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Supplementation of Gluten-Free Rice Flour with Yeast and Date Powder to Produce Rusk Rich in Selenium and Iron

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Abstract: Bakery products made with wheat flour are not suitable for people with gluten sensitivity or autism, so we have tended to produce rusks from rice flour with yeast and date powder to raise the quality of gluten-free product while remaining highly acceptable to consumers. Chemical, nutritional, physical and sensory characteristics of gluten-free rusks product from rice flour blends with different levels of yeast and date powder were studied. The chemical composition of raw materials and rice flour blends were measured. The results observed that the protein, fat, ash and fiber content were increased with the addition of yeast and dates powder from 5 to 15% levels. The best blends were achieved made from 70% rice flour, 15% yeast and 15% date powder to give rusk contained of 15.30 % protein, 1.43% ash, 2.75 fat and 1.65 fibers, respectively. The results also showed an increase in minerals content of rusk, resulting from increasing of yeast and dates powder. The high proportion of selenium yeast led to an increased selenium and iron rate in the rusk product, which increased from 1.56 and 1.34 mg100/g for rusks made of 90% rice flour, 5 yeast and 5% date powder to 3.77 and 2,06 mg/ 100g for rusks made of 70% rice flour, 15 yeast and 15% date powder. The results also showed that slight decreases in the sensory properties of rusks when increasing the addition of yeast and dates powder. Therefore, it could be recommended that the best sample of rusk was made from 80% and 90% of rice flour to the consumer. Moreover, the results showed a noticeable improvement in the physical properties of rusk with an increase in the ratio of adding yeast and dates powder to rice flour.
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1. Introduction

Autism spectrum disorders (ASD) is defined by the American Psychiatric Association as a biologically based neurodevelopment disorder characterized by deficits in social communication and interaction, and a restricted, repetitive pattern of behavior or activities **(American Psychiatric Association, 2013). Peretti *et al.* (2019)** reported that up to date, 1% of the world population has ASD, with a male-female ratio of 2.5:1. **El-Kour *et al.* (2020)** stated that for individuals with ASD, a nutritious, balanced diet can make a big difference in their ability to learn and process information. Some of the nutrition intervention strategies, as stated by **Mahan *et al.* (2012)**, include elimination diets such as gluten-free and casein-free diets, mineral and vitamin therapy, avoidance of certain common allergens, and supplementation with essential fatty acids and megavitamins.

Esteban-Figuerola *et al.* (2019) reported a significant decrease in the intake of protein, calcium, dairy products, selenium and vitamin D compared to the control group, but higher intakes of fruits and vegetables and vitamin B complex than the daily recommendations.

A survey of the parents of nearly 400 kids with autism, by **Pennesi and Klein, (2012),** found evidence that a gluten-free and casein-free (GFCF) diet improved symptoms such as hyperactivity, temper tantrums, problems with eye contact and speech skills, and physical ailments such as skin rashes and seizures for certain groups of children. Those who followed the diet closely stayed on it for at least 6 months or had a history of food allergies or digestive issues, such as chronic constipation and diarrhea showed the most improvement either. **Li *et al.* (2017)** suggested that it might also be helpful to supplement the diet of persons with ASD with probiotics/prebiotics, which can normalize the gut microbiota, enhance the gut barrier, and aid in relieve of symptoms and behaviors associated with ASD. A healthy and balanced nutrition should be encouraged in children with attention-deficit/hyperactivity disorder (ADHD) and autism.

Table (A) showed that some regional variation occurs in diagnosed children. It was also found that the majority of the sample (80%) lived in cities. Upon inquiring about the age stage in which the disease was observed and discovered among the infected children, it became clear that half of the children in the sample was diagnosed after the age of 3 years, while (45%) were from one year to two years. **Valicenti-McDermott et al. (2012)** showed that 57.5% of the mothers had a high level of education (university and above university). Also, the results show that the majority of participants (76.3%) denied having relatives with ASDs, while 20% acknowledged that it.

