Effect of Stabilized Rice Bran Supplementation on Different Box Bread Properties

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تأثير التدعيم بردة الأرز المثبتة على الخواص المختلفة لخبز القوالب

د. دينا البشوتي

الملخص

يعتبر استخدام المخلفات الغذائية أحدث اتجاه لزيادة القيمة الغذائية للمنتجات . هدفت الدراسة الحالية إلي معرفة تأثير استبدال دقيق القمح في خبز القوالب بردة الأرز المثبتة بنسبة (10% ، 20% ،30%) علي التركيب الكيمائي ، الخواص الفيزيائية ، خواص الملمس والخواص اللونية والخواص الحسية للخبز المنتج وكذلك ظاهرة البيات . تم إعداد خبز القوالب بخلطات مختلفة (100% دقيق قمح ، 90% دقيق قمح + 10% مطحون ردة الأرز ، 80% دقيق قمح+ 20% مطحون ردة الأرز ، 70% دقيق قمح + 30% مطحون ردة الأرز). أظهرت نتائج التحليل الكيميائى أن الاستبدال أدي إلي زيادة محتوي خبز القوالب من الرماد والبروتين والدهون والألياف . كما أظهرت نتائج الخواص الفيزيائية انخفاض معنوى فى الحجم والحجم النوعى و أظهرت نتائج قياس الخواص اللونية انخفاض معنوى فى قيم (L*) وذلك بالنسبة للقشرة واللب وبالمثل حدث انخفاض فى قيم (b*)، أما بالنسبة لظاهرة البيات حدث نقص تدريجى فى (AWRC) وذلك بزيادة نسبة ردة الأرز كما تأثرت خواص الملمس بعمليات الاستبدال حيث حدثت زيادة فى معاملات الالتصاق واللزوجة وأظهرت نتائج التقييم الحسى أن الاستبدال يعتبر مقبولاً حتى نسبة 20٪. وقد أوصت الدراسة بإدخال ردة الأرز فى عمل خبز القوالب وذلك بنسب استبدال لا تزيد عن 20٪

الكلمات المفتاحية :

ردة الأرز المثبتة ، التركيب الكيميائي ، الخصائص الفيزيائية ، خواص الملمس ،الخواص اللونية، ، ظاهرة البيات ، خواص الملمس ،الخواص الحسية.

Effect of Stabilized Rice Bran Supplementation on Different Box Bread Properties

Abstract

The use of nutritional waste is the latest trend to increase products nutritional value. The aim of this study was to investigate the effects of partial substitution of wheat flour by stabilized rice bran at levels 10, 20 and 30 % on chemical , physical, texture profile, color measurement, staling rate and sensory properties of box bread. Box bread prepared from wheat flour with replacing it by rice bran at levels 10, 20 and 30 %. Chemical analysis of box bread demonstrated increase in protein, fat ,ash and dietary fiber content which were increased in all supplemented box bread. Concern -ing physical properties volume and specific volume were gradually decreased. Also, color measurement (L*, a* and b*) showed significant decrease in lightness values L* and b* values of crust and crumb. Concerning stalling rate results declared significant decrease in the AWRC with the increasing of rice bran. The results of texture profile showed increasing adhesiveness and gumminess parameters. As well as, sensory properties of box bread remain acceptable until replacement ratio 20% .The study recommended adding rice bran in making box bread at replacement rates of not more than 20%.

Key words: stabilized rice bran , chemical properties, physical properties, texture profile, color measurement, staling rate, sensory properties and box bread .

Introduction

Rice bran or *Oryza sativa* is one of the major by-products during paddy processing **(Begum *et al.*,2020)**. It is the outermost layer of the rice nucleus and is a by product of milling rice, which makes up 8% of all rice grains **(Parrado *et al.*, 2006 and Raghav *et al.*, 2019).** It is obtained from grain milling process , Concerning the nutrients, bran contains minerals like iron, phosphorus and magnesium **(Silva *et al.*,2006)**.Recently, rice by-products are becoming a great concern as functional foods due to their phenolic essential compounds, over there it has large quantities of vitamins, minerals and fibre, which helps in lowering cholesterol and activate antiatherogenic activity **(Wilson *et al.*, 2000).**

