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Effect Adding Of Rice Bran Or Tomato Seed Protein Concentrate On Wheat Dough Performance And Pan Bread Quality Properties

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ABSTRACT

This study was carried out to investigate the effect of partial supplementation of wheat flour with different ratio of rice bran or tomato seed protein concentrate on quality parameters of pan bread. It was used to supplement wheat flour under levels 5, 10 and 15% for rice bran protein concentrate (RBPC) and 3, 5 and 8% for tomato seed protein concentrate (TSPC) for production of pan bread. The results showed that the significant highest protein content was achieved by TSPC followed by RBPC. Lysine content, as a limited amino acid in wheat flour, increased in all supplemented samples. Samples supplemented with RBPC gained the highest chemical score than those of TSPC supplemented samples. Water absorption of wheat flour and stability of dough increase gradually by increasing of RBPC or TSPC. The addition of TSPC at all tested levels to wheat flour decreased the C3 values (pasting ability). All tested samples showed lower values of (C4, C3 –C4, and γ) compared to the control sample (increasing the activity of amylase), also, retrogradition ability decreased (C5 and C5 – C4). Extensibility of wheat flour dough was decreased as a result to adding RBPC, but it increases by adding TSPC. Energy of the dough was decreased gradually by increasing of RBPC. Moisture, crude protein, ash and crude fiber contents of pan bread had gradually increased with increasing the supplementation levels of PBPC or TSPC. As the supplementation ratio of either RBPC or TSPC increased, volume and specific volume of bread decreased. Pan bread produced by supplementation with 5%RBPC or 3%TSPC had more sensory acceptable rather the control bread. On the other hand, pan bread prepared by added 10% RBPC or 5% TSPC had the best freshness percentages during storage.

Keywords: wheat flour, rice bran protein concentrate, tomato seed protein concentrate, pan bread, quality properties.

INTRODUCTION

Bread is an important stable food in both developed and developing countries, wheat flour of both hard and soft wheat classes has been the major ingredient of leavened bread for many years (Abdelghafar *et al.,* 2011). Wheat flour fortification with high-protein material had been used by many researchers for example (Ameh et al; 2013, Carlson; 1981,Yaseen;1991) to increase protein content and to improve essential amino acid balance of bread to compact worldwide protein mal-nutrition. The value of such fortification would largely depend on the acceptability of the baked product (Prakash and ramaswamy; 1996).

In recent years, there is an increasing trend to eat bread prepared from either whole wheat flour or the bread prepared by blending refined wheat flour with many of the fiber and protein rich sources, rice bran protein concentrate (RBPC) is one of such sources, which could be well utilized for improving the functional properties of the blends and nutritional quality of the bread. Tomato seed protein has been shown compare favorably with that of soybean protein (Brodowski and Geisman, 1980). The high lysine content of tomato seeds could be provide a valuable source of supplementing the proteins of cereal products which are low in lysine. The addition of tomato seed which is high in lipids to wheat flour bread may ameliorate loaf volume depression which usually occurs when protein preparations are incorporate in breads (Knorr and Betschart, 1978).

The aim of this study was preparation of rice bran and tomato seed protein concentrates, studying it's functional and rheological properties and effect addition on pan bread quality properties.

MATERIALS AND METHODS

Materials

Wheat flour (72% ext.) was obtained from El-Hoda Company, Shoubra El-Kheima, Egypt during 2015, which used in preparation of pan bread. Rice bran was obtained from Rice Research and Training Center, Sakha, Kafr El-Sheikha, Egypt during 2015. Tomato seed was obtained from tomato paste manufacturing plant (Hanz Company), 6^{th} October, was obtained during 2015.

Instant active dry yeast (*Saccharomyces cerevisiae*) processed by AKMAYA Co., Turkey, was obtained from the local market. Sugar (sucrose), salt (sodium chloride) and shortening were purchased from the local market, Cairo, Egypt.

All solvents and chemical used in this study for analysis were of analytical grade.

Methods:

Preparation of tomato seed: Tomato seed need to be separated from pulper-refiner waste for use utilization according to Sogi, et al., (2000). The seed fraction was sun dried at (30-35°C) for 48 h., then, was dried in air-oven at 40°C±2 for 12 h. after that, The seed fraction was ground and passed through a 40-mesh (420 μm).

Stabilization of rice bran:

Rice bran was stabilized in air-oven at (60°C±2 / for 8 h) according to Phongthai and Rawdkuen, 2015. The stabilized rice bran were ground and passed through a 40-mesh (420 μM).

Preparation of rice bran and tomato seed protein concentrates

Defatting rice bran and tomato seeds were prepared according to the method described by Kaur *et al* (2012). The protein concentrate from defatted rice bran and tomato seeds was prepared as per the procedure described by Baker *et al* (1979). a 250 g of sample were eliminated with six, 20 min extraction; the slurry was filtered under vacuum through Whatman No. 2 filter paper followed by washing with one volume of ethanol 70%. The final product (protein concentrate) were dried in air-oven at 40°C±2 for 12 hours, then ground and passed through a 420 µm).

All prepared samples described above packed in polyethylene bags and stored at -18°C until used.

Preparation of supplemented samples

Different blends of flour samples were prepared by partially supplementation of wheat flour (72% ext.) by different ratios of RBPC (5, 10 and 15%) or TSPC (3, 5 and 8%) to prepared different flour samples which used in preparation of experimental samples (Rheological properties and bread making).

Analytical analysis

All samples were chemically analyzed for moisture, ash, crude fiber, lipid, and protein according to the methods described in AOAC (2005) .Also, the amino acids contents were analyzed according to AOAC (2005). The protein content was calculated by multiplying total nitrogen × 5.7 for wheat flour, 6.25 for rice bran and tomato seed.

