

Effect of Using Oat and Yellow Maize Flour on Sensory and Physical Properties of Rusk Fingers

By

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Abstract

The present investigation was carried out to analyze and compares the nutritional values, physic- chemical properties of rusk fingers prepared from two flour oat and yellow maize by levels 10,20,30% .It also aimed to study the effect of adding methods on the sensory characteristics and physical properties of prepared rusk fingers. Results indicated that moisture content increased for wheat flour (13.00 ± 0.01 g/100g) . Wheat flour and oat flour recorded the highest value of protein (11.40 ± 0.01 and 11.50 ± 0.15 g/100g, respectively), oat flour recorded the highest value of fat (8.90 ± 0.11 g/100g). Oat and yellow maize flour were rich in ash , fiber content and energy. Using oat and yellow maize flour decreased moisture content of product. Rusk fingers prepared using 10% oat flour was recorded the highest value of protein (12.29 ± 0.04). The highest value of fat was recorded in rusk fingers with 30% oat flour (6.34 ± 0.02 g/100g) . Using oat and yellow maize flour increased ash , fibers content ,while decreased carbohydrates content . Rusk fingers prepared using 10,20 % oat flour and rusk fingers prepared using 30% yellow maize flour recorded the highest value of total calories. All samples were accepted. Using oat and yellow maize flour effected on physical properties of rusk fingers. It can be recommended that the oat and yellow maize flour can be utilized in preparation of rusk finger until 30/70 substitution levels with wheat flour to improve nutritional values, sensory characteristics and physical properties of some bakery products.

Key words: Chemical composition, caloric value, sensory evaluation and physical properties.

Introduction

Bakery products are widely consumed and are becoming a major component of the international food market (**Kotsianis et al., 2002**).Cereals and their products constitute an important part of the human diet, providing a high proportion of carbohydrates, proteins, fats, dietary fiber, B-group vitamins and minerals. More and more foods are made from whole grain (**Okarter and Liu, 2010**). Oat (*Avena sativa* L.) had long been recognized as a natural ingredient of functional foods because they provide dietary fiber, good protein, unsaturated lipids, vitamins, minerals components and antioxidants required for human health (**Jones ,2002**). Oats are an excellent food for lowering cholesterol and reducing risk of heart disease because of the high soluble fiber content (**Lifschitz et al., 2002**).Oats are an important source of nutrients; they contain protein, carbohydrates and dietary fiber fractions required for a balanced human diet. Likewise, oats were mainly used as feed for animals, but recent findings

had pointed out new possibilities for the health-promoting properties of oats and oat products (**Brennan and Cleary, 2005**).

Rooney and Serna, (2003) reported that maize (*Zea mays* L.) is one of the most important crops cultivated worldwide due to its huge versatility and multiple uses such as food, forage and industrial purposes. In Latin America, Asia and Africa, it is used for the preparation of traditional foods but in recent years, in Western countries, the use of this crop for gluten-free foods has increased due to the increase in consumption of gluten free foods. Maize is a good source of starch, proteins and lipids, and it also contains several bioactive compounds that are important for human health (**Nuss and Tanumihardjo, 2010**). **Kumari, (2019)** pointed to the corn flour, derived from ground maize kernels, is a versatile and widely used ingredient in the world. Known for its distinctive yellow hue, corn flour offers a mild, slightly sweet flavor that complements a variety of dishes This finely ground flour is a key ingredient in numerous traditional dishes worldwide, including tortillas, cornbread, and various baked goods (**El Khoury et al., 2018**). It is valued not only for its role in creating delicious and textured foods but also for its nutritional content, featuring essential nutrients like fiber, vitamins and minerals. As a staple in many cuisines, corn flour continues to be a fundamental component, contributing both flavor and nutritional benefits to a diverse range of culinary creations (**Woomer and Adedeji, 2021**).

The objective of the present study were to analysis and compare investigation the effect of adding methods of oat and yellow maize flour (10,20 and 30%) on chemical composition, nutritional values, sensory and physical properties change of rusk fingers prepared of oat and yellow maize flour.