Also, rice bran can be incorporated into functional foods, however it is still under use due to lipase enzyme. Lipase enzyme degrades the oil content into glycerol and free fatty acids. Because of this conversion, the quality of rice bran is reduced. This produces unpleasant odor and tastes bitter. Because of this rancidity problem, rice bran converts into unsuitable for human consumption and most of the rice bran used as high protein animal diet or as fuel **(Lakkakula *et al.*, 2004).** After milling, rapid stabilization of the rice bran using thermal treatment techniques destroys enzymes responsible for its degradation. Stabilized rice bran is free from rancidity, off flavors and bitter and soupy taste, and is more convenient use and processing .The useful effects of rice bran as natural antioxidants is in lowering hyperglycemic in albino rats **(Faid,2015).**

Furtheremore, rice bran is a good source of essential nutritients. It contains micronutrients like oryzanols, tocopherols, tocotrienols, phytosterols which include vitamin E and appear clearly antioxidant activity. As well, it contains 20% oil, 15% protein, 50% carbohydrates (at most starch), dietary fibers such as pectin, beta glucan and gum **(Piironen *et al.*,2000).** It contains bioactive phytochemicals with antioxidant and lipid lowering effects including γ-oryzanol, tocols (tocopherols and tocotrienols) and flavonoid compounds. Despite the abundance of natural antioxidant components and nutritional proteins in rice bran , its potential application as a natural and raw material for the preparation of functional foods or nutrients is limited by the extreme insolubility of its protein, the safety of the nutraceutical components of the product, its tendency to rancidity, and the difficulty of storage associated with it **(Jiang and wang 2005 and Justo *et al.*, 2013).**The present work aimed to investigate the effects of partial substitution of wheat flour by stabilized rice bran at levels 10, 20 and 30 %. on chemical , physical, texture profile, color measurement, staling rate, and sensory properties of box bread.

Materials and Methods

Materials

Wheat flour (72%) extract was obtained from local market, Damietta City, Rice bran was obtained from Faraskur Mill , Damietta, Egypt, other ingredients Instant yeast, bread improver , sugar,salt and shortening were obtained from local market, EL Hayah, Damietta ,Egypt.

Methods

Stabilized Rice Bran

Fresh mill rice bran was stabilized using microwave heating maintained at temperature of 120^{0}C for 10 minutes to inactivate lipase enzyme. The stabilized rice bran was allowed to cool at room temperature packaged in air tight bags and stored for further analysis as declared by **(Iqbal *et al.*, 2005).**

Preparation of box bread samples

Box bread formula are shown in table (1). They were prepared as follow control: 100% wheat flour ,90% wheat flour and 10% rice bran (RBB1) , 80% wheat flour and 20% rice bran (RBB2), 70% wheat flour and 30% rice bran (RBB3).

The standard formula according to **(Abdelghafor *et al.*, 2011)** included 1500g of wheat flour, 22.5g yeast, 22.5gsalt (NaCl), 45g shortining, 45g sugar (sucrose) and 15g improver . Three formulas were prepared with different levels of rice bran powder 10%, 20% and 30% on wheat flour replacement basis and tap water added to make the dough as needed. All dry components were weighed and placed in a mixer for 5 sec, and consequently a suspension of the yeast in water was added. The mixture was further run at high speed for 92sec and water was added to the mixture for making the dough. The doughs were scaled into portions, rounded into balls by hand in fermentation bowls and placed in fermentation cabinet at 30°C and 85% relative humidity for 20 min. The fermented doughs were placed in boxes and finally returned into the fermentation cabinet for 50 min. The boxes were put in a convection oven at 212°C for 18 min. Loaves were weighed after cooling at room temperature, sensory evaluation and various properties were recorded.

Table (1): Formula of box bread samples

Ingredients (g)	**Control**	**Replacement levels of wheat flour by rice bran**		
		RBB1	**RBB2**	**RBB3**
Wheat flour	1500	1350	1200	1050
Rice bran	--	150	300	450
Instant yeast	22.50	22.50	22.50	22.50
Improver	15.00	15.00	15.00	15.00
Sugar	45.00	45.00	45.00	45.00
Salt	22.50	22.50	22.50	22.50
Shortening	45.00	45.00	45.00	45.00

Control: 100% wheat flour; **RBB1**: 90% wheat flour and 10% rice bran; **RBB2**:80% wheat flour and 20% rice bran; **RBB3**: 70% wheat flour and 30% rice bran

Chemical analysis

Proximate analysis including protein, fat, ash and crude fiber were carried out according to the methods of **AOAC (2005).** Carbohydrates content calculated by difference.