The nitrogen free extract (NFE) was calculated by differences. Amino acids analysis was done by (regional center for food and feed) by using the system of high performance Amino Acid analyzer (Biochrom 30) according to AOAC (2005). The proportion of essential amino acids (E) to the total amino acids (T) of the sample protein was calculated using Chavan, et al., (2001) equation below:

$$\frac{E}{T}(\%) = \frac{\text{Sum of essential amino acids}}{\text{Sum of total amino acids}} \times 100 \quad [1]$$

Calculated protein efficiency ratio (C-PER) were estimated according to the equation developed by Alsmeyer, et al., (1974), as given below.

$$C-PER = -1.816 + 0.435\,(Met) + 0.780\,(Leu) + 0.211\,(His) - 0.944\,(Tyr) \quad [2]$$

Essential amino acid index (EAAI) in relation to amino acid requirements of whole egg protein (Valine, 6.6; Methionine+Cystine, 5.7; Isoleucine, 5.4; leucine, 8.6; Phenylalanine+Tyrosine, 9.3; Lysine, 7.0; Threonine, 4.7) (Shils, et al., 1998) was determined as described by Oser (1959) as follows:

$$EAAI = \sqrt[n]{\left(Ilu.\frac{P}{Ilu}.S\right) \times \left(Leu.\frac{P}{Leu}.S\right) \times ... \times (Phe.+Tyr.P/Phe.+Tyr.S)} \times 100 \quad [3]$$

Where P, refers to the sample protein and S, refers to the standard protein.

Biological value (BV) was calculated according to the following equation as described by Oser (1959):

$$BV = (1.09 \times EAAI) - 11.73 \quad [4]$$

Chemical score (CS) was calculated using the standard of amino acid requirement for an adult human (FAO/WHO, 1985) according to the follows equation:

$$CS = \left(\frac{Ai}{As}\right) \times 100 \quad [5]$$

Where Ai, the amino acid in sample and As, the amino acid in standard

Physical analysis

Physical tests (Rheological properties of dough were carried out of dough for wheat flour and wheat flour supplemented with 5, 10 and 15% RBPC or 3, 5, and 8% TSPC using Chopin Mixolab, Villeneuve-La-Garenne, France, using ICC (2006) method No. 173. Also, the samples were tested by using Brabender extensograph according to the method described in AACC (2002).

Pan bread processing

The conventional straight-dough method for pan bread was performed according to the procedure developed by AACC (2002) .the processing was done in Food technology research institute, The ingredients were: 100 g wheat flour (72% ext.), 1 g instant active dry yeast, 1 g salt, 5 g sugar, 5 g shortening and water according to Mixolab test.

Physical properties of pan bread

The weights of pan bread loaves were determined after cooling for one hour. Bread loaf volume was measured by rape seed displacement methods as described by (AACC, 2002). Specific volumes of bread were calculated by dividing the volume (cm^3) by their weight (g).

Sensory evaluation of pan bread

The external and internal characteristics were scored as shown in table (8) according to (Lawless and Heymann, 1999).

Freshness of pan bread

The staling rate of pan bread was determined by alkaline water retention capacity (AWRC %) described by Yamazaki (1953) modified by Kitterman and Rabenthalor (1971).

Statistical analysis

The obtained data calculated by analysis of variance ANOVA and significant differences among of various score were established using Duncan multiple test according to (Waller and Duncan, 1969).

RESULTS AND DISCUSSION

Proximate composition:

The proximate composition of wheat flour (72% extraction rate), rice bran (RB), tomato seed (TS), RBPC and TSPC is shown in Table 1. TSPC had the significant highest value of protein content (46.21%)^{a} followed by RBPC (33.33%)^{b}, where its protein content increased 2.3 and 2.2 times when compared to RB and TS, respectively. The lowest protein content was (10.99%)^{e} for wheat flour (Protein content was calculated by multiplying: total nitrogen × 5.7 for wheat flour, 6.25 for rice bran and tomato seed).

RBPC had the lowest fat value (1.45%)^{e} which decreased more than 9 times than that of RB. In the same trend, TSPC possessed (7.92%)^{c} of fat with 3.7 decrement fold than that of TS. The highest ash values, (10.76%)^{a} and (9.14%)^{b}, were recorded by RBPC and

RB, respectively. The ash and crude fiber contents of TSPC increased 1.5 and 1.3 times, respectively than those of TS. The lowest NFE% was possessed by TSPC followed RBPC, while wheat flour showed the highest NFE%. These data were in agreement with those of Prakash and Ramanatham (1994), Wang et al., (1999), Persia et al., (2002), Shih (2003) and Patsanguan et al., (2014).

Table (1): Proximate composition (% on dry weight basis) of wheat flour, RB, TS, RBPC and TSPC

Samples	Proximate composition (%)					
	Moisture* Content	Crude protein	Crude fat	Ash	Crude fiber	NFE
WF 72% ext.	12.32[a]	10.99[e]	02.05[d]	0.51[e]	00.46[e]	86.11[a]
RB	10.66[b]	14.71[d]	13.47[b]	9.14[b]	09.15[d]	53.56[b]
TS	06.27[d]	21.21[c]	29.32[a]	3.49[d]	25.65[b]	38.78[c]
RBPC	10.44[b]	33.33[b]	01.45[e]	10.76[a]	15.70[c]	20.36[d]
TSPC	09.99[c]	46.21[a]	07.92[c]	5.29[c]	32.75[a]	07.86[e]

WF= Wheat flour, RB= Rice bran, TS= Tomato seed, RBPC= Rice bran protein concentrate, TSPC=Tomato seed protein concentrate, NFE= Nitrogen free extract was calculated by difference, *= calculated on wet basis

Protein content was calculated by multiplying: total nitrogen × 5.7 for wheat flour, 6.25 for rice bran and tomato seed.