Materials and methods

Materials:

Wheat flour (72% extraction rate) was obtained from Al Doha Company , 10th Ramadan, Egypt, yellow maize flour was obtained from Dobella Company, the other ingredients such as yeast, oil, salt and sugar were purchased from local markets, Kafrelsheikh City, Egypt. Chemicals used for gross chemical composition determination were purchased from Algmhoria Company, Egypt.

Methods

Preparation of oat flour

Oat seeds were collected from Sakha Agricultural Research Station, Kafrelsheikh city, Egypt, and ground with a grinder (Moulinex, France) , and then stored in polyethylene bags until use.

Preparation of rusk fingers

Rusk fingers were prepared using the method as described (Yaseen, 2000) with some modifications. Yeast and water were mixed in a bowl and kept for 30 min then sugar was added for activation of the yeast. Flour and other ingredients except oil were added to the yeast water solution. Oil was added last. Mixing was carried out for 10-12 min with Kneader(Kenwood, KHH05.0SI). Two-stage proofing was carried out. First proofing for 105 minutes, knock back, and a further 45 minutes second proofing. Dough were shaped in fingers .Baking was done at 200°C for 15 minutes and rusk fingers were left to cool. The rusk fingers were made by using standard

Table (A). Formula of procedure.

rusk finger prepared of different levels of oat and yellow maize flour as compared with control .

Ingredient	Control	Rusk finger prepared using 10% oat flour	Rusk finger prepared using 20% oat flour	Rusk finger prepared using 30% oat flour	Rusk finger prepared using 10% yellow maize flour	Rusk finger prepared using 20% yellow maize flour	Rusk finger prepared using 30% yellow maize flour
Wheat flour	100	90	80	70	90	80	70
Oat flour	---	10	20	30	----	----	----
Yellow maize flour	---	----	---	---	10	20	30
Corn oil	48	48	48	48	48	48	48
Yeast	10	10	10	10	10	10	10
Sugar	10	10	10	10	10	10	10
Salt	5	5	5	5	5	5	5
Water	48	48	48	48	48	48	48

Proximate chemical composition

Oat , yellow maize flour and rusk fingers were analyzed for chemical composition. All analyses were carried out in triplicate. Moisture, crude protein, fat, ash and fiber content were determined according to (A.O.A.C., 2005). Carbohydrate contents were estimated by difference. Total calories (Kcal) were calculated by differences according to (James ,1995).

Sensory evaluation

Rusk fingers were cooled for 1-2 h at room temperature (25±3 ° C) in a sealed plastic bag. Sensory evaluation of prepared rusk fingers was evaluated by 20 trained panelists for appearance, taste, flavor, inter color, external color, crispness, texture and acceptance. The sensory evaluation was conducted after approval by the Scientific Research Ethics Committee for the Humanities, Social Sciences, and Arts, Kafrelsheikh University, to use humans in sensory evaluation. Samples were evaluated using a 9- point hedonic scale (1= dislike very much to 9= like very much) (Eneche, 1999).

Physical properties

Physical properties of fortified rusk fingers were evaluated for weight, width, thickness and spread ratio. Weight (g) were measured by using sensitive balance (WJ, china), the width, thickness of the products were measured to the nearest (cm) and the spread ratio were calculated according to (A.A.C.C., 1983). The spread ratio was calculated as follows: Spread ratio (cm) = width (cm)/ thickness (cm). All objective measurements were done on triplicates and the average value was calculated.

Statistical analysis:

The data were statistically analyzed using SPSS 16.0 software. Means and standard deviations were determined using descriptive statistics. Comparisons between samples were determined using analysis of one-way variance (ANOVA) and multiple range tests. Statistical significance was defined at $P \leq 0.05$. The data were analyzed using SPSS (version 28) according to Steel and Torrie (1980).