Mothers of autistic children reported that the child suffers from some gastrointestinal symptoms such as diarrhea and constipation at a rate of (13 and 65% respectively). These results are confirming work by **Li *et al.* (2017)** who reported that gastrointestinal symptoms tend to be very prominent in children with ASD. Constipation has been identified as one of the most common symptoms, up to 70%, as well as diarrhea (19%). This underlines the association between ASD and the increased permeability of the intestinal tract (leaky gut) which has been reported in recent studies **(Mahan *et al.*, 2012; Li *et al.*, 2017).**

Rice (*Oryza sativa*) is one of the most important staples in the daily meals of people around the world. It is the highest grain in agricultural production after maize (corn). Rice provides 27% of the total energy capacity in the developing countries and only 4% of the total energy capacity in the developed countries. The rice cereal has a high content of complex carbohydrates, cholesterol-free and is considered a source of protein, minerals, vitamins (Vit. B) **(Cristina and Cristina, 2008).**

Palm dates (*Phoenix dactylifera*) belong to the botanical family of *Arecaceae* that grows in subtropical climate areas especially Saudi Arabia and Egypt **(Al Tamim, 2014)**. Also, the same author showed that, palm dates fruits have high nutritious and functional rate regarding to their contents of moisture, total sugars, protein, fiber, fat and a lot of vitamins and minerals.

Demographic Data of Studied Children with Autistic Disorder

Demographic Data	**Present**
Sex	
Male	62.5
Female	37.5
Living	
Urban	80
Rural	20
Time Child Was Diagnosed	
<1 year	5
1-2 years	45
>3 years	50
Presence of Another Patient in the Family	
Yes	20
No	76.3
Don't Know	3.7
Mother Education Level	
Low	16.8
Intermediate	26.3
High	57.5
Breast Feeding	
Yes	60
No	40
Nutritional Problems	
Anemia	15
Diarrhea	13
Constipation	65
Food Allergies	30
Obesity	14
Other Problems	
Dental cavities	60
Hyperactivity	50

This research aims to investigate the effect of adding inactive dry yeast and date powder (5, 10 and 15%) in formulation to obtain a product rich in minerals and vitamins, especially iron and selenium with perfect physico-chemical and sensory properties which is suitable for gluten sensitive and autistic patents.

2. Materials and Methods

Materials

Rice flour sample, inactive dried yeast, date fruit and other ingredients for rusks were purchased from the local market at Mecca, Kingdom of Saudi Arabia.

Preparation of date powder:

Date flour was obtained by the method described by **Ikechukwu *et al.* (2017)**. The date palm fruit was cleaned and washing with water to remove adhering dirt, followed by removing of the seeds (De-pitting) of the fruit manually and cut into small pieces with the aid of a knife. The pulp was then oven-dried at 75ºC for 6 – 8 hours and subsequently milled using a hand milling machine and sieved through a 0.35mm mesh sieve to obtain fine homogenized particles. The date palm fruit meal was sealed in a cellophane bag and stored at room temperature.

Preparation of the blends:

Rice flour was well blended with date powder and inactive dried yeast with 1% xanthan gum to produce individual mixtures containing 5, 10 and 15 replacement levels to give three blends were contained of as in Table (1). All samples were stored in airtight containers and kept at 3–4°C until required.

Table (1). Recipe blends to prepare rusk gluten-free

Cookies formula	1	2	3
Rice flour	90	80	70
Inactive dried yeast	5	10	15
Date powder	5	10	15
Xanthan	1	1	1
Vegetable oil	3	3	3
Sugar	5	5	5
Salt	1.5	1.5	1.5

Chemical composition in raw materials and different rusks product:

A standard Association of Official Analytical Chemistry method, **AOAC (2005)** was adopted for estimating moisture, ash, crude fiber, crude fat and protein contents in raw materials and different rusks product. Total carbohydrates were calculated as: 100 - (protein + fat+ crude fiber + moisture + ash).

Baked of rusk blends

Rusks were formulated and prepared according to **Yaseen (2000)**. The rusk formula included 100 g blend flour, 1.5 g salt, 5 g sugar, 3.0 g vegetable oil and an adequate amount of water to obtain dough of optimum consistency. Flour samples and all ingredients were mixed in Hobart mixer (Model N50, Hobart, and Edmonton, Alberta, Canada). The dough was kneaded until reaching to maximum consistency, and then it was left for 20 min for resting. The dough was divided into pieces of 70 g (as pan capacity), then it was mechanically molded and put in a pan. Pan was left in the fermentation chamber (National Manufacturing Company, Lincoln, NE) for 90 min at 32 ± 1°C and 85% relative humidity and then was baked in a revolving reel oven (National Manufacturing Company, Lincoln) at 220 ±1°C for 25 min. The rusks were allowed to cool on racks for about 1h at room temperature (30°C±2).