Means followed by different letters in the same column are significantly different by Duncan multiple test ($p< 0.05$)

Amino acids analysis:

Amino acids content (g AA/100g protein) of wheat flour, RBPC, TSPC and different supplementation levels of RBPC or TSPC is presented in Table (2), RBPC ,TSPC recorded 5.91 and 7.16 for lysine and 4.33 and 3.57 for threonine, which it were higher than these of WF 72%. Methionine and cystine were the lowest amino acids values recorded by RBPC and TSPC than of WF 72%. However, these low values of methionine and cystine not negatively affect on its content in supplemented samples as observed at Table (2) All supplemented samples, 5%RBPC, 10%RBPC, 15%RBPC, 3%TSPC, 5%TSPC and 8%TSPC increased in its lysine content by 6.44, 12.5, 18.56, 5.30, 8.71 and 14.02%, respectively when compared with control sample. Glutamic acid recorded the highest values of AA content for all tested samples. RBPC and TSPC recorded 10.70 and 11.13 for Aspartic acid, 7.02 and 5.00 for Alanine, 9.06 and 9.40 for arginine, 6.50 and 6.28 for glycine.

Table (2): Amino acid contents of wheat flour, RBPC, TSPC and different supplementation levels of RBPC or TSPC (g AA/100g protein)

Amino acids	WF 72%	RBPC	TSPC	5% RBPC	10% RBPC	15% RBPC	3% TSPC	5% TSPC	8% TSPC	FAO/WHO(1985)	
										child	adult
Histidine	2.53	1.79	2.66	2.49	2.45	2.41	2.53	2.53	2.54	1.9	1.6
Valine	5.05	6.89	3.99	5.14	5.23	5.33	5.02	5.00	4.97	3.5	1.3
Methionine	6.31	1.22	2.14	6.05	5.80	5.54	6.18	6.10	5.97	2.5	1.7
Isoleucine	4.09	4.07	4.02	4.09	4.09	4.09	4.09	4.08	4.08	2.8	1.3
leucine	7.36	7.94	6.39	7.39	7.42	7.45	7.33	7.31	7.28	6.6	1.9
Phenylalanine	6.25	6.17	5.88	6.25	6.24	6.24	6.24	6.23	6.22	6.3	1.9
Lysine	2.64	5.91	7.16	2.81	2.97	3.13	2.78	2.87	3.01	5.6	1.6
Threonine	2.89	4.33	3.57	2.96	3.03	3.10	2.91	2.92	2.94	3.4	0.9
Aspartic acid	4.33	10.70	11.13	4.65	4.97	5.28	4.53	4.67	4.87		
Glutamic acid	21.20	14.23	17.41	20.85	20.50	20.16	21.09	21.01	20.90		
serine	4.93	5.12	4.90	4.94	4.95	4.96	4.93	4.93	4.93		
Alanine	3.13	7.02	5.00	3.32	3.52	3.71	3.18	3.22	3.28		
Arginine	4.33	9.06	9.40	4.57	4.80	5.04	4.48	4.58	4.73		
Glycine	3.61	6.50	6.28	3.75	3.90	4.04	3.69	3.74	3.82		
Proline	13.35	4.33	5.64	12.90	12.45	12.00	13.12	12.96	12.73		
Cystine	2.12	1.19	2.09	2.08	2.03	1.98	2.12	2.12	2.12		
Tyrosine	5.89	3.52	2.35	5.77	5.65	5.53	5.78	5.71	5.61		

WF= Wheat flour, RBPC= Rice bran protein concentrate, TSPC=Tomato seed protein concentrate

The contents of studied essential amino acids in supplemented samples with RBPC or TSPC, met the standard for the child and adult intake recommendations of FAO/WHO except lysine and threonine which met only the recommended intake of adult only as presented in Table 2.

Calculated protein biological values of wheat flour 72%ext., RBPC, TSPC and different supplementation levels of RBPC or TSPC are presented in Table 3. RBPC and TSPC had lower values of total essential amino acids (TEAA), 43.03 and 40.25 when compared to 45.13 value of WF 72%. RBPC and TSPC showed total non essential amino acids (TNEAA), 56.96 and 59.76, higher than WF 72% by 11.70 and 12.27 increment fold, respectively. Calculated protein efficiency (C-PER) of RBPC and TSPC were 1.96 and 2.44, respectively with increment percent 19.51 and 48.78 than WF 72%. Biological values (BV) of all supplemented samples are slightly increased than that of WF 72%. Chemical score (CS) of supplemented samples, 5%RBPC, 10%RBPC, 15%RBPC, 3%TSPC, 5%TSPC and 8%TSPC were 48.40, 51.22, 54.03, 47.93, 49.48 and 51.82, respectively with increment percent 6.16, 12.35, 18.51, 5.13, 8.53 and 13.67, respectively when compared to the control sample. It could be noticed that the supplemented samples with RBPC gained higher CS than these of samples which supplemented with TSPC.

Table (3): Calculated protein biological values of wheat flour 72%, RBPC, TSPC and different supplementation levels of RBPC or TSPC

Amino acids	WF 72%	RBPC	TSPC	5% RBPC	10% RBPC	15% RBPC	3% TSPC	5% TSPC	8% TSPC
TEAA	45.13	43.03	40.25	45.02	44.92	44.81	44.98	44.88	44.74
TNEAA	04.87	56.96	59.76	54.97	55.08	55.18	55.02	55.11	55.26
TEAA	45.13	43.03	40.25	45.02	44.92	44.81	44.98	44.88	44.74
C-PER	01.64	01.96	02.44	01.66	01.67	01.69	01.67	01.68	01.71
E/T %	45.13	43.03	40.24	45.02	44.92	44.81	44.98	44.88	44.74
EAAI	80.66	82.00	77.66	81.35	81.98	82.55	80.90	81.05	81.25
BV	76.19	77.65	72.92	76.94	77.63	78.25	76.46	76.62	76.83
CS	45.59	94.10	96.79	48.40	51.22	54.03	47.93	49.48	51.82
LAM	Lysine	Histidine	Leucine	Lysine	Lysine	Lysine	Lysine	Lysine	Lysine

WF= Wheat flour, RBPC= Rice bran protein concentrate, TSPC=Tomato seed protein concentrate, TNEAA= Total non-essential amino acids, TEAA= Total essential amino acids, C-PER= Calculated protein efficiency rate, E/T= the ratio between essential and total AA, EAAI= Essential amino acids index, BV= Biological value, CS= Chemical score, LAM= Limiting amino acid.