Estimation amounts of prepared rusk fingers (g) consumed to cover male adults requirements of protein and caloric levels

The G.D.R of energy (g) were calculated using the equation reported by (FAO/WHO/UNU,1985).

$$\text{G.D.R (g)} = \frac{\text{Energy daily requirements of male adults (2900 k.cal./day)}}{\text{Energy value (k.cal/100g food)}}$$

Number of grams consumed of prepared rusk fingers to cover the daily requirements of protein for male adults (25-50 years) were calculated using the daily requirements for male adults (63g) as given by (N.R.C.F.N.,1989). The G.D.R of protein (g) was calculated using the equation given by (FAO/ WHO/ UNU ,1985).

$$\text{G.D.R of protein (g)} = \frac{\text{Protein daily requirements of male adults (63g/day)}}{\text{Protein content (g /100g food)}}$$

Results and Discussion

Chemical composition of wheat flour ,oat and yellow maize flour

Chemical compositions of wheat flour ,oat and yellow maize flour showed in Table (1), the results indicated that moisture content increased significantly for wheat flour (13.00 ± 0.01 g/100 g compared with oat and yellow maize flour (10.45 ± 0.01 and 10.77 ± 0.02 g/100 g), respectively. Protein recorded the highest value for wheat flour and oat flour (11.40 ± 0.01 and 11.50 ± 0.15 g/100 g), respectively. Fat recorded the highest value for oat flour (8.90 ± 0.11 g/100 g) compared with (1.10 ± 0.02 and 3.88 ± 0.10 g/100 g), respectively for oat and yellow maize flour .Oat and yellow maize flour were rich significantly in ash content (2.12 ± 0.15 and 1.82 ± 0.01 g/100 g), respectively compared with control (0.58 ± 0.01 g/100 g). Oat and yellow maize flour were rich significantly in crude fiber content (5.77 ± 0.11 and 2.85 ± 0.01 g/100 g), respectively compared with (0.94 ± 0.01 g/100 g). Oat flour recorded the highest value of carbohydrates (71.71 ± 0.10 g/100 g). Oat and yellow maize flour recorded the highest value of energy (412.94 ± 0.15 and 400.72 ± 0.11 k.cal/100 g.).

Oats are an excellent protein source among cereal crops. High protein content (12–17%) enable oats to be an ideal nutritional ingredient for both animals and humans (Mäkinen *et al.*,2017). Oat is considered to be a potential source of low cost protein with good nutritional value. Results in the same line with (Klose *et al.*,2009) who found that oat has a unique protein composition along with high protein content of 11–15 %. Oat is a good source of lipids. It contains much higher levels of lipids than other cereals which are excellent sources of energy and unsaturated fatty acids. The majority of lipids of oats are in the endosperm. The fat content of oat ranges from 5.0 to 9.0 % of the total lipid content (Keying *et al.*, 2009).

Amira *et al.*,(2015) studied the chemical composition of wheat and oat flour , they found that , the highest fat, fiber and ash recorded with oat flour compared with Shaista *et al.*, (2017) wheat flour.

studied chemical composition of white maize , they found that, in the dry weight basis white maize flours significantly ($p < 0.05$) contained moisture 9-15 %, ash 1.4-2.6%, protein 7.82-12.02%, crude fiber 0.95-2.01%, and total carbohydrates 65.38-78.74% and yellow maize flour significantly ($p < 0.05$) contained moisture 17%,ash 3.3%, protein 12.45%, crude fiber 2.97%, and total carbohydrates 60.23% (Comparative study for the determination of nutritional composition in commercial and noncommercial maize flours.

Table (1):Gross chemical composition of wheat flour ,oat and yellow maize flour as (g/100 g)

Chemical composition	Wheat flour	Oat flour	Yellow maize flour
Moisture	13.00±0.01 a	10.45 ±0.01c	10.77 ±.02b
Crude protein	11.40±0.01 b	11.50 ±0.15 a	9.56±0.10 c
Crude fat	1.10±0.02 c	8.90± 0.11a	3.88±0.10 b
Ash	0.58±0.01 c	2.12± 0.15 a	1.82±0.01 b
Crude fiber	0.94±0.01 c	5.77±0.11 a	2.85 ±0.01b
Carbohydrates	85.98. ±0.02 a	71.71±0.10 c	81.89±0.01 b
Energy (k.cal./ 100g)	399.42±0.01 c	412.94± 0.15a	400.72± 0.11 b

Mean values in the same column which are not followed by the same letter indicate significant difference at $P < 0.05$.