Physical properties of box bread

The loaf volume was measured by rapeseed displacement method according to **A.A.C.C (1990)**. Specific volume was measured from loaf volume and loaf weight taken after 1 h of baking.

Color measurement of box bread

Color measurements of box bread samples was measured by a spectro-colorimeter with the CIE color scale (Hunter, Lab scan XE). This tool was standardized against white tile of Hunter Lab color standard (LX No.16379): X= 77.26, Y= 81.94 and Z= 88.14. The L*, a* and b* values were reported **(Mohammad, 2010).**

Measurement of box bread staling rate

Box bread staling rate was measured by determination of alkaline water retention capacity (AWRC) according to the method of **(kitterman and Rubenthaler ,1971)** as follow:

Each of samples of box bread was cooled at room temperature after baking, therefore packed in polyethylene bags. At intervals i.e. zero, 24, 48 and 72 hr. of storage samples were cut into small pieces, dried in an electric oven at 50±0.5ºC overnight then ground to pass through at 60 mesh stainless steel sieve.

Five grams of box bread sample was placed into a 50 ml dry plastic centrifuge tube. Then, 25 ml of $NaHCO_3$ solution (8.4 g Sodium bicarbonate dissolved in one-liter distilled water) were added. This tube was closed and shacked until the sample become wet. Thus, the mixture was left for 20 minutes with shaking every 5 minutes. Then the contents were centrifuged at 2500 rpm for 15 minutes.

After centrifugation, the supernatant was decanted and the precipitate was left for 10 minutes at 45º angel to disposal of free water.

The experiment was doubled and average of the 2 runs was multiplied by 20 to give Alkaline Water Retention Capacity in percent (AWRC %). The following equations were used:

AWRC (%) = [(Weight of tube with sample after centrifuge – weight of empty tube)/Weight of sample] x 100.

Rate of decrease (R.D) (%) = [AWRC (0 time)–AWRC (N time)]/ AWRC (0 time)} X 100.

Texture Profile analysis (TPA) of box bread

Box bread texture (hardness, cohesiveness, gumminess, chewiness, springiness and resilience) was determined by Texture Profile Analyzer (TPA) according to (**Bourne, 2003).** Crumb texture was determined by universal testing machine (Texture Pro CT V1.6 Build) provided with software. An aluminum 25 mm diameter cylindrical probe was used in a TPA double compression test to permeate to 30% depth, at 2mm/s speed test. Texture determinations were performed, after removing the crust, in (40*40*30) mm-sized samples.

Sensory Evaluation of box Bread

Samples of box bread were evaluated by 10 panelists for color of crust (15), color of crumb (15), taste (20), flavor (15), crumb distribution (15) and general appearance (20). The total value of these sensory characteristics was assessed as overall acceptability and descriptive category as follows: 90-100: very good, 80-90: good, 70-79: satisfactory: less than 70: questionable **(Khorshid *et al*., 2011).**

Statistical Analysis

Statistical analysis was carried out according to **(Fisher, 1970)**. LSD (Least significant difference) test was used to compare the significant differences between means of treatments **(Waller and Duncan ,1969).** One way analysis of variance (ANOVA) was used to test the differences between groups **(SPSS, 1999)**.

Results and Discussion

Chemical composition of processed box bread samples

Chemical composition of processed box bread samples were summarized in table (2), It could be observed that increasing levels of stabilized rice bran in all box bread samples caused a decrease in carbohy -drate contents which ranged between 86.08$\pm$ 0.20 to 75.16$\pm$0.30g% .On the other hand, the same table showed that protein content was high in processed box bread comparing with control sample . Also, It was found that all processed box bread had high content of fat comparing with control sample which ranged between 1.20±0.01 to 2.73± 0.03% whereas ash content was increasing in processed box bread comparing with control sample These results were in accordance with the findings by **Moongngarm *et al.*, (2012)** who reported that rice bran had higher ash and fat contents, because of the presence of germ in the bran..Results also showed that increasing levels of stabilized rice bran in box bread increased the amount of total dietary fiber in all box bread as compared with control sample which ranged between 1.15±0.15 to 8.49±0.40g% .