As presented in Table 3, the limiting amino acid of WF 72% was lysine and for RBPC and TSPC it was Histidine and Leucine, respectively. Despite the supplementation process, but the amino acid Lysine still the limiting amino acid for all supplemented samples. However, with the increase of supplementation level either with RBPC or TSPC the CS increased, which mean increase in the concentration of limiting amino acid in supplemented samples than the control. The nutritive value of tomato seed protein concentrate was less than casein but equivalent to other plant proteins (Karmer and Kwee, 1977).

Rheological properties of wheat flour supplemented with rice bran or tomato seed protein concentrate

Rheological properties of wheat flour dough and wheat flour supplemented with different levels of RBPC or TSPC were measured by using Chopin Mixolab, Villeneuve-La-Garenne, France, and Brabender extensograph instruments.

Mixolap parameters of dough behavior of wheat flour supplemented with RBPC or TSPC

The results obtained from Mixolap measurement of dough are presented in Tables (4 and 5), they describe the following stages: dough development, over-mixing, heating and cooling. From the obtained data, it could be noticed that, the addition of RBPC or TSPC to WF 72% by different ratios, water absorption gradually increased in parallel with RBPC or TSPC increase. The increase in water absorption might be due to higher protein and complex carbohydrate contents contributed from bran (Pomeranz et al, 1988). Also, the increasing proportion of RBPC in wheat flour blends from 5 to 15% or TSPC from 3 to 8% led to progressive increased in the dough stability this observation is in line with those of Yaseen et al. (1991) and Sogi et al. (2002).

Also, Salehi and Bibalan (2012) reported that water absorption increased as rice bran level increased. The higher values of C2 (dough stability) indicate that the dough were more tolerant to mixing. From data in Table (4), generally the addition of RBPC or TSPC to wheat flour increased this parameter. The positive effect of RBPC or TSPC on C2 (dough stability) could be due to the high protein content. Regarding protein weakening (C1 - C2), Table (4) shows that, the addition of 3 and 5% of TSPC or 5% of RBPC to wheat flour slightly increased was observed. Concerning wet gluten (%) data in table (5) show the addition of RBPC or TSPC to wheat flour caused increase of wet gluten. The higher values were found for the wheat flour supplemented with 10% RBPC or 5% TSPC. From the data presented in Table (6), the pasting ability (C3) show that the addition of 5 and 10% of RBPC or 3, 5 and 8% TSPC were decreased compared with control sample. These results are in agreement with Teng et al.

(2015), they reported that addition of rice bran would decrease the C3 value.

Concerning the stability of hot gel C4 (minimum torque), (C3- C4) and values and cooking stability (γ values), all tested samples, generally showed lower stability compared to control. The further reduction in viscosity (C4 value)(minimum torque) is the result of the physical breakdown of the granules due to the mechanical shear stress and temperature constraint (Rosell et al. 2007).

On cooling, starch retrogrades and the consistency increase (C5 values) (final torque) and the cooling setback (C5 - C4) indicates the retrogradation ability of the starch (Coller et al., 2007). According to the results summarized in Table (6) all tested samples showed decreased C5 and (C5 – C4) values compared to the control (which meaning increase in amylase activity by increasing in addition). Also, these results are in agreement with Teng et al. (2015) they found that the difference value (C5 - C4) decreased with more addition of rice bran.

Table (4): Mixing properties of wheat flour dough supplemented with different levels of RBPC or TSPC

samples		WA (%)	DDT C1 (min)	Stability (min)	C2 (Nm/min)	Protein weakening (Nm) (C1-C2)	α (Nm/min) Protein breakdown rate
control	WF72%	56.8	1.10	10.35	0.52	0.57	----
WF& RBPC%	5	59.3	1.07	10.92	0.56	0.59	-----
	10	61.5	0.90	11.85	0.56	0.51	-----
	15	63.8	0.88	12.00	0.50	0.51	- 0.068
WF& TSPC%	3	57.3	1.47	10.52	0.50	0.58	----
	5	59.1	1.73	10.80	0.52	0.59	----
	8	60.2	1.40	11.12	0.54	0.55	----

WA= Water absorption, DDT= Dough development time, C1= The maximum torque during mixing, C2= Minimum consistency, α= Protein breakdown rate, WF= Wheat flour, RBPC= Rice bran protein concentrate, TSPC=Tomato seed protein concentrate.

Table(5): Wet gluten and ash ratios in blends of wheat flour supplemented with RBPC or TSPC (%)

components	WF72%	RBPC			TSPC		
		5%	10%	15%	3%	5%	8%
(Wet gluten %)	23.0	24.9	25.1	24.7	23.8	25.7	24.5
Ash (%)	0.51	1.02	1.58	2.08	0.64	0.73	0.85

WF= Wheat flour, RBPC= Rice bran protein concentrate, TSPC=Tomato seed protein concentrate.