Gross chemical Composition of rusk fingers

Table (2) cleared the chemical composition of rusk fingers .The results cleared that control sample was the highest value in moisture content as it recorded 12.31±0.01 g/100 g, it was observed that using oat and yellow maize flour in preparing rusk fingers decreased moisture content , it may be due to moisture content in oat and yellow maize flour (Table.1). Significant differences at $P < 0.05$ were found between treated samples for moisture content. The highest value of protein were

found in rusk finger prepared using 10% oat flour and rusk finger prepared using 10% yellow maize flour (12.29 ± 0.04 and 11.76 ± 0.07 g/100 g), respectively. Significant differences at $P < 0.05$ were found among treated samples for protein. The highest values of fat were found in rusk fingers with 30% oat and yellow maize flour (6.34 ± 0.02 and 4.24 ± 0.02 g/100 g), respectively. Significant differences at $P < 0.05$ were found between samples compared with control. Using oat and yellow maize flour increased ash content, it may be due to ash content in oat and yellow maize powder (Table.1). Fibers content cleared significant differences at $P < 0.05$ between rusk finger samples compared with control. Using oat and yellow maize flour increased fibers content of rusk fingers. Results were in agreement with **Bajpai et al., (2018)** reported that the incorporation of oat makes cake rich in fiber content. Carbohydrates decreased by using oat and yellow maize flour. **Sangwan et al., (2014)** studied the chemical composition of .Oats provide more protein, fiber, iron and zinc than other whole grains. They have high nutritive value both for people and animals because of good taste and an activity of stimulating metabolic changes in the body **Hoda et al.,(2018)** found that cake produced with oat flours it were characterized with their higher content of moisture, ash, fiber and total carbohydrate and their lower content in protein compared with control. Results were in agreement with **Yasmin et al., (2023)** who used yellow corn flour in biscuit production and found that it could increase the fiber, fat and ash contents of the product.

Table (2) : Gross chemical composition of rusk finger prepared of different levels of oat and yellow maize flour as compared with control as (g / 100 g)

Samples	Moisture	Crude Protein	Crude fat	Ash	Crude fibers	Carbohydrates
Control	12.31±0.01 b	11.70±0.03 c	3.05±0.02 g	0.67±0.01 e	0.80±0.01 g	83.78±0.05 a
Rusk finger prepared using 10% oat flour	8.71±0.01 e	12.29±0.04 b	4.87±0.06 c	1.14±0.01 b	1.79±0.02 c	79.91±0.03 d
Rusk finger prepared using 20% oat flour	12.81±0.07 a	11.65±0.01 d	5.61±0.01 b	1.16±0.01 b	2.81±0.02 b	78.77±0.12 e
Rusk finger prepared using 30% oat flour	7.73±0.30 f	11.14±0.02 a	6.34±0.02 a	1.27±0.06 a	3.84±0.02 a	77.41±0.24 f
Rusk finger prepared using 10% yellow maize flour	12.01±0.07 b	11.76±0.07 c	3.22 ±0.02 f	0.83±0.01 d	0.90±0.01 f	83.29±0.19 c
Rusk finger prepared using 20% yellow maize flour	9.76±0.25 d	10.91±0.07 e	3.63±0.03 e	0.93±0.02 c	1.02±0.01 e	83.51±0.28 b
Rusk finger prepared using 30% yellow maize flour	10.20±0.20 c	10.01±0.01 f	4.24±0.02 d	0.97±0.02 c	1.14±0.02 d	83.64±0.49 b

Mean values in the same column which are not followed by the same letter indicate significant difference at $P < 0.05$.