In this concept **Mishra (2017)** demonstrated that fortification wheat flour using rice bran will improve nutritional quality and provide health benefits to consumers. Rice bran powder has much higher contents of protein, fat, ash and fiber than wheat flour. Thus , rice bran integrated food products would be rich in protein, fiber, bioactive compounds and might contribute to health benefits like lowering blood cholesterol **Chotimarkorn (2007).**

Table (2): Chemical composition of processed box bread samples

Treatments	Protein (g%)	Fat (g%)	Ash (g%)	Fiber (g%)	Carbohydrates (g%)	Calories (Kcal/100)
Control	10.95±0.05^{d}	1.20±0.01^{d}	0.62±0.01^{d}	1.15±0.15^{d}	86.08±0.20^{a}	398.92±0.50^{a}
RBB1	11.26±0.03^{c}	1.71±0.03^{c}	1.00±0.05^{c}	3.60±0.20^{c}	82.43±0.15^{b}	390.15±0.90^{b}
RBB2	11,56±0.06^{b}	2,22±0.02^{b}	1.38±0.10^{b}	6.04±0.50^{b}	78.8±0.60^{c}	381.42±0.20^{c}
RBB3	11,87±0.03^{a}	2.73±0.03^{a}	1.75±0.05^{a}	8.49±0.40^{a}	75.16±0.30^{d}	372.69±0.05^{d}

Different superscript letters in the same column indicate a significant ($p \leq 0.05$) difference according to Duncan's test; control: 100% wheat flour; RBB1: 90% wheat flour and 10% rice bran; RBB2:80% wheat flour and 20% rice bran; RBB3: 70% wheat flour and 30% rice bran

Physical properties of processed box bread samples

Physical parameters of processed box bread samples are shown in table (3). The results in the same table indicated that the lowest value of weight box bread was investigated by the control sample 295.48±0.07g with no significant differences with other samples. Many researchers added rice bran to wheat flour at 15-30% in yeast bread and declared that rice bran can be supplemented successfully up to 15% substitution level without affecting loaf weight **Sharp and Kitchen (1990) ; Shaheen *et al.*, (2005)** . The increase in the loaf weight may be due to the high water absorption by the rice bran and decreased air entrapment, cause heavy dough. This might also reflected in the moisture content of bread loaves, According to **Greene and Benjamin (2004).**In this concern, the weight of fortified biscuits was increased, by increasing level of rice bran **Sudha *et al.*, (2007)** .On contrast to the volume of box bread the control sample recorded the highest value of volume 1020±0.50cm3 and the same parameter was gradually decreased with the increasing of replacement level of rice bran with significant differences.

Using rice bran in making bread lead to weakening of the structure and baking properties of dough, decrease bread volume **Noort *et al.*, (2010)**. Also, **Milani *et al.*, (2006)** revealed that rice bran added to dough formulation reduced its elasticity which affected reducing specific volume.

In this concern **Sudha *et al.*, (2007)** stated that adding different fiber sources to bakery products led to decrease volume.Consequently, the highest value of specific volume was recorded by the control sample 3.45± 0.08 cm3/g followed by 3.20± 0.07 cm3/g which recorded by the box bread sample contained 10% rice bran then 2.96 ±0.04 cm3/g for the sample contained 20% rice bran while the lowest value of the same parameter was recorded by the sample contained 30% rice bran with significant differences. Therefore, **Sangnaraka and Noomhorm (2004)** concluded that the volume and the specific volume of samples were decreased by fiber addition (15 g fiber per 100 g flour) to bread forming. On contrary to the density of box bread where the lowest value was observed by the control sample and the density was increased by the increment ratio of rice bran with significant differences.Therefore ,**Sharma and Chauhan (2002)** declared that physical properties of bakery products were affected remarkably with increasing level of bran and by way of stabilization.

