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Preparation and evaluation of brownies soft biscuit from non-wheat flour using date molasses

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ABSTRACT

The effect of fortification of brownies soft biscuit, which prepared from corn and rice flours as a non-wheat flour with different levels of date molasses (DM) as a natural source of iron and other nutrients on the quality was studied. The results showed that RF+60%DM describing the extreme sensory evaluation points followed by RF+70%DM then CF+60% then CF+70% DM. Physical properties tests of biscuits showed that the volume of biscuits significantly increased ($p<0.05$) by increasing the ratio of DM up to 60% and 70%. Texture results showed that firmness at zero time were lower for CF+50%DM (14.69), CF+ 60% DM (8.53), RF+ 50% DM (13.22) and RF+ 60% DM (7.74). There is a direct relationship between the increase in the ratio of date molasses and the increase in the values of K, Ca, Mg, Fe, Zn and Mn in produced soft biscuits. Iron contents results of RF+ 70% DM, RF+ 60% DM and CF+ 70% DM were 3.85, 3.67 and 3.35 mg/100 gm biscuit products respectively. They give the highest values of iron contents. Consumed of 100 gm of biscuits made by enrichment with 50 or 60 % of DM in the biscuit's dough give about 26.5 to 34.4 % for adolescent males and 19.5 to 24.5% for adolescent females.

1. Introduction

Food fortification with micronutrients continues to be one of the possible policy options to tackle micronutrient malnutrition as it is considered a more sustainable and cost-effective method available to improve public health, especially when it is mandated. Food fortification can provide relatively rapid solutions to address low micronutrient intakes at a population level, as it does not require complex behavior change and enables maintenance of traditional dietary patterns. Whilst it is adopted in a number of developing countries where it remains one of the key strategies to tackle these serious issues (Timotijevic et al., 2013). In 2019, anemia affected 40% of children between 6 months and 5 years of age, 37% of pregnant women and 30% of women 15–49 years of age. It is most prevalent in low- and middle-income countries. Anemia increases the risk of infections and death, impairs cognitive performance, and causes extreme fatigue, poor pregnancy outcomes, loss of earnings, and poor growth and development. It is a strong indicator of overall health (WHO, 2023). According to a UNICEF report (UNICEF, 2002), more than two billion individuals have anemia worldwide and most of them have Iron-deficiency anemia (IDA), especially in underdeveloped and developing countries, where 40-50% of children are iron deficient compared with 6 - 20% in developed countries. Iron status improvements for large-scale programs are relatively small, iron improvement status in infants and young children fed iron-fortified foods could be encouraged. Iron has proven the most difficult micronutrient to add to foods and to demonstrate an improvement in nutrient status (Hurrell, 2022). %50-20of the world's population and is common in young children suffered from Iron-deficiency anemia (IDA). In Egypt, little studies have been done on this problem in children, and little progress has been made in combating anemia and IDA, particularly in aboriginal and rural communities. A national survey, recently conducted on adolescents, detected overall prevalence of anemia of 46.6% among the age group 10-19 years.

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Another clinic based Egyptian study showed that 43% of the study population from 6 to 24 months had IDA. Iron deficiency mainly caused by the intake of inadequate bioavailable iron from the diet. (Baker and Greer, 2010). Varied arrays of interventions are designed to prevent and correct iron deficiency anemia. These include dietary improvement, fortification of foods with iron, iron supplementation, and other public health measures, such as helminthes control. All of these approaches improve iron status in some contexts. The appropriate use of iron supplements will be an important part of anemia control programs in almost all contexts, but supplements should be viewed as one of several tools in the battle against iron deficiency anemia. The priority among target groups for iron supplementation is based on the likelihood of both iron deficiency and the public health benefits resulting from its control. Pregnant and postpartum women and children 6-24 months of age are the priority target groups for both reasons. Iron supplements are essential for the rapid treatment of severe iron deficiency anemia in all sex and age groups. A daily protocol of iron supplementation is recommended for treatment and prevention in the priority target groups (Stoltzfus and Dreyfuss, 1998).

There is a high frequency of iron deficiency anemia between Egyptian children, which look like a severe problem facing the public health. Therefore, they recommend more epidemiological investigations to study this problem. Moreover, arrangement of campaigns through the mass media to mark the foods that contain high content of iron is recommended. Prophylactic iron supplementations should be given to susceptible infants, especially from 6 - 23 months (Al Ghwass et al., 2015 and Cann and Day, 2013) defined celiac disease as an immune-mediated enteropathy induced by exposure to dietary gluten which is defined as the material that can be separated from wheat flour when starch, and other minor components, are removed by washing under running water . With the continuous inflammation of intestinal mucosa and villous atrophy, it causes of damage to the lining of the small intestine, and reduced absorption of iron, calcium, vitamins A, D, E, K, and folate (Rosell and Garzon, 2015).