Table (6): Pasting behavior of wheat flour dough supplemented with different levels of RBPC or TSPC

samples		Pasting ability (C3) (Nm)	Gelatinization rate (β) Nm/min	Minimum torque (C4) (Nm)	Breakdown torque (C3-C4) (Nm)	Cooking stability (γ) Nm/min	Finial torque (C5) (Nm)	Setback torque (C5-C4) (Nm)
control	WF72%	2.17	----	1.96	0.21	----	2.99	1.03
WF& RBPC%	5	2.17	----	1.82	0.35	----	2.39	0.57
	10	2.13	----	1.61	0.52	----	2.13	0.52
	15	2.11	----	1.47	0.64	----	2.01	0.54
WF& TSPC%	3	2.02	----	1.78	0.24	----	2.52	0.74
	5	1.94	----	1.66	0.28	----	2.027	0.61
	8	1.95	----	1.57	0.38	----	2.06	0.49

----- = the value < 0.001. WF= Wheat flour, RBPC= Rice bran protein concentrate, TSPC=Tomato seed protein concentrate,

Extensograph parameters of wheat flour dough supplemented with different levels of RBPC or TSPC

Data presented in Table (7) showed the effect of supplementation of wheat flour with 5, 10 and 15% RBPC or 3, 5 and 8% TSPC on extensogram properties. It could be noticed that the extensibility of wheat flour dough was decreased as a result to adding RBPC. Extensibility was decreased from 130 mm for control sample to 115 mm of wheat flour supplemented with 10 or 15% RBPC. These results are in good accordance with El-Gammal and Elkewawy (2014), they reported that extensibility of dough are decreased by adding stabilizing rice bran to wheat flour. But, these values were increased from 130 mm (control sample) to 135, 140 and 155 mm for wheat flour supplemented with 3, 5 and 8% TSPC. Data in the same table show that RBPC caused gradually increase in the values of resistance to extension from 320 BU for control sample to 390 and 440 BU for wheat flour supplemented with 10 and 15% RBPC, respectively. This is in line with Sudha et al., (2007) who reported that resistance to extension values gradually increased for blends with increasing levels of rice bran. But these values decreased to 270 and 220 BU for wheat flour supplemented with 5 and 8% TSPC, respectively.

The results in the same table showed that the values of the proportional number was increased gradually by the increasing levels of RBPC, but these values was decreased from 2.46 for control sample to 2.33, 1.93 and 1.42 for wheat flour supplemented with 3, 5 and 8% TSPC. On the other hand, the energy of the dough increased to 60 cm^2 for wheat flour supplemented with 15% RBPC compared with control sample (54 cm^2). While the addition of TSPC to wheat flour at the ratio of 3% caused a little bit increase, where the energy value reached (56 cm^2) and then decreased to 48 or 40 cm^2 for wheat flour supplemented with 5 or 8% TSPC.

Table (7): Extensograph parameters of wheat flour dough supplemented with different levels of RBPC or TSPC

Rheological properties	Wheat flour	RBPC (%)			TSPC (%)		
		5	10	15	3	5	8
Extensibility (mm) a	130	110	115	115	135	140	155
Extensibility at maximum elasticity (mm)	85	65	70	75	80	100	110
Resistance to extension (elasticity) (BU) b	320	320	390	440	315	270	220
Proporional number (b/a)	2.46	2.91	3.39	3.83	2.33	1.93	1.42
Strength of dough (energy) (cm^2)	54	47	54	60	56	48	40

WF= Wheat flour, RBPC= Rice bran protein concentrate, TSPC=Tomato seed protein concentrate

Proximate composition of pan bread

The proximate compositions of control pan bread and other pan bread supplemented with 5%, 10% and 15% RBPC and 3%, 5% and 8% TSPC are presented in Table (8). The obtained results revealed that the moisture, protein and ash contents significantly ($P<0.05$) increased with the addition of either RBPC or TSPC, while, carbohydrate contents were decreased. The higher moisture contents of pan bread contained different ratios of RBPC or TSPC compared with moisture value of control sample could be attributed to high water absorption capacity of both RBPC and TSPC, These results confirmed with Chinma *et al* (2015).

The protein, ash and fiber contents of pan bread increased as the amount of RBPC increased. Due to the fact that rice bran is a good source of fiber (Abdul-Hamid and Luan, 2000) as well as these being a considerable amount of protein in RBPC.

Table (8): Proximate analysis of pan bread prepared by partial supplementation of RBPC or TSPC (% on dry weight basis)

Pan bread		Chemical composition %					
		Moisture content	Crude protein	Lipids	Ash	Crude fiber	NFE
Control	WF (100%)	34.71^{d}	12.23^{f}	4.65^{c}	1.55^{e}	0.65^{g}	80.92^{a}
WF& RBPC%	5	36.35^{c}	13.34^{e}	4.40^{d}	2.22^{d}	1.12^{f}	78.92^{b}
	10	37.08^{bc}	13.96^{d}	4.35^{d}	2.70^{cb}	1.95^{d}	77.04^{d}
	15	38.00^{ba}	14.35^{c}	4.17^{e}	3.22^{a}	2.65^{b}	75.61^{e}
WF& TSPC%	3	36.08^{c}	14.37^{c}	4.77^{b}	2.19^{d}	1.25^{e}	77.42^{c}
	5	36.59^{bc}	15.34^{b}	4.86^{ba}	2.56^{c}	2.15^{c}	75.09^{f}
	8	39.23^{a}	16.67^{a}	4.93^{a}	2.79^{b}	2.85^{a}	72.76^{g}

WF=Wheat flour, RBPC =Rice bran protein concentrate, TSPC=Tomato seed protein concentrate and NFE =Nitrogen free extract was calculated by difference.

***Means followed by different letters in the same column are significantly different by Duncan multiple test ($p>0.05$)**

As shown in Table (8), percentage of protein, fat, ash and crude fiber in pan bread supplemented with TSPC were higher than those in control pan bread. These results agreed with those reported by Yaseen *et al* (1991).

