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EFFECT OF ADDITION OF STABILIZED RICE BRAN ON PHYSICAL, RHEOLOGICAL AND CHEMICAL CHARATARESTICS OF PAN BREAD

El-Gammal, Rania E.[1] and Hala E. El kewawy

1- F**ood Industries Dept., Fac. of Agric., Mansoura, Univ., Egypt.**

2- Home Economics Dept. , Fac. of Specific Education, Mansoura, Univ., Egypt.

ABSTRACT

This study was performed to investigate the effect of addition of stabilized rice bran on physical, rheological and chemical properties of pan bread processed from wheat flour 72 % extraction . Stabilized Rice bran was added in rates of (20%, 30% and 40% substitution from wheat flour) .

Gross Chemical composition showed that protein, total dietary fiber, ash, and minerals, and carbohydrate content have been increased in all processed pan bread Addition of stabilized rice bran caused a positive effect on different physical properties namely loaf volume , baking loss% and uniform index. Also, the same trend were observed in texture profile analysis (TPA).

Results of farinograph and extensograph showed the addition of stabilized rice bran (20, 30 and 40%) led to increase the rate of water absorption and extensibility up to (110 mm). On the other hand there were an observed increase in the dough stability, dough development time and the proportional number up to (9.5 min).

Generally, it could be recommended that the incorporation of stabilized rice bran as rice mills by products had a pronounced effects for improving the sensorial and nutritional characteristics of processed pan bread and it was a good source of dietary fiber

Keywords: stabilized rice bran , wheat flour , rheological parameters, chemical properties

INTRODUCTION

Cereals main dietary contribution is carbohydrates beside these they also provide protein and a smaller amount of lipids, fiber and vitamins. It is commonly known that the main nutritional drawback of cereal is their low protein contents and limited biological quality of their protein (highly deficient in lysine and tryptophan) when compared with animal protein (Waliszewski *et al*., 2000), Wheat is one of the most common cereals used for bread making. However, bread prepared from wheat flour dough is considered to be nutritionally poor (Sabanis and Tzia, 2009).

Functional foods are not pills or capsules but are consumed as part of a normal every day diet. Epidemiological studies randomized clinical trails carried out in different countries have demonstrated numerous health effects related to functional food consumption such as reduction of cancer, heart health, reduction of blood pressure, also anti-obese effect (Raghuveer and Tandon, 2009).

Partial replacement of wheat flour with non-wheat flours improves the nutritional quality of bakery products and satisfies consumers' demands for healthy food and variety in food products (Alvarez-Jubete *et al*., 2010**).** Wheat can be used for preparation of many products; bread is one of the least expensive most important staples in the world. Because of their high popularity and large consuming, bakery products (including bread) could be a vehicle to improve the quality and nutritive value (Abreu *et al.,* 1994). Dietary fiber intake has health-protective effects and disease-reversal benefits. people consume generous amounts of dietary fiber, compared to those who have minimal fiber intake, are at lower risk for developing; Cardiovascular health disease, hypertension, diabetes, obesity, and certain gastrointestinal diseases. Increasing the intake of high fiber foods or fiber supplements improves serum lipoprotein values, lowers blood pressure, improves blood glucose control for diabetic individuals, aids weight loss, and improves regularity. (Otles and Ozgoz, 2014).

Rice bran is a by- product that is obtained during the polishing step of rice and rice bran consists (8-10%) from the total grain (Shaheen *et al*., 2005) also, it is a good source of protein, lipids , dietary fiber vitamins and minerals has cardiovascular health benefits. Human consumption of rice bran has been limited primarily because of the rapid onset of rancidity . Stabilized rice bran or its components have been used in various food matrices such as bread, cookies, beverages and tuna oil. Despite of its excellent nutritional properties it is mainly utilized for animal feed or simply discharged due to the rancidity problem caused mainly by lipases. Because of lipid susceptibility, the commercial use of rice bran requires enzymatic inactivation immediately after bran separation to avoid fatty acid liberation, extend its shelf life and allow its commercialization for human consumption. Enzymatic inactivation can be achieved by heating to high temperatures for a short period (Ramezanzadeh *et al*., 1999)

This work aimed to is to study the effects of addition of stabilized rice bran as source of dietary fibers on physical, chemical and rheological properties of pan bread.

MATERIALS AND METHODS

Materials:

Wheat flour (72%) extract was obtained from METRO super market, El-Mansoura City, Egypt. Rice bran was obtained from OMAR EL-HALWANI Mill ,El- Dakhaleia - Egypt

Other ingredients:

Salt, dry yeast, bread improver , sugar and corn oil were obtained from local market, Mit Gamar City , El- Dakhaleia - Egypt.

Methods:

Rice bran was stabilized using microwave oven at 550 W output power for 3 min. at 120°C according to the method described by Ramezanzadeh *et al.,* (2000).

Moisture, fat, ash were determined using A.O.A.C.(2005) .Protein was determined using micro-kjelahel method as described by A.O.A.C. (2000).And carbohydrate content was determined by the differences according to the following equation: [100- Moisture% +ash%+ fat % + crude protein%), fiber, total soluble and insoluble dietary fiber were determined according to AOAC (2005), at Food Technology Research Institute, Agricultural Research Center , Giza, Egypt .

Minerals content:

Total contents of potassium, phosphorus, calcium and sodium were determined using Perkin Elmer, Atomic Absorption Specol model 3300 in Agricultural Research Center, Giza, Egypt.

The rheological measurements:

The rheological measurements were carried out for flour using farinograph and extensograph tests at Rheological Lab,. Department of Bread and Dough Food Technology Research Institute, Giza, Egypt, as described by Borune (2003) and AACC, (2000).

Pan bread texture profile analysis:

Was performed at Food Technology Research Institute using an QC-Tech universal testing machine (Cometech, B type Ltd, Taiwan), the data were analyzed to measure pan bread firmness, cohesiveness, gumminess, chewiness, springiness and resilience as described by Gomez *et al.*, (2007).

Quality attributes evaluation of processed pan bread: loaf volume (cm^3)was determined by rape seeds displacement method A.A.C.C.(2000)

And other physical properties measurements were done on pan bread after baking namely uniform index according to Penfield and Campbell(1990 a,b) while baking loss (w_l) was calculated according to (A.A.C.C.2000)

Using the following equation = $w_l = (w_i - w_f) / w_i \times 100$

w_i = weight of pan bread before baking w_f = weight of pan bread after baking

Flour blends:

Flour blends were prepared according to the ratio outlined in Table (1).

Table (1): Flour blends used in pan bread preparation with different level from stabilized rice bran (SRB) .

No. of sample	WF%	SRB%
Control	100	-
A	90	20
B	80	30
C	60	40

WF= wheat flour, SRB = Stabilized Rice Bran .

Baking procedures:

Pan bread was prepared by straight dough method and baking carried out in local bakery at Mit Gamr City, Dakahlia ,Egypt as described by Lazaridou *et al*., (2007) as follows: Firstly, dry yeast dissolved in (75–80) ml of warm water (35°C), then mixed and kneaded with flour (100g), salt (1.5%) and sugar (1%) for about 6 min to form the dough. The dough was left to

ferment at 30°C/30 min and 80-85% relative humidity. The dough was then divided into (150g/unit) and booted in metal pans that had been left to ferment for about 45 min at the same temperature and relative humidity. Bread dough were baked at 240°C for 20–25 min in an electric oven (Mondial Formi, 4T 40/60, Italy). Pan bread was allowed to cool at room temperature for 2 h before being packed in polyethylene bags and stored at room temperature for further analysis.

Statistical analysis:

Data analysis was performed using *SPSS*(2007) , Inc v.17.00, software. All data were expressed as mean ± standard deviation. Analysis of variance (ANOVA) was used to test differences between the groups. Least Significant Differences (LSD) test was used to determine significant differences ranking among the mean values at $P< 0.05$.

RESULTS AND DISCUSSION

Some chemical properties of stabilized rice bran used in pan bread:

Stabilized rice bran was chemically analyzed and the results was tabulated in Table (2). Data indicated that rice bran is a good source of protein being 14.03 and total dietary fiber namely, total soluble and insoluble were 26.69, 3.54 and 23.15 respectively, while the amount of moisture content was 6.94±0.01 % these results were agreement with *Faria et al., (2012)* who found that chemical composition of rice bran being 8.41,16.6,24,15 and 17,87 in moisture, protein total dietary fiber and fat.

Table (2): some chemical properties of stabilized rice bran :

Constitutes of	Moisture %	Protein %	Ash %	Fat %	Carb. %	Fiber %		
						TDF	INSDF	SDF
Rice bran	6.94±0.01	14.03	4.5	6.51±0.03	68.02	26.69	23.15	3.54

TDF = total dietary fiber SDF = soluble dietary fiber INSDF= insoluble dietary fiber All values are means of three replicates ± SD

Some Chemical properties of processed pan bread samples.