(Fabian and Ju 2011) reported that rice flour should be utilized in gluten free products manufacturing because it does not contain gluten. on other hand (Masure et al*.,* 2016) showed that yellow corn flour after rice flour are the most commonly used to obtain an acceptable gluten free products.

Rice (Oryza sativa) is considered as one of the significantly gluten-free vital food crops all over the world being a unique crop due to its white color, soft taste, low sodium levels easily digestible carbohydrates and hypoallergenic properties (Chan, et al., 2020). Date syrup is a high energy food rich in carbohydrate, a good source of minerals; but it also contains a very complex mixture of other saccharides, amino and organic acids, polyphenols and carotenoids. Its directly consumed or used as an ingredient in some food formulation such as ice cream products, beverage, confectionery, bakery products, sesame paste/date syrup blends, jam and butter (Abbès et al., 2013). The first problem to overcome in this research, the vary widely of iron compounds vary widely in the extent to which they are absorbed, and they vary in their potential, or not, to cause unacceptable changes in the color and flavor of the food to which they are added. A second challenge has been that common food fortification, such as cereals foods, contains inhibitors of iron absorption. Different strategies were developed to overcome their inhibition and optimize iron absorption from the iron-fortified foods by design iron -fortified products to be without iron inhibitors to have suitable amount of iron that based on estimated consumption in, would provide an iron intake that would fill part of the gap between current iron intake and iron requirements in man and woman depend on recommended dietary allowance (RDA). This research was carried out to produce and evaluate iron-fortified soft biscuits which desired by adults and children, and suitable for celiac disease patients.

2. Materials and methods

Materials

The materials used in this investigation and their sources were:

a. Corn and rice grains

Two different flours were obtained for soft biscuits production. Corn grains (single crossbred 128 variety) was obtained from Field Crops Research Institute, Agriculture Research Center, Giza, Egypt. Rice grains were obtained from local markets Cairo, Egypt. Both of grain types milled by Barabender laboratory grinder, Germany, to obtain 40- 60 mesh corn and rice flours.

b. Butter

Butter obtained from IFFCO Company for Oil and Fats Products - Suez City, Egypt.

c. Date molasses

Date molasses manufacturing by Food Technology Research Institute, as a one of the outputs of the project "Using Egyptian dates in the manufacture of some functional foods", Agriculture Research Center, Giza, Egypt.

d. other materials

Powdered sugar, eggs, anise baking powder and vanilla were purchased from the local market, Giza, Egypt

Methods

Chemical composition of corn and rice flours

Date molasses, well milled corn and rice flours were analyzed for moisture, proteins, fats, crude fibers and ash according to the methods described in the (AOAC 2000). Carbohydrates on dry weight basis as follow: (100- protein%+ fat%+ ash% + crude fibers%).

Determination of iron by atomic absorption spectrophotometric (AAS)

Date molasses and samples of soft biscuits were prepared for analysis. An amount of 5-15 g of the homogenized sample was dried in an air oven at 105°e for 3 hours. The dried sample was next charred until it ceased to smoke. The charred sample was then ashed in a muffle furnace at 550° C until a whitish or grayish ash was obtained. The ash was treated with concentrated hydrochloric acid, transferred to a volumetric flask and made up to 50 ml. For each food studied, two ash solutions were prepared, i.e. duplicate analysis was carried out. An aliquot of each ash solution was used for the determination of iron by the AAS method according to the method described by (Siang et al., 1989).

A Varian Atomic Absorption Spectrophotometer model 175 with an air- acetylene flame was used. Wavelength was set to 248.3 nm for solutions with iron concentrations ranging from 2.5 to 10 J.l.g/ml, or 327.0 nm for concentrations ranging from 25 to 100 J.l.g/ml. Ferric nitrate solution for atomic absorption spectrophotometry (BDH) was used as standard. A calibration curve with at least 4 concentrations of iron within the analytical range was prepared. Concentrations of iron in test solutions were calculated from the standard curve prepared. For each ash solution, at least three readings were obtained and the average calculated.

Processing of soft biscuits

The brownies soft biscuits recipe including all the baking parameters used in this study based on a general recipe used for commercial bakery brownies. