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PHYSICO-CHEMICAL AND TECHNOLOGICAL STUDIES ON SOME EGYPTIAN RICE VARIETIES

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ABSTRACT

The present study was carried out to evaluate different varieties of rice (Black, Sakha 105 and Egyptian Yasmen) as brown and white rice physically, chemically and technologicaly as well as to investigate the possibility of using their rice flour as substitution materials of wheat flour in preparing biscuits.

The obtained results revealed that, physical properties of paddy, brown and white rice varied from one variety to another. It was found that *E. yasmine* had the longest length when compared with other varieties. It had also the lowest width among all of the tested ones, whereas Sakha 105 had the highest value in grain index. The paddy rice of raw *E. yasmine* had the highest percentages of broken kernels and the lowest percentages of head and white rice as compared with other rice varieties.

Water uptake of white rice was significantly higher than that of brown rice. Brown black rice had the longest cooking time (38 min) compared to the others.

Gel consistency (GC) varied significantly between varieties in both brown and white rice. Alkali spreading value in brown rice varieties showed lower values in comparing with white rice varieties. Black rice had the highest amylase content and the lowest pasting characteristics values than those of Sakha 105. Furthermore, Black rice contains high content of ether extract, ash and crude fibers, but lower content of total carbohydrate, compared with other varieties. In addition, brown rice of all varieties had higher contents of crude protein, ether extract, ash and fiber but lower content of total carbohydrates, whereas the rice variety of black rice had a relatively high levels of mineral contents comparing with the other rice varieties.

Results of Organoleptic evaluation indicated that, biscuit samples prepared using rice flour of the studied varieties as substitutions insted of wheat flour up to 50% were very acceptable. Where most samples have sensory characteristics scores higher than those of control (wheat flour biscuit).

INTRODUCTION

Rice is staple food for people in many countries. For paddy rice, when the husk is removed, the grain obtained are called brown rice due to the brown color bran that covers the grain. White rice is obtained when the bran is removed in the regular milling process (Jiamyangyuen and Ooraikul, 2008).

Brown rice is nutritionally superior to white rice. Whereas, it has higher percentages of all nutrients except carbohydrate (Kennedy, 1980).

Genetics plays a major role in determining rice functionality. Environment and cultural practices also have been shown to significantly affect composition and consequently, cooking characteristics of rice (Dang and Copeland 2004).

Cooking and eating quality of rice have never caused a serious problem in Egypt since nearly more than 95% of the rice area is planted by Japonica rice varieties because of their moistures, tenderness, gloss and taste. Recently, however, emphasis of development of long grain Indica rice

has brought in to focus the problem of cooking and eating quality in breeding program (El-Hissewy and El-Kady 1992).

Black and red rice cultivars are popular in Asia, where they are consumed for nutritional color and unique flavor attributes. For example, red and black rice are used as food colorants in cakes, breeds, ice cream and liquor and as functional foods due to the antioxidant activity conferred by high levels of polyphenols (Abd El-Aal *et al.,* 2006). The color of black and red rice is derived from anthocyanin pigments. In black rice, cyanidin 3-glycoside and peonidin 3-glucoside are primary pigments, with the former being 136 x higher in black than in red rice (Yang *et al.,* 2008).

The objective of this study was to compare the physical attributes, chemical composition and physicochemical properties of three rice varieties grown together in the Sakha region of Kafrelsheikh Governrate.

MATERIALS AND METHODS

Materials

Three varieties of rice (*Oryza sativa* L.) namely black, Sakha 105 (short grain Japonica) and Egyptian Yasmaine (long grain Indica) were employed in this study. These samples were obtained from Rice Research and Training Center (RRTC) at Sakha Kafr El-Sheikh Governorate, Egypt during the season of 2008, under the recommended conditions for date of culture, fertilization, harvesting time and irrigation.

Methods

Preparation Of Rice Samples

Raw rice samples were dehulled to obtained the brown rice. The brown rice was divided into two parts the first one was used as brown rice, where the second was milled to obtained the white rice. The brown and white rice were kept in polyethylene bags and stored in freezer at -18^{o}C until further analysis.

Determination Of Physical Properties

Hulling, milling output and head rice percentages were estimated according to the method of Khan and Wikramanayake (1971) at Rice Research and Training Center (RRTC) Sakha, Kafr El-Sheikh, Egypt.