Physical properties of different rusks product:

Rusks from supplemented flours were baked in triplicate samples. After removing from the oven, rusks were immediately weighed and then placed on a wire grid for about 2 h before the volumes were determined. Volumes of rusk were measured by the rapeseed displacement method as described by **Gupta *et al.* (2011)**. Specific volumes were calculated by dividing the volume by the weigh.

Mineral content analysis of rusk:

Se, K, Na, Ca, Fe, Zn, Fe and Cu contents of rusks were estimated using SP 19000 atomic absorption spectroscopy according to the standard methods described by **AOAC (2005)**

Sensory evaluation of different rusks product:

A panel of 10 judges evaluated the organoleptic characteristics of prepared rusks. They assessed color, appearance, odor, Structure and taste, using a 10-point hedonic rating scale ranging from like extremely (10) to dislike extremely (1) for each characteristic, as suggested by **Austin and Ram, (1971**). Sensory evaluation was done by 10 judges in the age group of 20 to 50 years, comprising of professional, student and consumers.

Statistical Analysis:

The obtained results were statistically analyzed using SPSS-10 software statistical package according to **Rattanathanalerk *et al.*, 2005,** analysis of variance (ANOVA). Duncan's multiple range test and least significant difference (LSD) was chosen to determine

any significant difference among various treatments at $p<0.05$.

3. Results and Discussion

Proximate Chemical Composition

The proximate chemical composition of rice flour, inactive dried yeast and date powder are presented in **Table (2)**. The obtained results revealed that rice flour recorded the highest moisture content being 11.92%, while inactive dried yeast and date powder had lower moisture content being 9.23 and 8.09%, respectively. These data are similar with those reported by **More *et al.*, (2013), AlTamim (2014) and Onofre *et al.*, (2017).**

On the other hand, the highest value of crude protein was recorded for inactive dried yeast followed by rice flour being 35.12 and 9.34 %, respectively. Meanwhile, date powder recorded the lowest crude protein value being 1.92%. The obtained data are in line with those obtained by **Onofre *et al.*, (2017)** who found that the yeast has a high protein content of over 40%. On the other hand, **El-Bana *et al.*, (2010)**; **Ragab *et al* (2012), More *et al.*, (2013), AlTamim, (2014)** mentioned that, rice flour contained about 7.65 – 10.08 % crude protein, while date powder contained low percentages of protein and ranged between 1.87and 3.23%. In the same direction, inactive dried yeast had the highest lipid, ash and fiber content being 2.98, 3.93 and 3.31%, respectively followed by date powder being 1.56, 1.78 and 2.14%, respectively. Meanwhile, rice flour had the lowest lipid, ash and fiber content being 0.76, 1.16 and 0.88%, respectively.

Table (2). Proximate composition of raw materials on dry weight.

Samples	Moisture	Protein	Ash	Fat	Fiber	Total carbohydrates
RF	11.92a ±0.11	9.34b ±0.07	1.16ab ±0.02	0.76b ±0.01	0.88c ±0.07	87.86a ±2.10
Y	9.23b ±0.13	35.12a ±0.91	3.93a ±0.01	2.98a ±0.12	3.31a ±0.13	55.66b ±1.15
DP	8.09c ±0.06	1.92c ±0.04	1.78ab ±0.08	1.56a ±0.11	2.14b ±0.09	92.50a ±3.17

Values are mean and SD (n = 3); where: Mean values in the same with the letter are significantly different at 0.05 levels. RF= Rice Flour Y= Yeast DP= Date Palm

Date powder recorded the highest values of carbohydrates being 92.50%. Meanwhile, rice flour and inactive dried yeast had the lowest carbohydrates being 87.86 and 55.66%, respectively. These values were within the range reported by **El-Bana *et al.*, 2010**; **Ragab *et al*, 2012; More *et al.* (2013); AlTamim, (2014) and Onofre *et al.* (2017).**

Proximate composition of rice flour blends

Oommen and Al-Omar, (2020) reported that maintenance of proper nutritional status may be considered as a key to the prevention of autism in children. They also stated there is a marked improvement in symptoms of autistic children when micronutrient deficiency is corrected. They referred that to the need for numerous nutrients for the growth and proper functioning of the brain. A healthy and balanced nutrition should be encouraged in children with attention-deficit/hyperactivity disorder (ADHD) and autism.