Table (3) :Physical properties of box bread samples

Samples	Loaf weight (g)	Loaf volume (cm^3)	Specific volume (cm^3/g)	Density (g/cm^3)
Control	295.48+0.07a	1020.00+0.50a	3.45+ 0.08a	0.29+0.01d
RBB1	298.71+ 0.08a	955.50+0.40b	3.20+ 0.07 b	0.31+0.02c
RBB2	299.89+0 .10a	886.34+ 0.30 c	2.96+0.04 c	0.34+0.01b
RBB3	300.93+0.06a	704.76+0.02 d	2.34+0.02d	0.43+0.03a

Different superscript letters in the same column indicate a significant ($p \leq 0.05$) difference according to Duncan's test; control: 100% wheat flour; RBB1: 90% wheat flour and 10% rice bran; RBB2:80% wheat flour and 20% rice bran; RBB3: 70% wheat flour and 30% rice bran

Color measurements of box bread samples

Color measurements of box bread samples were investigated, and results shown in table (4). Crust and crumb color of box bread were estimated by Hunter color instrument to determine the lightness (L), redness (a) and yellowness (b) values and the results were presented in table (4). From these data it could be noticed that, the control sample recorded the highest value of lightness of crust and crumb color 61.34$\pm$0.70 and 80.31 $\pm$0.4 respectively with significant differences with other samples, and the replacement of wheat flour by different levels of rice bran led to decrease the L*values significantly. The light colour of rice bran may be due to the existence of bound phenolics in rice **Min *et al.*, (2012).** According to **Ramy *et al.*, (2002)** dried rice bran is darker than wheat flour Therefore, darkness was expected to increase due to the presence of dried rice bran in food products. In this concern **Hu *et al.*, (2009)** reported that L* value of rice flake fortified with rice bran decreased with rice bran powder. Flakes darkness was directly relevant to increase rice bran powder. Thus, adding rice bran fiber caused darkness of bread crumb caused by fiber .As well , **Al-Okbi *et al.*,(2016)** declared that lightness decreased with increasing the level of dried rice bran in bakery products from 90 to 60%.Furthermore , it was mentioned that rice bran is rich in lysine which produces darker shades of brown colours **Dhingra and Jood (2000)** also, indicated that the ideals of that the b* values of crust and crumb color values were decreased while the control sample recorded 31.22±0.6 and 22.19 ±0.2 for crust and crumb color respectively with significant differences with other samples, while, the sample contained 30% of rice bran recorded the lowest scores of b* values 17.77±0.3 and 12.48 ±0.2 for crust and crumb color respectively with significant differences. As for the redness values a* declared no significant difference between the sample contained 10% rice bran and 20% rice bran 13.57±0.3 and 12.48± 0.50 respectively for crust color, also no significant difference between the sample contained 20% rice bran and 30% rice bran 0.57± 0.10 and 0.38±0.05 respectively for crumb color. In this concern **Gomez *et al.*, (2010)** demonstrated that natural pigments found in the rice bran are some of the basic causes for changes of the crumb color. Therefore, **Purlis and Salvadori (2009)** reveled that bread surface changes controlled the brightness and smooth surface which had a bitter ability to reflect light and increase L* value than uneven surface .In this concern , testing the a* and b* values stated that there was significant differences between rice bran samples and control.

Table(4):Color measurement of box bread samples

Samples	Crust color			Crumb color		
	L	a	b	L	a	b
Control	61.34±0.70[a]	15.84±0.10[a]	31.22±0.60[a]	80.31±0.40[a]	1.51±0.15[a]	22.19±0.20[a]
RBB1	56.28±0.50[b]	13.57±0.30[b]	25.97±0.20[b]	65.93±0.80[b]	0.92±0.10[b]	19.43±0.50[b]
RBB2	51.39±0.50[c]	12.48±0.50[bc]	20.87±0.05[c]	55.78±0.05[c]	0.57±0.10[c]	15.70±0.10[c]
RBB3	47.19±0.30[d]	10.98±0.20[c]	17.77±0.30[d]	48.17±0.30[d]	0.38±0.05[c]	12.48±0.20[d]

Different superscript letters in the same column indicate a significant ($p \leq 0.05$) difference according to Duncan's test; control: 100% wheat flour; RBB1: 90% wheat flour and 10% rice bran; RBB2:80% wheat flour and 20% rice bran; RBB3: 70% wheat flour and 30% rice bran .