Physical measurements of pan bread

weight (g), loaf volume (cm^3) and specific volume (cm^3/g) samples of pan bread are shown in Fig.(1). The loaf weight decreased with the supplementation ratios of both RBPC and TSPC. Both loaf volume (cm^3) and specific volume (cm^3/g) showed similar trends at 5% RBPC and 3% TSPC had the highest values of these parameters (500 cm^3/g and 495 cm^3/g, respectively). As the supplementation ratio increased, both volume and specific volume decreased. The lowest relative index appeared in 8% TSPC, followed by 15% RBPC (87.89% and 91.13%, respectively). These results are in parallel with those of Sogi *et al.*, (2002) and Ameh *et al.*, (2013) who reported a depression in loaf volume and specific volume of pan bread supplementation with tomato seed meal and RBPC which can be attributed to the reduction in gluten content of flour and to water holding capacity of both TSPC and RBPC.

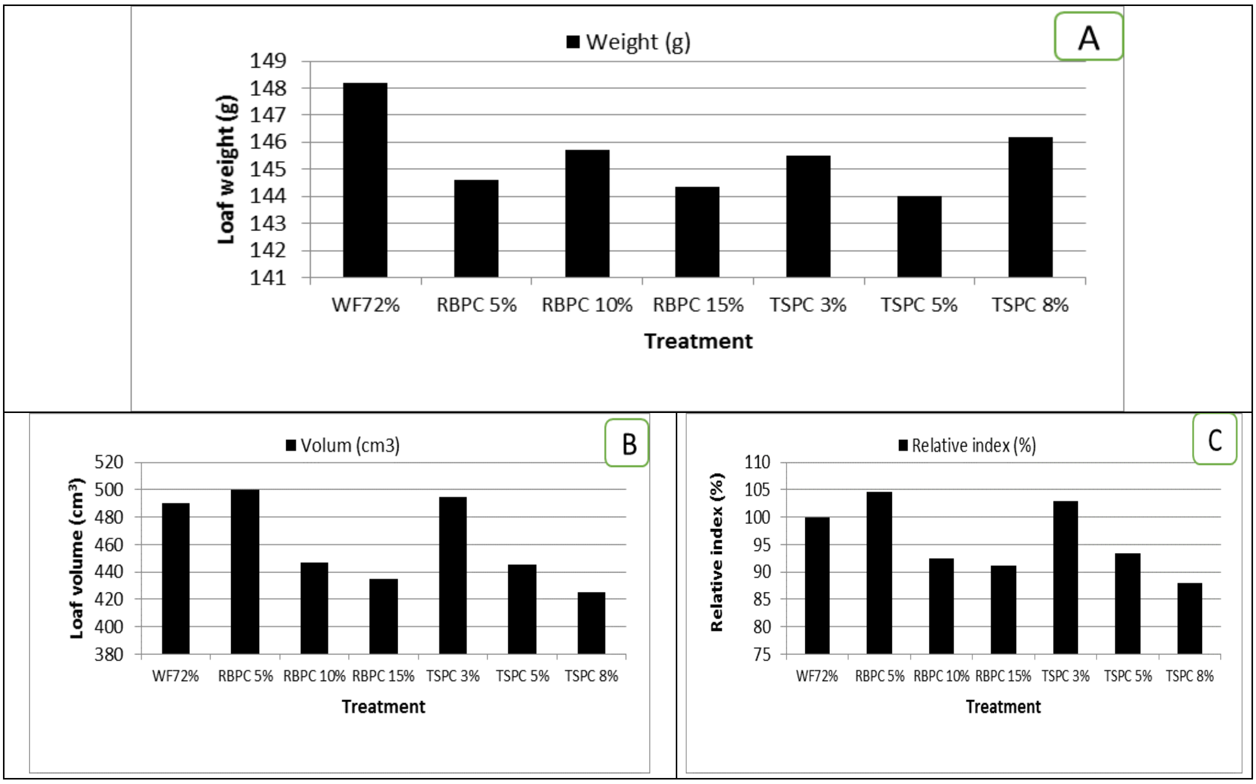

Fig. (1): Effect of supplementation of wheat flour with RBPC or TSPC on physical characteristics of pan bread.

(A) : indicate weight of pan bread loaves, (B): indicate volume of pan bread loaves and
(C) : indicate the relative index of pan bread loaves.
WF=Wheat flour, RBPC =Rice bran protein concentrate and TSPC = Tomato seed protein concentrate.

Sensory evaluation of fresh pan bread prepared by supplementation of wheat flour with RBPC and TSPC

The organoleptic properties of pan bread produced by using 100% wheat flour as control and pan bread with supplemented with 5%, 10% and 15% of RBPC or 3%, 5% and 8% of TSPC were evaluated to found the best supplementation level for produce high quality pan bread.

The results from Table (9) show that there were no significant differences (P> 0.05) in bloom and crust color of pan bread between control sample and bread prepared by added 5% RBPC, 10% RBPC, 3% TSPC and 5% TSPC Meanwhile, both 15% RBPC and 8% TSPC had significant (P<0.05) lower values when compared to other treatments (7.1 and 6.5, respectively). Concerning the summetry of form, the results indicated that there were significant (P<0.05) differences between control and other samples. The highest significant values were appeared in 3% TSPC, 5% RSPC and 5% RBPC (13.6, 12.9 and 12.8 respectively), these results confirmed with those of Constandache., (2005).