The effect of substituting stabilized rice bran with different ratios 20,30 and 40% to pan bread were studied and the results were presented in Table (3) Obtained results indicated that the increasing amount of stabilized rice bran in all pan bread caused a clear decrease in moisture and carbohydrate contents. It was found that , all pan bread have low content of fat which ranged between 1.85 to 1.40 . Whereas ash content were high in processed pan bread in compare with control sample .

Also, increasing amount of stabilized rice bran to pan bread decreased the amount of total carbohydrates in all pan bread as compared with control sample and the decreases ranged from 71.30 to 65.86% .

Results also in the same Table indicated that the amount of dietary fiber was increased in all prepared pan bread samples from 5.60 to 22.68. These results were in agreement with Faria *et al*,. 2012 who found that

chemical composition of stabilized rice bran being 9.41, 4.6, 24,15 and 17,87 in moisture, protein , fat and total dietary .

Table (3): Chemical properties of processed pan bread using stabilized rice bran (calculated as mg/100g dry sample).

Chemical properties	Control	Processed pan bread samples		
		A	B	C
Moisture	9.01±0.04	10.13±0.02	11.02*±0.05	11.95*±0.02
Protein	15.66±0.03	15.21±0.01	14.73*±0.03	14.32±0.10
FAT	1.85±0.02	1.87±0.13	1.65*±0.01	1.40±0.11
Ash	2.18±0.04	4.93* ±0.11	5.87* ±0.05	6.47* ±0.01
Carbohydrates	71.30	67.86	66.73	65.86
TDF	10.13	22.69	23.99	24.19
SDF	4.53	2.54	2.13	1.51
INSDF	5.60	20.15	21.86	22.68

TDF = total dietary fiber SDF = soluble dietary fiber INSDF= insoluble dietary fiber
All values means of three replicated ±SD *= p≤ 0.05

Minerals content of processed pan bread :

Data in Table (4) represent that minerals content of different processed pan bread samples, it could be observed that all bread samples were superior in phosphorus, calcium ,potassium and sodium magnesium in compare with control sample these results were agreement with those reported by Rizwan (2006), who found that the content of phosphorus , calcium were (15.90 and 0.618 mg) respectively, These data agree with those found by Faria *et a*l,. (2012) and USDA (2012) who reported that Ca and P content in rice bran were (63.3and 979 mg/100g). And stabilized rice bran were (65 and 979 mg/100g).

Also, results in Table (4) showed that there were an increased amount of phosphorus and potassium in all pan bread . These data not agreed agree with those found by Bowes and Church (1983) who found that phosphorus content, was (1677and 1482 mg/100g).

Table (4): Minerals content of in pan bread processing (calculated as mg sample on dry weight basis).

Samples	Minerals content			
	P	Ca	k	Na
Control	672.6	61.7	537.8	10.8
Sample A	765.4	78.3	624.9	13.1
Sample B	883.2	89.8	715.1	14.6
Sample C	995.6	112.4	799.3	16.9

Sample A = 20%SRB Sample B= 30% SRB Sample C= 40% SRB

Physical characteristics of processed pan bread:

Some physical characteristics, namely, volume measurements, baking loss% and pan bread texture profile analysis (TPA) (firmness, Cohesiveness, Gumminess, Chewiness, Springiness, Resilience) were determined and results were summarized in Table (5). Results in Table (5) indicated that

volume measurements of pan bread is one of the most important quality attributes as it influences consumer acceptance. (Masoodi *et al.*, 2002). Loaf volume (cm3) were gradually decreased in all pan bread samples in compare with control sample, the values assigned to volume of pan bread ranged from 635to 598 cm^3 among different bread samples . These results were agreement with Sharma and Chauhan (2002)who substituted rice bran from wheat flour at high proportion 20 and 30% which decrease the values of loaf volume. Results also in the same table indicated that addition of SRB increased the amount of baking loss % from 3.50 10 8.0% . Uniformity index **(**UI**),** is an indicator related to the symmetry of the pan bread Results in Table (5) indicated that there were no significant differences at ($p \leq 0.05$) with increasing stabilized rice bran level in all prepared pan bread samples.

Table (5): some physical properties of different processed pan bread with Stabilized Rice Bran.

