على التقييم الحسي الذي تم إجراءه. وتم تقدير التركيب الكيميائي للمنتج المصنع وكذا دراسة تأثير إستبدال دقيق القمح (إستخلاص ٧٢%) بهذه المواد علي صفات القوام (الخواص الميكانيكية) بإستخدام جهاز قياس وتحليل القوام لتقدير ثوابت القوام وهي النعومة ، التحبب ،التصمغ، ،المضغ ، المطاطية والمرونة لعينة الكنترول وللمعاملات (١) إستبدال ٧,٥% حلبة ، (٢) إستبدال ٧,٥% حلفابر ، (٣) إستبدال ٧,٥% خلة و(٤) إستبدال ٧,٥% كركديه من دقيق القمح إستخلاص ٧٢%. وأوضحت النتائج زيادة قيمة النعومة في عينة المعاملة (٤) نتيجة إضافة الكركديه حيث كانت ١٣,١٨مقارنة بعينة الكنترول ٨,٩٥ وكانت صفة التحبب ٠,٦٣ في المعاملة (٣) تليها المعاملة (٤) ٠,٦١ ، وأيضا كانت صفة التصمغ أعلى قيمة لها في عينة الكنترول ٣٥,٠١نيوتن وأقل قيمة لها في المعاملة (٣) ١٢,٦٩نيوتن، وبالنسبة لصفة المضغ كانت أعلى قيمة في عينة الكنترول ٢٧٢,٧٠ ملي جول وأقل قيمة كانت في المعاملة (٣) ٩٩,٧٠ ملي جول وصفة المطاطية كانت أعلى قيمة في المعاملة (٢) ١٠,٣٠ملم بينما كانت أقل قيمة في عينة الكنترول (٧,٧٩ ملم). أما بالنسبة لصفة المرونة فكانت أعلى قيمة لها في المعاملة (٣) ٠,٢٧ وأقل قيمة كانت في المعاملة (٤)٠,١١ .

ومن النتائج المتحصل عليها وجد أن إستبدال دقيق القمح (إستخلاص ٧٢%) بنسبة ٧,٥% من مواد الدراسة السابقة لم تؤثر سلبا علي خصائص القوام , وكانت جميع العينات مقبولة للتغذية عليها من الناحية الحسية.