Table (9) Sensory evaluation of fresh pan bread prepared by partial supplementation of wheat flour with RBPC and TSPC

Pan bread samples		Bloom & Crust color (10)	Summitry Of form (15)	Texture (15)	Crumb Color (15)	Aroma (15)	Taste (10)	Mouth feel (10)	Slicing quality (10)	Total Score (100)
control	WF 100%	8.4^{cab}	11.5^{b}	12.6^{ab}	14.1^{a}	9.6^{c}	7.6^{c}	8.0^{cb}	9.0^{a}	80.8
	5	8.8^{ab}	12.8^{a}	13.6^{a}	14.0^{a}	13.0^{a}	9.6^{a}	9.1^{a}	9.1^{a}	90
RBPC%	10	7.7^{cd}	10.0^{c}	12.1^{b}	12.0^{b}	11.2^{b}	8.6^{b}	8.4^{ab}	7.5^{b}	77.5
	15	7.1^{ed}	10.4^{bc}	9.7^{c}	10.0^{d}	12.1^{ab}	8.4^{b}	7.6^{c}	6.8^{c}	72.1
	3	9.0^{a}	13.6^{a}	13.6^{a}	14.0^{a}	12.5^{ab}	8.6^{b}	9.0^{a}	8.9^{a}	89.2
TSPC%	5	8.8^{cb}	12.9^{a}	11.6^{b}	11.1^{c}	11.9^{ab}	8.3^{b}	7.9^{cb}	7.7^{b}	80.2
	8	6.5^{e}	8.2^{d}	8.7^{d}	8.2^{e}	9.7^{c}	9.5^{a}	7.3^{c}	6.2^{c}	64. 3

RBPC=Rice bran protein concentrate, TSPC=Tomato seed protein concentrate
***Means followed by different letters in the same column are significantly different by Duncan multiple test (p>0.05)**

In addition, the results indicated that, there were no significant (P>0.05) differences between control bread samples and bread prepared by added 5% RBPC and 3% TSPC, but the low significant (P<0.05) values of texture were appeared in other treatments. These results were coincided with those of Ameh *et al*., (2013) and Sogi *et al*., (2002).

As shown in Table (9) the score of bread crumb color were no significant differences could be observed (P>0.05) between control and both of 5% RBPC and 3% TSPC pan bread samples. Crumb color was reduced by increasing the level of supplementation of both RBPC and TSPC, it was darker and had lower crumb color scores. The lowest value was found in 8% TSPC pan bread samples. Also, from the data, showed that scores assigned to aroma and taste of pan bread were significantly (P<0.05) the highest when wheat flour was supplemented with RBPC or TSPC. However, for general no significant for both aroma and taste could be noticed.

Also, the obtained results of slicing quality indicated that, there were no significant (P>0.05) differences between control bread sample and bread prepared by added 5% RBPC and 3% TSPC (9, 9.1 and 8.9, respectively). The supplementation level of both RBPC and TSPC were significant (P<0.05) effect on this criteria and the slicing quality scores were decreased with the addition level increased.

Generally, it could be concluded that, the pan bread produced by supplementation with 5% RBPC or 3% TSPC gave bread loaves more sensory acceptable rather than the pan bread produced by 100% wheat flour (72% ext.).

Freshness of pan bread as affected by addition of RBPC and TSPC during storage at room temperature (25±2°C):

The freshness of pan bread prepared by using wheat flour and wheat flour supplemented with 5,10 and 15% RBPC, as well as, 3,5and 8% TSPC during storage for 4 days at room temperature (25±2°C) are presented in figure(2). The freshness of pan bread decreased from 100% for control sample after baking to 91.32% after 24 hours for control sample and to 94.29% for bread sample prepared by added. On the other hand, the freshness of 5% TSPC and the other samples had a range of 89.0%: 81.7%, compared to control sample Fig.(2).