Constitutes	Control	Processed pan bread		
		Sample A	Sample B	Sample C
Loaf volume (cm^3)	635	630	620	598
Baking loss%	3.50	5.0	5.0	8.0
Uniform index	10.5 ±0.01	9.5±0.03 ^{Ns}	9.4±0.01 ^{Ns}	9.4±0.02 ^{Ns}
Pan bread texture profile				
Firmness	5.665	2.645	2.805	2.720
Cohesiveness	0.566	0.483	0.525	0.564
Gumminess	2.087	1.277	1.901	1.543
Chewiness	1.365	0.647	1.065	0.859
Springiness	0.628	0.493	0.555	0.560
Resilience	0.316	0.244	0.209	0.332

values are average ± SD of three replicates. Ns = Non significant at p ≤0.05

Results in Table (5) showed also , that the effect of addition stabilized rice bran on texture profile of different bread samples, results in Table (5) showed an observed decrease in texture profile properties namely Gumminess, Chewiness, Springiness and Resilience in all pan bread samples in compare with control. Data revealed that no observed changes in firmness in all pan bread while samples with(30% SRB) sample B exhibited the lowest value of springiness being 0.555 followed by pan bread with (20% SRB) sample A being 0.493.While the minimum value of resilience was in pan bread contain 30% SRB sample B . Also, there were a decreasing trend observed in Gumminess with increasing amount of SRA among pan bread samples .These results were in accordance with the findings by Younas *et al*., (2011) who stated that physical properties of cookies and pan bread were affected significantly with the increasing level of rice bran up to 25% .

Staling rate of different processed pan bread.

Staling is a phenomenon, it concerns with the changes that occur in bread after baking . alkaline water retention capacity (AWRC) is simplest test follow the stalling in bakery products , increases in AWRC are resulted from the freshness of baked products Gray and Bemiller (2003).

Generally there were gradual increases in all processed pan bread staling rate prolonged storage period around 6 days. The best values of freshness recorded for processed pan bread with sample C followed by sample B and A being 202.56, 220.20 and 274.36.up to 6 days of storage. All processed pan bread with different ratios of SRB were more freshness than that of the control sample prolonged storage. No differences were observed among all processed pan bread up to 4 days , while there were an observed increase in staling rate values at 6 days of storage in all pan bread samples .

Table (6): Staling rate of different processed pan bread.

Bread	storage days			
	zero time	2 days	4 days	6days
Control	194.27	174.56	153.44	142.84
Sample A	206.11	198.71	174.32	167.11
Sample B	258.25	234.52	205.33	198.47
Sample C	298.32	274.36	220.20	202.56

Rheological properties of whole wheat flour and its mixtures:
Farinograph test:

Dough rheological properties are important for their effect in bread quality due to their significant effect on final loaf volume . the rheological behavior of the dough with stabilized rice bran substituted with wheat flour was determined by farinograph and extensograph and the results were presented in Table (7) and Figures (1 and 2) that show water absorption, arrival time, dough development time, dough stability and dough weakening for all pan bread samples. An observed increase of water absorption (WA) was ranged from 63.57 to 71.5%. This increase may be due to increase in protein and dietary fiber content in the sample; similar effect on WA was observed by Tanska *et al*., (2007) when added microwaved ricebran to wheat dough .The explanation of this phenomenon is based partly on the fact that the fiber structure contains a large number of hydroxyl groups . which interact with the hydrogen bonds of water (Bouaziz *et al*., 2010 and Gomez *et al*., 2003). Dough development time (DDT) increased with increasing level of SRB from 5.0 min in control sample to 8.0 in sample C with 40% substitution of SRB These results were almost nearly with those obtained by Ognean *et al* ., (2010) increasing time of DDT could be attributed to the fiber gluten interaction , which prevent protein hydration.

Dough stability (DS) is a parameter related to the quality of the protein matrix, which is easily needed by the incorporation of the other ingredients (Gomez *et al.,* 2011) . Addition of SRB increased DS from 6.0 min to 9.5 min. These results were confirmed with those obtained by Ognean *et al*., (2010) and Anil (2011) who stated that rice bran supplemented to wheat dough had highly effect and interaction between water and flour proteins.

Table (7): Effect of whole wheat flour and its mixtures on farinograph parameters.