Caloric values of prepared rusk fingers

Table (3) showed caloric value of rusk fingers. Rusk fingers prepared using 10% oat flour and rusk fingers 10% yellow maize flour had the highest values of protein calories (49.16 ± 0.10 and 47.04 ± 0.10 k.cal./100g, respectively), it may be due to its protein content (Table.1). Significant differences at $P < 0.05$ were found among prepared samples for protein calories. Rusk fingers prepared using 10,20 and 30% oat flour recorded the highest value of fat calories (43.83 ± 0.15 , 50.49 ± 0.02 and 57.06 ± 0.00 k.cal./100g, respectively), it may be due to fat content in oat flour (Table.1). Significant differences at $P < 0.05$ were found among samples compared with control. Control recorded the highest value of carbohydrates calories (335.12 ± 0.10 k.cal./100g), it may be due to its carbohydrates content (Table.1). Significant differences at $P < 0.05$ were found among samples prepared with oat flour. Non-significant differences at $P < 0.05$ were found between rusk finger prepared using 20,30% yellow maize flour compared with control. Rusk fingers prepared using 10,20 % oat flour and rusk fingers prepared using 30% yellow maize flour recorded the highest value total calories (412.63 ± 0.10 , 412.17 ± 0.02 and 412.76 ± 0.06 k.cal./100g, respectively). Non-significant differences at $P < 0.05$ were found between rusk finger prepared using 10% , 20 oat flour and rusk finger prepared using 30% yellow maize flour. Non-significant differences at $P < 0.05$ were found between rusk finger prepared using 30% oat flour, rusk finger prepared using 10% yellow maize

flour compared with control. Results were in agreement with **Van and Tran, (2012)** who found that substitution of wheat flour by corn flour in preparation of biscuits resulted in improvement of its nutritional values as chemical composition.

Table (3): Caloric values of prepared rusk fingers prepared of different levels of oat and yellow maize flour as compared with control (k.cal./100 g)

Sample	Sources of calories			Total caloric values
	Protein	Fat	Carbohydrates	
Control	46.80±0.01c	27.45±0.01 g	335.12±0.10 a	409.37±0.06 c
Rusk finger prepared using 10% oat flour	49.16±0.10 a	43.83±0.15 c	319.64±0.15 c	412.63±0.10 a
Rusk finger prepared using 20% oat flour	46.60±0.02c	50.49±0.02 b	315.08±0.03 d	412.17±0.02 a
Rusk finger prepared using 30% oat flour	44.56±0.01d	57.06±0.00 a	309.64±0.11 e	411.26±0.03 c
Rusk finger prepared using 10% yellow maize flour	47.04±0.10 b	28.98±0.01 f	333.16±0.10 b	409.18±0.07 c
Rusk finger prepared using 20% yellow maize flour	43.64±0.02e	32.67±0.02 e	334.04±0.15 a	410.35±0.05 b
Rusk finger prepared using 30% yellow maize flour	40.04±0.03f	38.16±0.10 d	334.56±0.10 a	412.76±0.06 a

Mean values in the same row which are not followed by the same letter indicate significant difference at $P < 0.05$.

Sensory evaluation of rusk fingers prepared using oat and yellow maize flour

Table (4) showed the sensory evaluation of rusk fingers. It is evident from the results that control, rusk fingers prepared using 20,30% oat flour and rusk fingers prepared using 20 and 30% yellow maize flour recorded the highest value of appearance ($7.50 \pm 0.01, 7.60 \pm 1.10, 7.50 \pm 1.17$ and 7.70 ± 1.15 , respectively) for appearance.

Control, rusk fingers prepared using 10% and 20% oat flour recorded the highest value of taste ($8.00 \pm 0.94, 8.00 \pm 0.94$ and 7.90 ± 1.44 , respectively) and flavor ($7.70 \pm 1.15, 8.00 \pm 1.05$ and 7.80 ± 1.47 , respectively). Internal color value improved with increasing oat and yellow maize levels, rusk fingers prepared using 20,30% oat flour, 20 and 30% yellow maize flour recorded the highest value of internal color ($7.90 \pm 0.87, 8.10 \pm 0.73, 7.60 \pm 1.42$ and 8.10 ± 1.28 , respectively) compared with control (7.40 ± 1.42). External color improved with increasing oat and yellow maize levels, as it recorded the highest value for rusk fingers prepared using 20,30% oat