The grain physical attributes (100 grain weight, grain dimension (length and width), grain shape (grain length to width ratio) were measured. The 100 grain from each variety of rice were counted randomly in triplicate and weighted separately. Grain length and width were measured using a micrometer with accuracy of 0.001 mm where 10 uniform rice grain were randomly selected and their length and width were measured in duplicate (Suwansri and Meullenet, 2004).

Bulk density of rice was determined according to the method of Myklestad *et al.* (1968).

Water uptake, sedimentation values at 77^{o}C and 82^{o}C and cooking time: water uptake, sedimentation values and cooking time of brown and white rice varieties were determined following to procedures of Simpson *et al.* (1965).

Determination Of Cooking And Eating Quality

Alkali spreading value was determined according to the method described by Bhattacharya and Sowbhagya (1980).

Gel consistency (GC) was determined according to the method described by Cagampang *et al.* (1973). Elongation percentage was measured using the method of Tomar (1985).

Amylose content was measured according to Juliano *et al.* (1971) procedure. Pasting characteristics of rice flour were carried out using Brabender amylograph as described by A.A.C.C. (1995) procedure.

Chemical Composition Of Rice Samples

Moisture, ash, crude protein, ether extract and crude fiber contents were determined according to the methods of A.O.A.C. (2005). Total carbohydrates content was calculated by subtracting protein, ash, and ether extract from total mass of 100 as reported by A.O.A.C. (2005). Total phosphorus was determined colorimetrically using ascorbic acid method as described by Murphy and Riley (1962). Potassium and sodium contents of rice samples were estimated using flame photometer as given by Pearson (1976). Calcium, iron, zinc and copper contents of rice samples were conducted using the atomic absorption spectrophotometer Perken Elmer Model 20180 following the method of Pearson (1976).

Preparation of biscuits

Biscuits were prepared from French wheat flour (72% extraction) and used as control sample. Substitutions levels 25 and 50% using brown black and brown Sakha 105 rice flour varieties were used to prepare the biscuit samples. The biscuit formulas were shown in Table (A). The ingredients were mixed well. Laminated sheeted, shaped and baked at 215^{o}C for 12 min (Nnam and Nwokocha, 2003). The samples were removed and cooled on a rack for 5 min. before serving for the sensory evaluation.

Table (A):The used ingredients in biscuit making.

Ingredients	Amounts (g)	Ingredients	Amounts (g)
French wheat flour (72%)	100	Sucrose	287.6
Glucose syrup	2.9	Dry milk	1.4
Shortening	14	Vanilia	0.8
Sodium bicarbonate	0.6	Water	25

Sensory Evaluation Of Biscuits

Biscuit, were applied for **t**he sensory characteristics, by serving to panel of ten experienced judges from the staff of food Tech. Res. Institute, Agric. Res. Center, Giza, Egypt. as follows. The organoleptic properties of backed biscuits were evaluation by a personal of ten trained judges. The judges were asked to give score from 0 to 20 of taste, color, odor, texture and shape as reported by (Watts *et al.,* 1989).

Statistical Analysis

Most of the received data were analyzed statistically using the analysis of variance and the means were further tested using the least significant difference test (LSD) as outlined by Stell and Torrie (1980).

RESULTS AND DISCUSSION

Physical Properties Of Some Rice Varieties

Data presented in Table (1) indicated that, the length of brown rice grains ranged between 5.26 to 9.48 mm, whereas the length of white rice grains ranged from 5.13 to 9.26 mm, *E. yasmine* rice was significantly the longest among all rice varieties.

The width of brown rice in the three different varieties of rice (black , Sakha 105, *E. yasmine*) were, 2.85, 2.90 and 2.49 mm, and white rice grains had the values of 2.70, 2.75and 2.26 mm, respectively. As for grain shape the results referred that, *E. yasmine* variety was slender shape. black and Sakha 105 were bold shape according to Ahuja *et al.* (1995). Kent and Evers (1994) classified the shape as slender > 3.00, medium (3.01-3.00), bold (1.01-2.00) and round ($\leq$ 1.0).

Table (1): Some Physical properties of the tested rice varieties.

Rice variety	Treatment	Grain dimension		"Grain shape	Grain index (gm)	Bulk density (g/cm^3)
		Length (mm)	Width (mm)			
Black	Brown	*5.26 e+	*2.85 a+	*1.85 c+	*2.17 b+	*0.83 c+
	White	5.13 e	2.70 b	1.94 c	1.9 c	0.87 ab
Sakha 105	Brown	5.72 c	2.9 a	1.97 c	2.31 a	0.84 bc
	White	5.50 d	2.75 b	2.00 c	2.05 b	0.89 a
E. yasmine	Brown	9.48 a	2.49 c	3.81 b	2.07 b	0.86 b
	White	9.26 b	2.26 d	4.09 a	1.84 c	0.89 a

"Grain index = weight of 100 grains.
***Each value was an average of ten determinations**
+Values followed by the same letter in column are not significantly different at P $\leq$ 0.01

Apparent also form the same table that, grain index values of brown and white rice of the three rice varieties (black , Sakha 105 and *e. yasmaine*) were (2.17, 2.31and 2.07 gm); (1.9, 2.05and 1.84 gm), respectively. In addition **t**he data in the same table revealed that, bulk density were higher in white rice samples than those of brown rice. Apparent also from the above mentioned data that, milling process led to a pronounced increase of bulk density, where a noticeable decrement in grain index values were recorded. Data in this respect were in agreement with the findings of numerous investigators (FAO, 1993; Perdon *et al.,* 2000;Kamel *et al.,* 2001 and Jiamyangyuen and Ooraikul, 2008).

Milling Characteristics Of Some Rice Varieties

Data present in Table (2) indicated that, the hulls percentage of raw paddy rice ranged between 19.70 to 24.5%. Apparent also from the same table that, brown rice recovery differed significantly between the samples. Sakha 105 rice had the highest value of brown rice (80.3%) where *E. yasmine* rice had the lowest value (75.50%). Dealing the milled rice percentage, samples of Sakha 105 showed an increasing in the previous mentioned parameter in comparing with that of *E. yasmine*. The percentages of head and broken rice varied according to the length and width of the rice

varieties as given in Table (2) the japonica rice variety (Black) had lower percentages of broken rice than those of Indica rice variety (*E. yasmine*). These results were in the same trend with those reported by (El-Kady and Draz, 1995; Wiset *et al.,* 2001 and Abd El-Rassol *et al.,* 2005).

Table (2):Milling characteristics of some rice varieties.

Rice variety	Hulls %	Brown ricer %	Milled rice %	Head rice %	Broken rice %
Black	*21.14 b+	*48.86 b+	*68.11 b+	*62.51 b+	*5.6 c+
Sakha 105	19.70 c	80.3 a	71.22 a	63.50 a	7.72 b
E. yasmine	24.5 a	75.5 c	67.50 c	55.55 c	11.95 a

***Each value was an average of ten determinations**
+Values followed by the same letter in column are not significantly different at P ≤ 0.01

Water Uptake, Sedimentation Value And Cooking Time Of Some Rice Varieties

Results given in Table (3) show that, brown black rice had the highest cooking time compared to the other samples (38 min.). Generally, brown rice had cooking time higher than that of milled rice. The obtained results were in lien with those reported by Lee *et al.* (1995) who reported that , faster rate of water uptake indicated a shorter cooking time. As for water uptake it could be noted that, water uptake values of 77°C and 82°C were higher in white rice samples than those of brown rice ones. This may be related to the removal of protein, lipid and minerals in brown rice samples, Dharmaputra (1997) found that, water uptake could be easily bound by carbohydrate compared to lipid or protein.

Table (3): Water uptake, sedimentation value and cooling time of some rice varieties.

Rice variety	Treatment	Water uptake (ml H_2O/100 g rice)		Sedimentation value ml sed./200 g rice)		Cooking time (min.)
		77°C	82°C	77°C	82°C	
Black	Brown	*208.3 f+	*241.5 f+	*1.61 e+	*1.85 d+	*38 a+
	White	236.5 c	271.6 c	2.12 c	2.32 c	24 d
Sakha 105	Brown	226.13 d	260.4 d	1.21 f	1.39 e	26 c
	White	248.22 a	290.1 a	2.32 a	2.61 a	21 e
E. yasmine	Brown	217.3 e	246.3 e	1.71 d	1.89 d	34 b
	White	238 b	276.9 b	2.23 b	2.41 b	22 e

***Each value was an average of ten determinations**
+Values followed by the same letter in column are not significantly different at P ≤ 0.05

Apparent also from the same table that, sedimentation values at 77°C and 82°C were higher in white rice samples than those of brown rice. Furthermore, sedimentation values at 82°C were higher than those of 77°C for different rice varieties. Furthermore Sakha 105 had the lowest sedimentation value among all of the tested rice varieties (1.21 and 1.39 ml sed./100 g rice) at 77°C and 82°C, respectively.

The obtained results were in line with those reported by (Chrastil, 1994; Zhout *et al.,* 2002 and Sodhi *et al.,* 2003 and Jiamyangyuen and Ooraikul, 2008).

Cooking And Eating Quality Of Rice

Data presented in Table (4) show that , gel consistency (GC) varied significantly among varieties in both brown and white rice. GC in brown rice was low in comparing with that of white rice. These results were in agreement with those of Osman and Abd El-Galeel (2008). Black rice had the highest GC in both brown and white rice. Generally, all varieties classified under soft rice which their GC ranged between 61-100 mm as described by Cagampang *et al.,*(1973).

It should be also noted from the same table that, alkali spreading value in brown rice varieties showed lower values in comparing with those of white rice varieties.

Table (4): Cooking and eating quality of some rice varieties.

Rice variety	Treatment	Gel consistency (mm)	Alkali spreading value (GT)	Elongation %	Amylose %
Black	Brown	*85.5 b+	*5.o c+	*68.23 d+	*21.59 b+
	White	90.3 a	5.5 b	70.42 b	22.60 a
Sakha 105	Brown	81.0 c	5.3 b	69.50 c	18.72 d
	White	85.2 b	6.o a	72.23 a	19.54 c
E. yasmine	Brown	74.3 e	5.o c	59.0 f	17.92 e
	White	79.8 d	**5.5** b	63.60 e	18.88 d

***Each value was an average of ten determinations**
+Values followed by the same letter in column are not significantly different at P ≤ 0.01

As for brown rice, it seems to require a longer time to cook. Alkali spreading value is used as an inverse indicator of gelatinization temperature of rice starch granules that affected by several factors including water content of the gel, amylase content and degree of crystalinity in the amylopectin chain length (Lai, 2001; Irshad, 2001 and El-Bana *et al.,* 2007).

It could be noted that, elongation values of white rice were higher than those of brown rice, some trand was recorded in case of short grain variety (Sakha 101 and black rice) when compared with those of long grain variety (*E. yasmine*) for all treatments. This was expected since water related positively with grain elongation during cooking. These results are in accordance with those of (Ahuja *et al.,* 1995 and El-Bana *et al.,* 2007).

It is clear from the same table that, milling was considered one of the major factors that helped to increase the amylose contents of all rice samples. Hence, the highest contents for amylose were found in black rice variety (22.6% in white and 21.59% in brown) where brown rice of *E. yasmine* variety had the lowest value (17.92%). The results of Jane *et al.* (1999) and Osman and Abd El-Galeel (2008) support our findings.

Pasting Characteristics Of Rice Flour

Pasting characteristics of the tested rice samples presented in Table (5). The value of temperature at maximum viscosity ^{o}C, viscosity at 95^{o}C and

viscosity at 50°C in brown rice of the two tested varieties showed higher values in comparing with those of white rice varieties.

Table(5): Pasting characteristics of the two rice varieties (Sakha 105 and black).

Rice variety	Treatment	*T.P. °C	Max. viscosity B.U.	Temp. at max. viscosity	Viscosity at 95°C B.U.	Viscosity at 50°C B.U.	Set back viscosity
Sakha 105	Brown	76.0	950	95.0	560	1100	150
	White	67.5	645	91.5	340	920	275
Black	Brown	81.0	545	93.0	345	900	355
	White	88.5	340	87.0	300	815	475

*** T.P. = transmission point. B.U = Brabender unit.**
Set back viscosity (B.U) = Viscosity at 50°C-maximum viscosity

On, contrast, the value at transmission point in brown black rice variety showed decrease value in comparing with that of white black rice. In addition, black rice variety contained lower pasting characteristics value than that of Sakha 105. The drop in starch past viscosity was occurred as a function of cooking at 94°C may clarify the degree of disintegration of galvanization granules as reported by (Zhout *et al.,* 2002 and Jiamyanguen and Ooraikul, 2008). The viscosity of the cooked starch pastes cooked at 50°C reflects the degree of reassociation (retrogradation) of amylase (Singh *et al.,* 1990). The difference in viscosity value that recorded between hot paste and paste cooked at 50°C may be referred to the set back value as reported by (Singh *et al.,* 1990).

Chemical Composition Of Some Rice Varieties

Data presented in Table (6) showed that , the moisture content of brown and white rice varieties ranged between 11.65 to 12.51%. These values are in lien with those of (Perez, 1993 and Dharmaputra, 1997). Apparent also from the same table that, moisture content of brown rice varieties were lower than those of white rice. Amorim *et al.* (2004) reported that, moisture content plays a great role during the storage for rice. From the same table, it could be observed that , brown rice of *E. yasmine* variety contains a relatively high level of crude protein content (8.15%), while, white black rice variety had the lowest level of crude protein content (6.81%).

Table (6): Chemical composition (%) of some rice varieties.

Rice variety	Treatment	Moisture	Crude protein	Ether extract	Ash	Crude fiber	**Total carbohydrate
Black	Brown	*11.65 e+	*7.65 c+	*2.41 a+	*1.56 a+	*2.11 a+	*88.38
	White	12.1 c	6.81 e	1.4 d	1.22 b	1.13 b	90.57
Sakha 105	Brown	11.95 d	7.86 b	2.23 b	1.14 bc	1.31 b	88.77
	White	12.15 c	7.12 d	0.79 e	0.55 e	0.85 d	91.54
E. yasmine	Brown	12.33 b	8.15 a	2.01 c	1.27 b	1.15 b	88.57
	White	12.51 a	7.15 d	0.87 e	0.81 d	0.79 e	91.71

*** Each value was an average of ten determination **Total carbohydrate were calculated by difference.**
+Values followed by the same letter in column are not significantly different at P ≤ 0.05

Results of the same table also revealed that, there were high significant differ in ether extract between brown and white rice of the same

variety, also between the different varieties. The black rice variety had the highest ether extract content 2.41% for brown and 1.4% for white. Siebenmorgen and Sun (1994) and Pal *et al.* (1999) reported that surface fat content was inversely related to the degree of milling.

High significant differences in ash content was recorded between the varieties as well as between brown and white rice in the same variety. The black variety contained the highest ash content (1.56 and 1.22%) for brown and white rice, respectively. Amorim *et al.* (2004) found that, the ash content in the rice was 0.4% . It was reported that, the ash content indicated the amount of minerals.

The data presented in the same table showed that, the white rice variety of Sakha 105 had the highest carbohydrates content in comparing with the other tested samples. In addition, carbohydrates content of rice samples was increased as a result of milling. These results may be due to the removal of the embryo and bran layer, to yield milled rice poor in fat, crude protein, fiber and ash. So, the level of available carbohydrates will be higher in milled rice than in brown rice (Singh *et al*., 2000 and Suwansri and Meullenet, 2004).

Minerals Content

The ash content of rice varieties was important to some extent, it contained the nutritionally important minerals. Some of these minerals are shown in Table (7). Potassium content was the highest element among **of** all the determined mineral contents. In addition, brown rice contained the highest mineral contents among all of the tested rice samples whereas, the rice variety of Black rice had a relatively high levels of mineral contents comparing with the other rice varieties. These results were in agreement with those reported by (FAO, 1993 and Abd El-Rassol *et al.,* 2005).

Table (7): Mineral contents of some rice varieties.

Rice variety	Treatment	P %	(mg/100g)					
			K	Na	Ca	Fe	Zn	Cu
Black	Brown	0.32	368	13.6	18.8	3.99	2.5	0.76
	White	0.21	134	7.6	10.3	2.1	1.5	0.50
Sakha 105	Brown	0.28	212	9.5	11.8	1.1	1.7	0.57
	White	0.17	74	6.6	6.5	0.7	1.2	0.44
E. yasmine	Brown	0.24	291	8.3	12.0	0.9	1.6	0.63
	White	0.15	113	6.3	7.9	0.6	1.0	0.52

Organoleptic Evaluation Of Prepared Biscuit

The results of organoleptic evaluation for the prepared biscuit were recorded in Table (8) and indicate that, the samples contained brown black rice flour at the level of 25% gave better scores for all characteristics compared with control (wheat flour biscuit) and other samples except the odor. In addition, the same table showed that no significant differences were found in texture for all biscuit samples. The samples contained 25% brown black rice flour and brown Sakha 105 rice flour had the highest values of color among of all the tested biscuit samples. Furthermore, the samples contained 50% brown Sakha 105 rice flour had lower scores for the color,

taste, odor, shape and overall acceptability compared with the other biscuit samples. The mean scores of overall acceptability for biscuit samples revealed that, the acceptability of control (wheat flour) and biscuit contained 50% flour brown rice variety of Sakha 105 had the lowest score among all of the biscuit samples.