Also, the results in Table (3) showed that the chemical composition of the replacement of rice flour with 5, 10 and 15% inactive dried yeast and date powder caused slight and gradually decreased in moisture content, and also may be caused an increase in crude protein from 10.74% (for rice flour with 5% yeast and date powder) to15% (for rice flour with 15% yeast and date powder). The increased of crude protein values in rice flour replaced by different levels with yeast and date powder may be as a result of yeast having a high percentage of crude protein rather than of rice flour and date powder as shown in Table (3).

Table (3). Proximate composition of rice flour blends.

Blends	Moisture	Protein	Ash	Fat	Fiber	Total carbohydrates
1	11.30a ±0.10	10.74c ±0.11	1.33c ±0.00	0.87ab ±0.03	0.93a ±0.04	86.13a ±0.92
2	11.02a ±0.19	13.14b ±0.02	1.96b ±0.02	0.94a ±0.04	1.01a ±0.05	81.95a ±2.40
3	10.40b ±0.08	15.00a ±0.03	2.55a ±0.03	1.29a ±0.08	1.28a ±0.02	80.28a ±1.10

Values are mean and SD (n=3); where: Mean values in the same with the letter are significantly different at 0.05 levels.

Likewise, lipids, crude fiber and ash content were gradually increased as the level of replacement increased. This is due to the higher contents of these components in yeast and date powder. Lipids, crude fiber and ash content increased from 0.87, 0.93 and 1.33% for rice flour replacement with 5% yeast and date powder to 1.29, 1.28 and 2.55 % for rice flour replacement with 15% yeast and date powder, respectively.

Concerning carbohydrates data present in **Table (4)**, it seems evidence that there is no noticeable difference within the carbohydrates content as a result of using the different suggested levels of yeast and date powder. These results are consistent with what the researchers reported as mentioned previously, the high content of chemical elements in date powder and yeast led to an increase in the nutritional value of the resulting blend flours. **Ikechukwu *et al.*, (2017)** found that the addition of date palm fruit to cereal flour increased the sugar content and increased nutritional value and significantly reduced the water absorption capacity of the different flour ratios used in this work thereby making the dough handling very difficult. Also, **Salem and Asael, (2016)** showed an increase in couscous samples supplemented with inactive dried yeast in all nutrition parameters compared with control sample made from wheat durum flour.

Minerals content of different rusks

Macro-and micro-elements content of the rusk blends are given in **Table (4)**. Data showed that major minerals (K, Ca and Na) and minor elements (Se, Cu, Fe and Zn) were increased with all treatment 1, 2 and 3. The results show an increase in the percentage of all mineral elements with an increase in the replacement rate from 5 to 15%. According to date powder and yeast addition (Se, K, Na, Ca, Fe, Zn, Fe and Cu), contents increased from 1.56, 172,30, 10.74, 15.24, 1.34, 1.63 and 0.67mg/100 g for rusk made of rice flour with 5% yeast and date powder to 3.77, 216.93, 13.98, 22.14, 2.06, 2.00 and 1.16 mg/100 g in rusk sample containing 15% yeast 15%, date powder, respectively. This increase in the proportion of mineral elements is due to the high percentage of mineralin the date powder. **Ragab *et al.*, (2011), AlTamim, (2014) and Ikechukwu *et al.*, (2017)** indicated that dates are rich in mineral content. Also, the increase in minerals with added yeast was compatible with **Bekatorou *et al.*, (2006)**. They found that, yeast is an excellent source of Ca, P, K, Mg, Cu, Fe, Zn, Mn and Cr and has been studied extensively for its medicinal properties. The increase in mineral content is mainly due to ash content provided by the added ingredients (inactive dried yeast). In the same line, **(Crawshaw, 2004)** noted that, inactivated yeast is highly valuable source of protein, mineral.

Table (4). Mineral contents of different rusks product (mg/ 100g).