The effects of replacement wheat flour by rice bran on rate of decrease (R.D %) of processed box bread during storage period

Results presented in table (5) demonstrated the effects of replacement wheat flour by rice bran on rate of decrease (R.D %) of processed box bread during storage period.

Staling is a phenomenon, it is concerned with the changes that happen in bread after baking . alkaline water retention capacity (AWRC) is simplest test follow the stalling in bakery products , increases in AWRC point out the freshness of baked products **(Gray and Bemiller ,2003).**

The effects of replacement of wheat flour by different levels of rice bran on the freshness of box bread at different storage periods (0, 24, 48 and 72 hrs.) stored at room temperature was determined by estimation the alkaline water retention capacity (AWRC) to calculate the rate of decrease (R.D). The results were showed in table (5) indicated that the control sample recorded the highest values of AWRC during all storage periods significantly, consequently, the lowest values of rate of decrease (R.D%) were investigated by control sample during all storage periods significantly, meanwhile, the replacement of wheat flour by different levels of rice bran led to gradual decrease in the AWRC with the increasing of rice bran However, no significant differences between the samples contained 10 and 20% of rice bran in terms of the rate of decrease(R.D%) after 24h, and also no significant differences between the two aforementioned samples in terms of the rate of decrease after 48h.

Table (5): Effects of replacement wheat flour by rice bran on rate of decrease (R.D %) of processed box bread during storage period

Samples	Storage time (hrs.)						
	AWRC at zero Time	AWRC After 24hrs.	R.D% After 24hrs.	AWRC After 48hrs.	R.D% After 48hrs.	AWRC After 72hrs.	R.D% After 72hrs.
Control	327.65±0.9[a]	290.15±0.7[a]	11.45±0.15[c]	249.33±0.5[a]	23.90±0.10[c]	238.21±0.8[a]	27.30±0.05[d]
RBB1	311.54±0.6[b]	273.40±0.3[b]	12.24±0.10[bc]	233.62±0.2[b]	25.01±0.03[bc]	217.19±0.1[b]	30.29±0.1[c]
RBB2	300.47±0.5[c]	260.85±0.1[c]	13.19±0.05[b]	221.93±0.2[c]	26.14±0.05[b]	200.37± 0.5[c]	33.31±0.05[b]
RBB3	291.36±0.5[d]	246.61±0.1[d]	15.36±0.03[a]	201.45±0.1[d]	30.86±0.03[a]	180.43±0.02[d]	38.07±0.03[a]

Different superscript letters in the same column indicate a significant ($p \leq 0.05$) difference according to Duncan's test; control: 100% wheat flour; RBB1: 90% wheat flour and 10% rice bran; RBB2:80% wheat flour and 20% rice bran; RBB3: 70% wheat flour and 30% rice bran

Texture profile analysis of box bread samples

Texture profile analysis is primarily means the measurement of mechanical properties of product as attached to its sensory properties detected by human via applying controlled forces to product and recording its response in form of force, deformation and time. Texture measurements can be very valuable for the quality control and process optimization as well as for the development of new products with desirable properties and characteristics (**Bourne, 1978).**

The texture parameters of box bread samples were determined and results presented in table (6). Data presented in this table indicated that box bread sample produced from 100% wheat flour (control sample) recorded the lowest value of hardness cycle1 and cycle2 8.86±0.03 and 7.80±0.10 N respectively whereas, the replacement of wheat flour by 10, 20 and 30% of rice bran led to increase the hardness cycle1 and cycle2 where the sample contained 30% of rice bran recorded the height values of hardness cycle1 and cycle2 18.99 ±0.06 and 16.32±0.01 N respectively.. However, **Sangronis *et al.*, (1997)** reported that rice bran made products hard and dark but they were comparable to high fiber products existing in market.