Table (8): Organoleptic evaluation of biscuit prepared by substituting different levels of brown rice flour insted of wheat flour.

Sample	Color 20	Taste 20	Odor 20	Texture 20	Shape 20	Overall acceptability 100
Control	**16.8 b+**	**15.9 c+**	**17.0 b+**	**16.5 a+**	**15.2 c+**	**81.4 c+**
Black 25%	17.6 a	17.9 a	17.1 b	17.5 a	18.3 a	88.4 a
50%	16.85 b	16.2 bc	17.6 a	17.1 a	17.3 b	85.1 b
Sakha 25%	17.3 a	16.75 b	17.0 b	17.3 a	17.2 b	85.55 b
50%	16.25 c	15.41 c	17.2 b	17.1 a	15.9 c	81.86 c

+Values followed by the same letter in column are not significantly different at P ≤ 0.05

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دراسات طبيعية وكيماوية و تكنولوجية على بعض اصناف الارز المصرية

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اجريت هذه الدراسة بهدف تقييم اصناف الارز (الاسود – سخا ١٠٥ – ياسمين المصرى) من حيث الصفات الطبيعية والكيماوية والتكنولوجية وامكانية الاستفادة من دقيق الارز لتحل محل دقيق القمح فى صناعة بعض منتجات المخابز مثل البسكويت لتغذية الافراد ذوى الحساسية لجلوتين القمح.

واظهرت النتائج ما يلى:

- وجد ان هناك اختلاف فى الخواص الطبيعية للارز الشعير والبنى والابيض وذلك تبعا للصنف ووجد ان حبوب الارز للصنف ياسمين المصرى اكثر الاصناف فى الطول واقل الاصناف فى العرض بينما كان الصنف سخا ١٠٥ اكثر الاصناف فى وزن المائة حبة.
- وجد اختلاف فى نواتج الضرب بين الاصناف موضع الدراسة ففى الصنف ياسمين المصرى اعطى نسبة من الحبوب المكسورة واقل نسبة من الحبوب السليمة والارز الابيض مقارنتا بباقى الاصناف.
- بالنسبة للماء الممتص اثناء الطهى للارز المبيض كانت اعلى منها فى الارز المقشور وان الارز الاسود المقشور استغرق اطول فترة للطهى حوالى ٣٨ دقيقة مقارنة بباقى الاصناف.
- اختلفت قيم سيولة الجل فى حبوب الارز المقشور والمبيض تبعا للصنف.
- وجد ان هناك اختلافات فى قيم انتشار القلوى لحبوب الارز المقشور والمبيض وكانت قيم انتشار القلوى للارز المقشور اقل من الارز المبيض.
- الارز الاسود امتلك نسبة عالية من الاميلوز وكان اقل فى خصائص العجينة بالمقارنة بالصنف سخا ١٠٥.
- احتوى الارز الاسود على اعلى نسبة من المستخلص الاثيرى ـ الرماد ـ الالياف الخام واقل نسبة من الكربوهيدرات بالمقارنة بباقى الاصناف.
- اظهرت النتائج ان الارز المقشور لكل الاصناف احتوى على نسب اعلى من البروتين الخام والمستخلص الايثيرى والرماد والالياف الخام و نسيتة اقل من الكربوهيدرات الكلية مقارنة بالارز الابيض وان الارز الاسود احتوى على نسب اعلى من المعادن مقارنة بباقى الاصناف.
- اظهرت نتائج الخواص الحسية العضوية للبسكويت المصنع بنسيب استبدال من دقيق الارز **البنى** انه حتى ٥٠% استبدال كان المنتج مرغوب جدا لدى المتسهلك وان معظم العينات لها خواص حسية افضل من الكنترول.

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