Rusks	Se	K	Na	Ca	Fe	Zn	Cu
1	1.56ab ±0.08	172.3c ±1.23	10.74b ±0.78	15.24c ±1.76	1.34a ±0.14	1.63a ±0.09	0.67a ±0.01
2	2.35a ±0.21	194.52b ±2.39	12.14a ±0.23	18.63b ±1.34	1.72a ±0.08	1.84a ±0.03	0.92a ±0.04
3	3.77a ±0.45	216.93a ±2.38	13.89a ±1.28	22.14a ±0.69	2.06a ±0.10	2.0a ±0.00	1.16a ±0.08

Values are mean and SD (n = 3); where: Mean values in the same with the letter are significantly different at 0.05 levels.

Table (5). Vitamin contents of different rusks product

Rusks	Thiamine	Riboflavin	Niacin	Pantothenic acid
1	0.46b ±0.05	0.59b ±0.02	2.37a ±0.05	0.57ab ±0.06
2	0.56b ±0.00	0.92b ±0.10	2.40a ±0.02	0.88a ±0.06
3	1.09a ±0.03	1.70a ±0.11	2.66a ±0.09	1.30a ±0.07

Values are mean and SD (n = 3); where: Mean values in the same with the letter are significantly different at 0.05 levels.

Vitamin content of different rusks product

Results of vitamins analysis of rusk samples made of rice flour with different levels of yeast and date powder are shown in **Table (5)**, the results showed the same trend of the results of mineral**.** The content of vitamins (thiamine, riboflavin, niacin and pantothenic acid) increased with the addition of date powder and inactive dried yeast. Thiamine, riboflavin,

niacin and pantothenic acid increased from 0.46, 0.50.2.37 and 0.57 mg/100g for rusks made of rice flour with 5% date powder and 5% inactive dried yeast to 1.09, 1.7, 2.66 and 1.30 mg/100g, for rusks made of rice flour with 15% date powder and 15% inactive dried yeast respectively. These results may be due to the high vitamin content of yeast and date powder.

The results of this research are confirmed by **Agboola and Adejumo, (2013)** they found that, the date is very rich in vitamins such as vit C followed byriboflavin and thiamine. Also, **Onofre *et al.*, 2017** they mentioned that nutritional yeast is rich in many basic nutrients such as the B vitamins, chromium, sixteen amino acids, fourteen or more minerals, and seventeen vitamins.

Sensory evaluation of different rusks product

The effect of partial replacement with different ratio of both inactive dried yeast and date powder on the organoleptic quality characteristics of produced rusks is presented in **Table (6)**. From the sensory evaluation results, it could be seen that with the increase in the level of the inactive dried yeast and date powder in rice flour formulation used in rusks making, the sensory scores for color, odor and appearance of biscuit decreased, which were 9.95, 9.30 and 9.46 respectively.

Table (6): Sensory characteristics of fresh rusks product

Samples	General appearance (10)	Color (10)	Odor (10)	Taste (10)	Structure (10)
1	9.46a ±0.13	9.95a ±0.23	9.30a ±0.25	9.58a ±0.07	9.36a ±0.14
2	9.30a ±0.11	9.70a ±0.12	9.24a ±0.03	9.66a ±0.03	9.40a ±0.21
3	9.18b ±0.08	9.38b ±0.13	8.88b ±0.10	8.89b ±0.08	9.25ab ±0.13

Values are mean and SD (n = 3); where: Mean values in the same with the letter are significantly different at 0.05 levels.

Replacement of rice flour with 10% inactive dried yeast and 10% date powder was not significantly affected compared with rusk samples (1), which nearly observed the same score of rice sample (1), in addition to that rusks made from blends containing 10% inactive dried yeast and 10%date powder had maximum taste (9.66) and structure (9.40) acceptability. Whereas rusk samples containing 15% inactive dried yeast and 15%date powder were found to be unacceptable to the panelists.

Changes in color and taste of rusks may be due to aroma volatiles in raw materials (inactive dried yeast and date powder) used. The obtained results arein agreement with **Salem and Asael, (2016)** they mentioned that, couscous samples with 10% inactive dried yeast had acceptable characteristics, but less acceptable compared with couscous made of durum flour and that with 5% inactive dried yeast. In this study, taste improvement may be due to date powder which helped to improves the taste of the rusk as it is high in sugars.

Generally, it could be concluded that replacement of rice flour with inactive dried yeast and date powder gave good rusks in sensual qualities up to 10% inactive dried yeast and %10 date powder.