Also, the adhesiveness and gumminess parameters were increased with the increasing level of rice bran compared to the control sample. Whilst, the resilience, cohesiveness and springiness parameters were decreased with the increasing level of rice bran compared to the control sample. On the other hand, **Lima *et al*., (2002)** stated that addition of 10% full fat rice bran to the bread had no bad effect on texture but a very slight hardening of the loaves take place with 20% full fat rice bran when compared to the control . Texture profile analysis observed bread hardness and gumminess increased with increaseing levels of rice bran. Beside this, texture profile analysis showed not much difference as far as cohesiveness and springiness .Therefore, **Wang *et al*., (2002) and Sivam *et al*., (2010)** declared that Pan bread with 40% rice bran were notably harder than other processed pan bread, this probably due to alleviation of gluten content as well due the thickening of the walls surrounding the air bubbles in the crumb.

Table (6) : Texture profile analysis of box bread samples

TPA	Control	RBB1	RBB2	RBB3
Hardness cycle 1 (N)	8.86±0.03[d]	10.57±0.01[c]	13.48±0.05[b]	18.99±0.06[a]
Resilience	0.19±0.02[a]	0.14±0.01[ab]	0.11±0.01[b]	0.15±0.05[ab]
Adhesiveness (mJ)	0.20±0.01[d]	0.40±0.03[c]	0.90±0.01[b]	1.20±0.1[a]
Hardness cycle 2 (N)	7.80±0.10[d]	9.34±0.15[c]	11.84±0.03[b]	16.32±0.01[a]
Cohesiveness	0.52±0.05[a]	0.40±0.01[c]	0.42±0.02[bc]	0.47±0.03[ab]
Gumminess (N)	4.48±0.03[d]	4.63±0.01[c]	5.72±0.04[b]	8.93±0.02[a]
Chewiness (mJ)	48.30±0.04[c]	45.10±0.02[d]	55.70±0.01[b]	100.50±0.03[a]
Springiness (mm)	10.78±0.01[a]	9.73±0.05[b]	9.03±0.02[c]	8.26±0.10[d]

Different superscript letters in the same column indicate a significant ($p \leq 0.05$) difference according to Duncan's test; control: 100% wheat flour; RBB1: 90% wheat flour and 10% rice bran; RBB2:80% wheat flour and 20% rice bran; RBB3: 70% wheat flour and 30% rice bran

Organoleptic characteristics of box bread samples

Data in table (7) demonstrate the organoleptic characteristics of box bread samples . From data presented in the same table it could be noticed that the control sample recorded the highest values of general appearance and overall acceptability with significant differences compared to other groups whilst, no significant differences between the control sample and the samp - le contained 10% rice bran in terms of crust color, crumb color, taste and distribution of crumb. These results were in harmonization with the findings by **Shaheen *et al*., (2005)** who declared that processed rice bran up to 15% did not give any negative effect on bread scores but presented improvement in sensory parameters. Also, there was no significant differences between the control sample and the samples contained 10% rice bran in terms of the flavor. However, another increase of rice bran substitution produced bitter flavor in the products. A similar trend found by **Sharma and Chauhan (2002).**

In general the replacement of wheat flour by different levels of rice bran remains acceptable until replacement ratio 20% where, the highest replacement ratio of rice bran was graded as questionable whereas the samples contained 10% and 20% of rice bran were graded as good. For a similar trend to the results found in many researchers who added rice bran to wheat flour at 15-30% in yeast bread and revealed that rice bran can be supplemented successfully by a replacement ratio up to 15% **(Sharp and Kitchen ,1990).** It has been reported that the use of rice bran in making bread weakens the structure and quality of bread in the dough, thus reducing the overall quality of bread **(Noort *et al*., 2010).** These results agreed with the literature declared that baked goods display one of the most attractive possibilities for using rice bran as ingredient in that, it increased dough yield and take part in attractive crumb and crust . Sugar content of the rice bran (3 – 8%) contributed to oven browning which is an acceptable quality indicator in baked products **(Saunders ,1990 and Bunde *et al*., 2010).**