Samples	Water absorption %	Arrival time (min)	Dough development time (min)	Dough stability (MIN)	Degree of softening (B.U)
CONTROL	63.57	0.5	5.0	6.0	150
A	65.54	0.5	6.5	7.5	190
B	68.90	0.5	7.5	8.5	110
C	71.31	0.5	8.0	9.5	90

Extensograph test:

Extensograph analysis gives information about the viscoelastic behavior of a dough and measures dough extensibility and resistance to extension. A combination of good resistance and good extensibility results in desirable dough properties (Rosell *and Rajas* , 2001 and Zalatica *et al* ., 2012). Data presented in Table (8) showed that there were a difference in the results could be attributed to the differences in their components especially in wheat flour dough . The dough sample consisting of wheat flour showed an extensibility (E) by (175mm) and elasticity (EC) by 320BUas shown in (Fig 2). While addition OF stabilized rice bran showed an observed decrease in the dough elasticity which ranged from (320 to 170 BU) .Also these samples showed a decrease in the dough extensibility ranged between (145 to 110mm.

Table (8): Effect of whole wheat flour and its mixtures on extensograph.

Samples	Elasticity EC	Extensibility E (mm)	Proportional number (R/E)	Dough energy (cm^2)
CONTROL	320	175	1.83	44.6
A	250	145	1.72	33.1
B	200	135	1.48	32.1
C	170	110	1.55	16.0

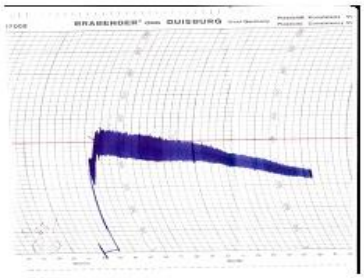

Fig 1-co: 100 %whole wheat flour.

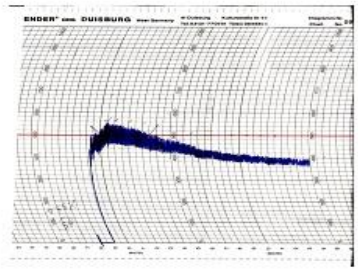

Fig 1- a: 80 %whole wheat flour +20% rice bran

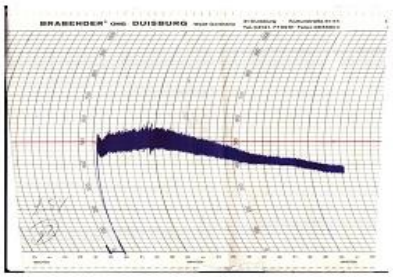

Fig 1- b: 70 %whole wheat flour + 30% rice bran

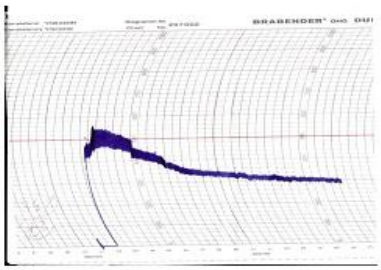

Fig 1- c: 60 %whole wheat flour +40% rice bran

Fig.(1) :Effect of addition rice bran on farinograph parameters for pan bread dough

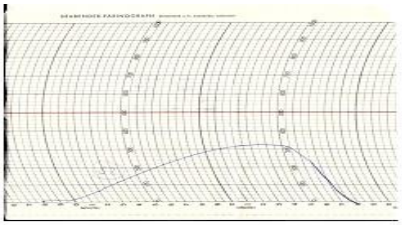

Fig 2-co: 100 %whole wheat flour.

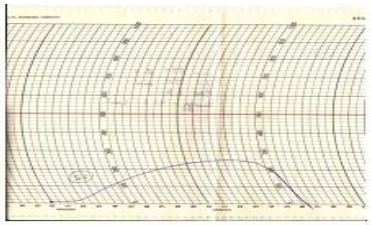

Fig 2- a: 80 %whole wheat flour +20% rice bran

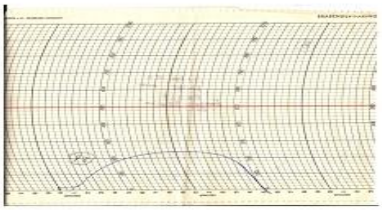

Fig 2- b: 70 %whole wheat flour +30% rice bran

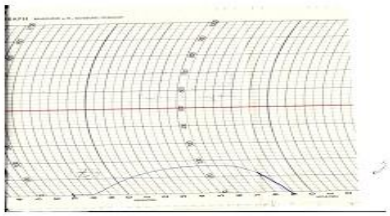

Fig 2- c: 60 %whole wheat flour +40% rice bran

Fig.(2): Effect of addition rice bran on extensograph parameters for pan bread dough.