flour, 20 and 30% yellow maize flour (7.60 ± 1.42 , 8.40 ± 0.84 , 7.80 ± 1.22 and 7.90 ± 1.28 , respectively) compared with control (7.30 ± 0.94). Crispness improved with increasing oat and yellow maize levels, as it recorded the highest value for rusk fingers prepared using 20,30% oat flour, 20 and 30% yellow maize flour (7.80 ± 1.03 , 8.20 ± 1.03 , 7.50 ± 1.35 and 7.70 ± 1.41 , respectively) compared with control (7.00 ± 1.05). For texture, control and rusk fingers prepared using 20 and 30% oat flour recorded the highest value (7.90 ± 0.99 , 7.70 ± 1.25 and 8.10 ± 0.99 , respectively), while texture values decreased with increasing yellow maize. All samples were accepted. Non-significant differences were found between samples. These results were in the same line of **Hoda et al.,(2018)**. A good taste and an activity of stimulating metabolic changes in the body make nutritive value of oats high for both people and animals (**Peterson, 2004**).

Table (4): Sensory evaluation of rusk fingers prepared of different levels of oat and yellow maize flour as compared with control

Sensory evaluation	Control	Rusk finger prepared using 10% oat flour	Rusk finger prepared using 20% oat flour	Rusk finger prepared using 30% oat flour	Rusk finger prepared using 10% yellow maize flour	Rusk finger prepared using 20% yellow maize flour	Rusk finger prepared using 30% yellow maize flour
Appearance	7.10 ± 0.99 a	7.30 ± 1.15 a	7.50 ± 0.01 a	7.60 ± 1.50 a	7.30 ± 1.49 a	7.50 ± 1.17 a	7.70 ± 1.15 a
Taste	8.00 ± 0.94 a	8.00 ± 0.94 a	7.90 ± 1.44 a	7.70 ± 1.15 a	6.50 ± 1.43 a	6.90 ± 1.66 a	7.20 ± 1.39 a
Flavor	7.70 ± 1.15 a	8.00 ± 1.05 a	7.80 ± 1.47 a	7.40 ± 0.96 a	7.20 ± 1.68 a	7.25 ± 1.49 a	7.30 ± 1.49 a
Internal color	7.40 ± 1.42 a	7.80 ± 1.31 a	7.90 ± 0.87 a	8.10 ± 0.73 a	7.50 ± 0.82 a	7.60 ± 1.42 a	8.10 ± 1.28 a
External color	7.30 ± 0.94 a	7.40 ± 1.26 a	7.60 ± 1.42 a	8.40 ± 0.84 a	7.50 ± 1.43 a	7.80 ± 1.22 a	7.90 ± 1.28 a
Crispness	7.00 ± 1.05 a	7.70 ± 1.41 a	7.80 ± 1.03 a	8.20 ± 1.03 a	7.20 ± 1.39 a	7.50 ± 1.35 a	7.70 ± 1.41 a
Texture	7.90 ± 0.99 a	7.60 ± 1.70 a	7.70 ± 1.25 a	8.10 ± 0.99 a	7.50 ± 1.50 a	7.40 ± 1.35 a	7.20 ± 1.61 a
Acceptance	7.90 ± 0.99 a	7.30 ± 1.63 a	7.88 ± 1.22 a	7.90 ± 1.19 a	7.00 ± 1.56 a	7.40 ± 1.26 a	7.50 ± 1.43 a

Mean values in the same row which are not followed by the same letter indicate significant difference at $P < 0.05$.