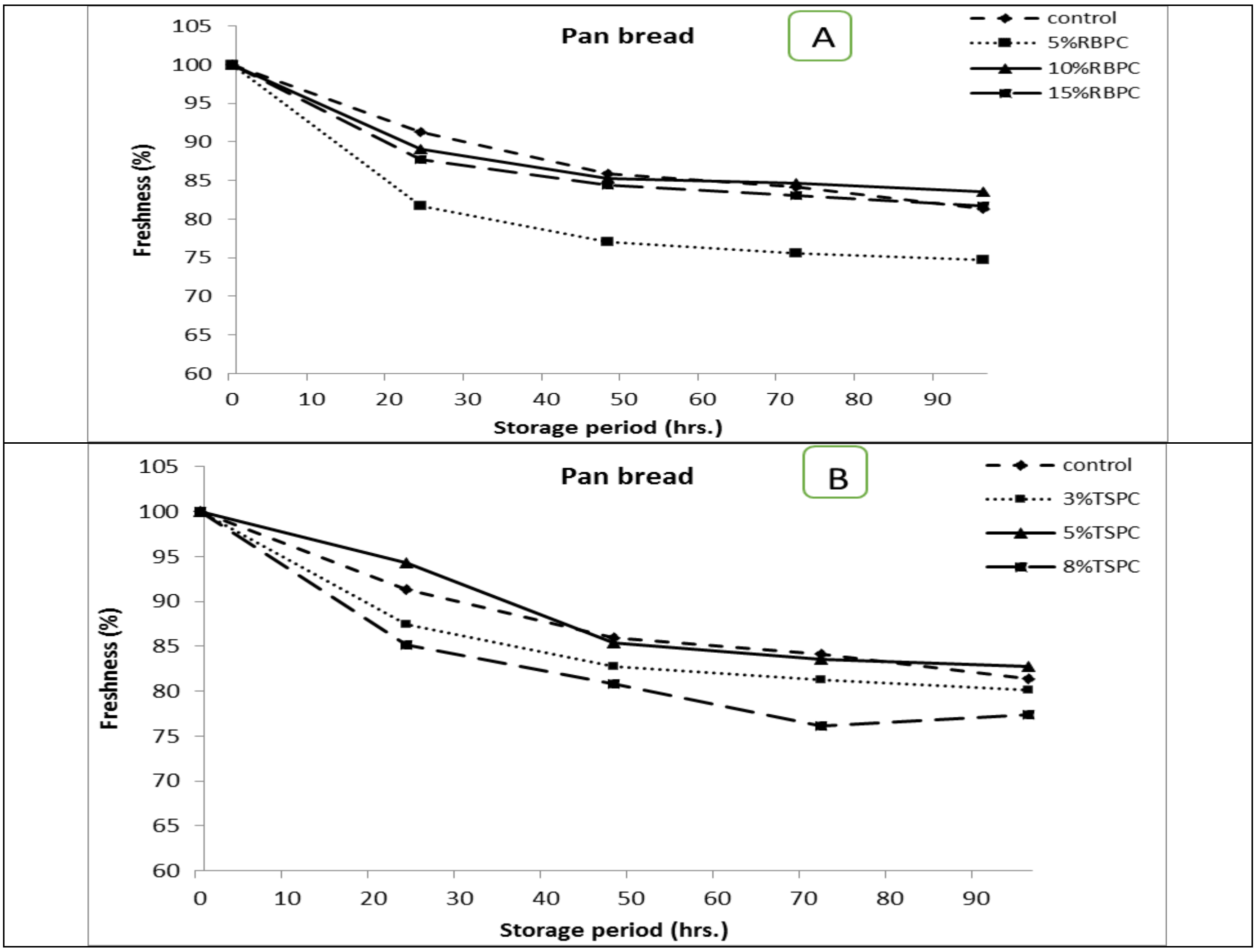

Fig. (2): Freshness percentage of pan bread prepared by wheat flour and different supplementation level of RBPC and TSPC during storage at room temperature

(A):indicate the effect addition of RBPC with different ratios on freshness of pan bread and (B):indicate the effect addition of TSPC with different ratios on freshness of pan bread.

Also, it could be observed that, the highest reduction in staling value (low freshness) during storage was noticed in pan bread sample which prepared by supplemented of wheat flour with 5% RBPC, followed by 8% TSPC Fig.(2). Among the supplementation level of RBPC, as the level of supplementation increased from 10% to 15%, the alkaline water retention capacity(AWRC) % and freshness % were decreased till the end of storage.

Both bread samples prepared by added 10% RBPC or 5% TSPC had the best freshness percentages during storage. Generally, it could be concluded that, the rate of freshness (%) were affected by addition of either RBPC or TSPC at different levels as compared to control. The results are go in parallel with those of Carlson et al, (1981) how found that,there was an incremental pattern in AWRC (%)of wheat flour bread with the addition of ground tomato seed in comparison with wheat flour breads.

Hoseney and Rogers (1990) recorded a decrease in crumb moisture during storage (as migrates from crumb towards crust), which accelerated starch gluten interaction and bread firming.

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تأثير إضافة المركز البروتيني لردة الأرز وبذور الطماطم على خواص العجائن وجودة الخبز

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أجريت هذه الدراسة بهدف دراسة تأثير الاستبدال الجزئي لدقيق القمح بنسب مختلفة من المركز البروتيني لكل من ردة الأرز وبذور الطماطم على صفات جودة خبز القوالب ، وقد تم استبدال دقيق القمح بمستويات مختلفة من المركز البروتيني لردة الارزRBPC(5،10،15%) ،و المركز البروتيني لبذور الطماطم TSPC(3،5،8%) وأظهرت النتائج المتحصل عليها أن المركز البروتيني لبذور الطماطم يحتوي على أعلى نسبة من البروتين، يليه المركز البروتيني لردة الأرز مقارنة بباقي العينات وقد زادت نسبة الحمض الأمينى ليسين فى جميع العينات المستبدلة عند مقارنتها بعينة المقارنة. وحققت عينات الاستبدال بمركز بروتين ردة الأرز درجة كيميائية أعلى (chemical score) مقارنة بعينات الاستبدال بمركز بروتين بذور الطماطم. كما وجد أن نسبة امتصاص الدقيق للماء وفترة ثبات العجين تزداد بزيادة نسب اضافة مركز بروتين ردة الأرز ومركز بروتين بذور الطماطم الى دقيق القمح. وقد أدت اضافة مركز بروتين بذور الطماطم الى دقيق القمح لانخفاض درجة جلتنة النشا (C3)، وانخفاض قيم الـ C4 و C3-C4 للعينات المختبرة مقارنة بعينة المقارنة (زيادة نشاط انزيم الأميليز)، وفى نفس الوقت انخفاض معدل الجلتنة (انخفاض C5 and C5 –C4). كما أدت اضافة مركز بروتين ردة الأرز لدقيق القمح الى انخفاض انسيابية العجين ، بينما تزداد هذه القيم باضافة مركز بروتين بذور الطماطم ، وبصفة عامة حدث انخفاض تدريجي في المساحة تحت المنحنى (energy) بزيادة نسب الإستبدال بكل من مركز بروتين ردة الأرز ومركز بروتين بذور الطماطم، كما كان لزيادة نسبة الاستبدال تاثير على زيادة نسبة البروتين والرماد والألياف في خبز القوالب ،كما لوحظ انخفاض كلا من حجم الخبز والحجم النوعي بزيادة نسب الاستبدال ، و بصفة عامة لوحظ أن خبز القوالب المنتج باضافة 5% من مركز بروتين ردة الأرز أو 3% من مركز بروتين بذور الطماطم قد ساهم في انتاج خبزا أكثر قبولا عن عينة المقارنة، كما لوحظ أن الخبز المنتج باضافة 10%من مركز بروتين ردة الأرزأو 5% من مركز بروتين بذور الطماطم قد احتفظ بطزاجته أثناء التخزين مقارنة بباقي المعاملات الأخرى.

الكلمات الدالة: دقيق القمح – المركز البروتيني لردة الأرز – المركز البروتيني لبذور الطماطم – خبز القوالب – صفات الجودة .