Physical properties of different rusks product

The physical measurements as, weight, volume and density of the rusks produced affected by addition of either inactive dry yeast and date powder are showed in **Table (7)**. It could be observed that, the rusk samples (1) which is prepared from 90% rice flour with 5% inactive dry yeast and 5% date powder had a weight of 53.2g and volume of 130 $cm^3$and density of 0.41 cm^3/g. Concerning the weight and volume of rusks, we noticed that, weight increased from 53.2 to 61.0g and from 130 to 137 cm3 for volume with the addition of yeast and dates powder. The obtained results of indicated that there were significant differences (P>0.05) between all samples except for the density. These results are in agreement with that obtained by **Gomez *et al.*, (2008)** mentioned that, flour which presented higher protein content could affect the baked product characteristics, especially volume. Also**, (Chen *et al.*, 1988)** found that, the increase in biscuit weight may be due to the increase fiber content which is characterized by higher water holding capacity. This explains the reason for the increase in volume and weight of the rusk with the addition of yeast and date powder increased this is due to the high proportion of protein and fiber content.

As expected, the values of density recorded a similar trend as that of volume. The highest values of density were recorded in rusks produced for rice flour replacement with 15% yeast and 15% date powder, these values were 0.41, 0.43 and 0.44 cm^3/g, respectively.

Finally, it is clear that, in active dry yeast and date powder could be successfully added to rice flour to produce rusks without any unfavorable change and excellent results in terms of physical properties.

Table (7): Physical measurements of rusk prepared by rice flour supplemented with inactive dried yeast and date powder

Blends	Weight (g)	Volume (cm^3)	Density (cm^3/g)
1	53.2c ±1.13	130c ±1.02	0.41a ±0.03
2	58.0b ±0.43	133b ±2.11	0.43a ±0.02
3	61.0a ±0.29	137a ±0.93	0.44a ±0.01

Values are mean and SD (n = 3); where: Mean values in the same with the letter are significantly different at 0.05 levels.

Chemical composition of different rusks product

Proximate chemical composition of rusks prepared from blend flour samples are showed in **Table (8)**. From the results of the table, it showed that, rusk samples (1) contained 3.83% moisture, 4.95% crude protein, 2.40% lipids, 1.26% ash, 1.05% crude fiber and 79.35 % carbohydrate. From the same table, we note that, protein content from different rusk samples increased as the percentage of inactive dried yeast and date powder raised. Similarly, lipids, ash and crude fiber contents of rusk samples were raised as increasing the substitution level of rice flour by of inactive dried yeast and date powder. This increment in protein content was greatly influenced by the addition of inactive dried yeast, while in case of date powder the increase in crude protein values was not influenced**.** At the same time, carbohydrate was gradually decreased as the level of substitution levels increased.

These results are in agreement with **Sulieman *et al*., (2011) and El-Sharnouby *et al*., (2007)** they found that, the use of date powder as a substitute for cereal flour in producing bakery products led to an increase in ash, fiber and lipids in the resulting baked product. They also mention that, the reduction in protein in biscuit supplemented sample could be attributed to the small amount of protein in date fruit.

In general, adding yeast and date powder to rice flour led to improvement in the chemical properties of the resulting rusks, which contributes to the nutritional status of gluten sensitivity and autistic patients.

Table (8). Proximate chemical composition of different rusk product on dry weight (g/100g)

Samples	Moisture	Crude Protein	Lipids	Crude fiber	Ash	Carbohydrate
1	4.83a ±0.10	10.91c ±0.28	2.40b ±0.02	1.05b ±0.00	1.26b ±0.02	79.35a ±0.44
2	4.95a ±0.03	13.60b ±0.00	2.67a ±0.08	1.58a ±0.05	1.39a ±0.03	75.81a ±0.34
3	5.20a ±0.13	15.30a ±0.11	2.75a ±0.10	1.65a ±0.12	1.43a ±0.01	73.67b ±0.19

Values are mean and SD (n = 3); where: Mean values in the same with the letter are significantly different at 0.05 levels.

5. Conclusion

The study aimed to produce gluten-free rusk with high nutritional value, thus rice flour was chosen to produce gluten-free rusk with the addition of date powder and yeast to increase the nutritional value. The results showed improvement in all nutrients, whether chemical elements, mineral elements or vitamins, with good physical properties. The organoleptic results showed excellent results for rusks made of rice flour to the level of 10% date powder and 10% yeast, with significant improvement in the nutritional properties.

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