Physical properties of prepared rusk fingers

Data in Table (5) cleared the physical properties of prepared rusk fingers. Weight decreased by using oat and yellow maize flour. Control recorded the highest value of weight (10.23 ± 0.05 g), rusk finger prepared using 30% oat flour and rusk fingers prepared using 30% yellow maize flour recorded the lowest values of weight (9.20 ± 0.20 and 9.50 ± 0.43 g, respectively). Non-significant differences at $p < 0.05$ were found between rusk fingers prepared using 10, 30% oat flour, 10% and 20% yellow maize flour compared with control. Results were in agreement with **Hoda et al., (2018)** who studied the effect of adding oat flour to whole meal wheat flour in preparing cake produced cake weight lower than control. Results disclosed that width was in the highest value in control, rusk finger prepared using 10% oat flour, rusk fingers prepared using 10% yellow maize flour (4.63 ± 0.15 , 4.70 ± 0.10 and 4.93 ± 0.05), respectively. Non-significant differences at $p < 0.05$ were found between rusk fingers prepared using 10, 20% oat flour, rusk fingers prepared using 10, 20% yellow maize flour. Significant differences at $p < 0.05$ were found between rusk fingers prepared using 30% oat flour, rusk fingers prepared using 10% yellow maize flour and control. Thickness decreased by using oat and yellow maize flour, control recorded the highest value of thickness (1.30 ± 0.00 cm³). Non-significant differences at $p < 0.05$ were found between all treated rusk fingers. Spread ratio increased by using oat and yellow maize flour, control recorded the lowest value of spread ratio (3.56 ± 0.10 cm). Significant differences at $p < 0.05$ were found between rusk fingers prepared using 30% oat flour, rusk fingers prepared using 10, 20, 30% yellow maize flour compared with control. Significant differences at $p < 0.05$ were found between rusk fingers prepared using 10, 20% oat flour compared with control. Results were in agreement with **Yasmin et al., (2023)** who studied the effect of yellow corn flour on physical properties of biscuits, they found that using yellow corn in the biscuit formulation leads to larger biscuits with increased spread during baking, which may be attributed to differences in ingredient properties. Results were in agreement with **Bornare and Khan Safiya Ajaz Khan (2015)** who studied the effect of using oat rolls on cookies, they found that as the level of rolled oats increases in the cookies there was gradual decrease in the weight, while increase in the diameter of cookies and thus, spread ratio of the cookies. **Flander et al., (2007)** reported that addition of wheat gluten to oat flour improves the processing properties of the dough and the quality of the final product.

Table (5): Physical properties of prepared rusk fingers prepared of different levels of oat and yellow maize flour as compared with control

Physical properties	Weight g.	Width cm	Thickness cm ³	Spread ratio cm
Rusk finger				
Control	10.23±0.05 ab	4.63±0.15 b	1.30±0.00 a	3.56 ±0.10 e
Rusk finger prepared using 10% oat flour	10.16±0.11 b	4.70±0.10 ab	1.10±0.10 ab	4.27±0.10 c
Rusk finger prepared using 20% oat flour	9.90±0.10 c	4.56±0.05 b	1.06±0.11 b	4.30±0.01 b
Rusk finger prepared using 30% oat flour	9.20±0.20 b	3.90±0.10 c	1.03±0.05 b	3.78±0.10 d
Rusk finger prepared using 10% yellow maize flour	10.10±0.10 ab	4.93±0.05 a	1.16±0.05 ab	4.25±0.10 c
Rusk finger prepared using 20% yellow maize flour	10.03±0.05 b	4.73±0.05 ab	1.10±0.10 ab	4.30±0.10 b
Rusk finger prepared using 30% yellow maize flour	9.50±0.43 a	4.60±0.20 b	1.03±0.06 b	4.46±0.01 a

Mean values in the same column which are not followed by the same letter indicate significant difference at P<0.05.

Estimation amounts of prepared rusk fingers (g) consumed to cover daily male adults requirements of protein and caloric levels

As compared with FAO/ WHO (1985) pattern, the results in table (6) show the estimated amount of rusk finger samples to cover daily male adults requirements of protein and calories. The daily requirements of protein could be covered when consumed 512.61- 629.37 g of prepared rusk fingers for male adults (25) years. It was observed that rusk finger prepared using 10% oat flour was the lowest consumed amount compared with the other samples. For calories , to cover daily male adults requirements need to consumed 702.40-708.73 g of rusk fingers daily . Rusk finger prepared using 10,20% yellow maize flour and control showed the highest amount to cover daily male adults requirements of calories (G.D.R 708.73, 706.71 and 708.52 g/day), it due to that it recorded the lowest caloric value (Table.3).