Sensory evaluation of processed pan bread:

Sensory characteristics of processed pan bread with different levels of stabilized rice bran were evaluated in Table (9). Results indicated the effect of addition stabilized rice bran as substitution of wheat flour on crust and crumb color was not observed clearly , and the effect on taste and smoothness was some what remarkable ,but all changes were in acceptable range, that may be due that stabilized rice bran contain reducing sugars more than wheat flour that could be effect on the bread color as resulted of Millard reaction during baking process, it could be also noticed the increasing limit of SRB lead to a gradual decrease in hardness and smoothness especially in pan bread sample B and C which contained 30 and 40 % SRB.

Also results in the same table showed that incorporated of SRB significantly influences the odor of pan bread , it has been primarily attributed to flavor compounds. Pan bread with 40% SRB were significantly harder than other processed pan bread this may be due to dilution of gluten content and also due the thickening of the walls surrounding the air bubbles in the crumb (Wang *et al*., 2002 and Sivam *et al*., 2010).

Evaluation of over all acceptability of SRB pan bread showed an observed acceptability in all processed pan bread samples

Also , addition of SRB changed the bread color slightly and the size of the holls become smaller this observation was confirmed with Sharma and Chauhan (2002)

Table (9): sensory evaluation of processed pan bread:

Pan bread Samples	Sensory characteristics						
	Taste	Odor	Hardness	Smoothness	Crust color	Crumb Color	Overall acceptability
Control	4.50 ±0.14	4.82 ±0.18	4.80 ±0.15	4.76 ±0.16	4.90 ±0.12	4.88 ±0.20	4.86 ±0.16
Sample A	3.84 ±0.14	4.66 ±0.13	4.73 ±0.15	4.76 ±0.16	* 4.88 ±0.12	4.84 ±0.21	4.50 ±0.12
Sample B	3.21 ±0.14	4.54 ±0.12	4.50 ±0.11	4.76 ±0.16	* 4.86 ±0.12	4.71 ±0.14	4.53 ±0.11
Sample C	3.11 ±0.14	** 4.01 ±0.18	** 4.30 ±0.10	** 4.76 ±0.16	* 4.80 ±0.12	** 3.65 ±0.22	4.01 ±0.14

sample A=20% SRB , sample B = 30% SRB , sample C= 40% SRB.
Each value in the mean of ± sd , significant with control group
***p≤ 0.05 **p≤ 0.01 ** *p≤ 0.001.**

CONCLUSION AND RECOMMENDATION

It could be recommended that rice bran which consider as by-products of rice mills can be used as cheap , available , and a good source of dietary fiber in pan bread processing , and substituted from wheat flour up to 30%

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تأثير إضافة رجيع الارز المثبت على الخواص الفيزيائية والريولوجية والكيماوية لخبز القوالب.

رانيا إبراهيم السيد الجمال[١] و هالة عزت الكواوي[٢]

١- قسم الصناعات الغذائية- كلية الزراعة- جامعة المنصورة - مصر.

٢- قسم الاقتصاد المنزلي – كلية التربية النوعية – جامعة المنصورة – مصر.

تم إعداد الدراسة بغرض دراسة تاثير اضافة رجيع الارز المثبت علي الخصائص الريولوجية والكيماوية والطبيعية لخبز القوالب المجهز من دقيق القمح استخلاص ٧٢% ولذا تم إضافة رجيع الارز المثبت بنسب (٢٠- ٣٠و٤٠ %) من دقيق القمح الكامل. اعطت نتائج التركيب الكيماوي زيادة ملحوظة في نسب البروتين – الالياف – الرماد- المعادن والكربوهيدرات مقارنة بالعينة الكونترول . كما كان لاضافة رجيع الارز المثبت تاثير ايجابي علي ا لصفات الفيزيائية لخبز القوالب (حجم الرغيف - % للفقد بعد الخبيز) وايضا لوحظت نفس النتائج لاختبارات القوام

وأظهرت نتائج الفارينوجراف والإكستنسوجراف أن إضافة رجيع الارزالمثبت للقمح بنسب (٢٠-٣٠و ٤٠ %) أدى إلى زيادة فى معدل إمتصاص الماء والتمدد للعجينة . من ناحية أخرى أدى إلى زيادة زمن الوصول (٩.٥دقيقة) وثبات العجينة وكذلك الوقت اللازم لتطور العجينة

ولذا تعتبر اضافة رجيع الارزالمثبت كمنتج ثانوي لمضارب الارز ذو تاثير ايجابي علي الصفات الحسية و الغذائية لخبز القوالب ومصدر جيد للالياف الغذائية .