Table (7): Organoleptic characteristics of box bread samples

Samples	Crust color (15)	Crumb color (15)	Taste (20)	Flavor (15)	Distribution of crumb (15)	General appearance (20)	Overall acceptability (100)	Grade
Control	13.56± 0.01[a]	14.25± 0.03 [a]	19.16± 0.10[a]	14.85± 0.05 [a]	14.98± 0.02 [a]	19.87± 0.01[a]	96.67± 0.05[a]	Very good
RBB1	12.85[a]± 0.01[a]	13.41± 0.02 [a]	18.42± 0.03[ab]	14.14± 0.03 [a]	13.20± 0.01 [a]	17.23± 0.04[b]	89.25± 0.01[b]	Good
RBB2	11.42± 0.03 [b]	10.96± 0.02 [b]	17.06± 0.15[b]	13.44± 0.01[ab]	12.04± 0.02[b]	15.49± 0.01[b]	80.81± 0.02[c]	Good
RBB3	8.86± 0.02 [c]	9.13± 0.04 [c]	13.73± 0.03[c]	12.41± 0.01[b]	10.02± 0.05[c]	7.91± 0.03[c]	62.06± 0.02[d]	Question-able

Different superscript letters in the same column indicate a significant ($p \leq 0.05$) difference according to Duncan's test; control: 100% wheat flour; RBB1: 90% wheat flour and 10% rice bran; RBB2:80% wheat flour and 20% rice bran; RBB3: 70% wheat flour and 30% rice bran

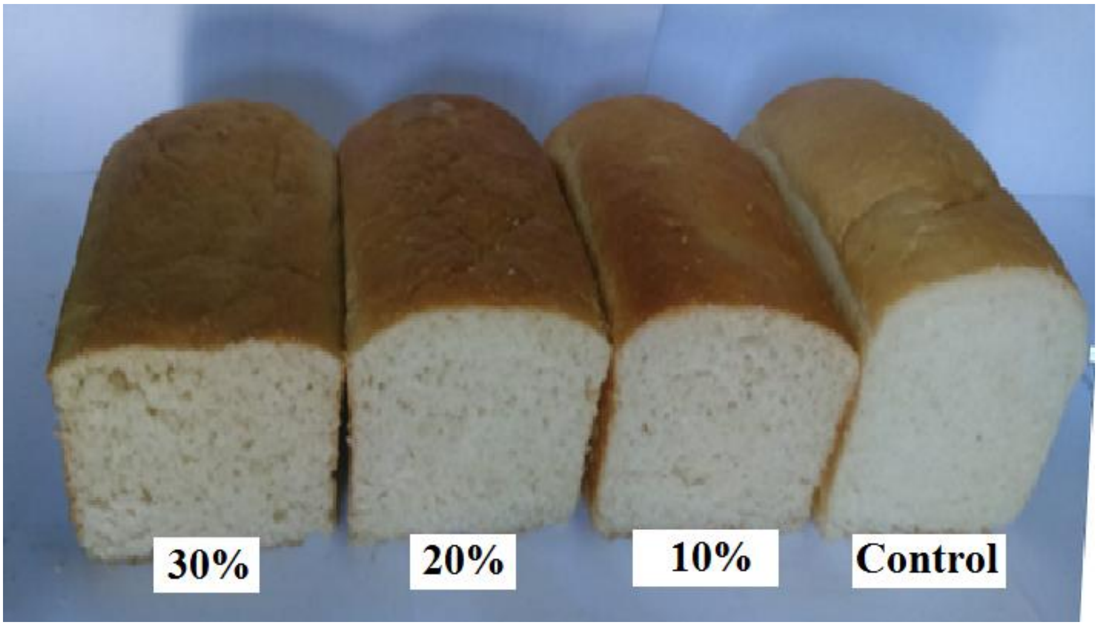

Photo (1) :Control: 100% wheat flour; **RBB1**: 90% wheat flour and 10% rice bran; **RBB2**:80% wheat flour and 20% rice bran; **RBB3**: 70% wheat flour and 30% rice bran

Conclusion

From this search results , it can be observed that wheat flour supplementation using rice bran at levels 10, 20 and 30 % in making box bread improved the nutritional value and decreased volume and specific volume bread .Color measurements showed significant decrease in lightness values L* and b* values of crust and crumb color .Furthermore, texture profile analysis of box bread declared that the adhesiveness and gumminess parameters were increased whilst, the resilience, cohesiveness and springiness parameters were decreased with the increasing level of rice bran .Concerning stalling rate the replacement of wheat flour by different levels of rice bran led to gradual decrease in AWRC with the increasing of rice bran. Box bread remains acceptable until replacement ratio 20% .

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