Table (6): The amount of prepared rusk fingers (g) consumed to cover daily male adults requirements of protein and calories

Prepared rusk fingers	*G.D.R g of protein	*G.D.R g of calories
	** Male adults (25-50 years) (63 g)	** Male adults (25-50years) (2900 k.cal.)
grams of rusk finger		
Control	538.46	708.40
Rusk fingers prepared using 10% oat flour	512.61	702.80
Rusk fingers prepared using 20% oat flour	540.77	703.59
Rusk fingers prepared using 30% oat flour	565.52	705.15
Rusk fingers prepared using 10% yellow maize flour	535.71	708.73
Rusk fingers prepared using 20% yellow maize flour	577.45	706.71
Rusk fingers prepared using 30% yellow maize flour	629.37	702.58

*G.D.R grams consumed of prepared rusk fingers to cover the daily requirements for man adults (25years) of protein and calories.

** Recommended levels of protein and calories according to FAO/WHO (1985).

Conclusion

From the obtained results would be a guide in the selection levels of preparation of rusk fingers by oat flour and yellow maize flour characteristics with its good sensorial properties , increase the nutritional value, calories content and their physical properties which to the seem control rusk finger.

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تأثير استخدام دقيق الشوفان والذرة الصفراء على الخصائص الحسية والفيزيائية لأصابع البقسماط

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الملخص العربي

تم تنفيذ الدراسة الحالية لتحليل ومقارنة القيمة الغذائية والخصائص الطبيعية الكيميائية لأصابع البقسماط المحضر من نوعين من دقيق (الشوفان والذرة الأصفر) بمستويات 10، 20، 30 % . هدفت أيضا الى دراسة تأثير طرق الاضافة على الصفات الحسية والخصائص الفيزيائية لأصابع البقسماط المحضرة. أشارت النتائج إلى أن محتوى الرطوبة قد ارتفع لدقيق القمح (0.01 ± 13.00 جم / 100 جم) . سجل دقيق القمح ودقيق الشوفان أعلى قيمة في البروتين (0.01 ± 11.40 ، 0.15 ± 11.50 جم / 100 جم على التوالي) ، وسجلت الدهون أعلى قيمة في دقيق الشوفان (0.11 ± 8.90 جم / 100 جم) ، وكان دقيق الشوفان والذرة الصفراء غنيان في محتوى الرماد والألياف والطاقة. أدى استخدام دقيق الشوفان والذرة الصفراء انخفاض نسبة الرطوبة في المنتج. سجلت أصابع البقسماط المحضرة باستخدام دقيق الشوفان 10%، وأصابع البقسماط المحضرة باستخدام دقيق الذرة الصفراء 10% أعلى قيمة للبروتين (0.04 ± 12.29 جم / 100 جم على التوالي) ، وسجلت أعلى قيم للدهون في أصابع البقسماط المحضرة باستخدام دقيق الشوفان بنسبة 30% (0.02 ± 6.34 جم / 100 جم) . زاد استخدام دقيق الشوفان والذرة الصفراء من محتوى الرماد والألياف بينما خفض محتوى الكربوهيدرات . سجلت أصابع البقسماط المحضرة باستخدام دقيق الشوفان 10، 20% وأصابع البقسماط المحضرة باستخدام دقيق الذرة الصفراء 30% أعلى قيمة إجمالية للسرعات الحرارية. كانت جميع العينات مقبولة . أثر استخدام دقيق الشوفان والذرة الصفراء على الخواص الفيزيائية لأصابع البقسماط، لذا توصي الدراسة باستخدام دقيق الشوفان والذرة الصفراء في تحضير أصابع البقسماط حتى 70/30 بمستويات الاستبدال بدقيق القمح لتحسين القيم الغذائية والصفات الحسية والخصائص الفيزيائية وبعض منتجات المخبوزات

الكلمات المفتاحية: التركيب الكيميائي، القيمة الحرارية، التقييم الحسي، الخصائص الفيزيائية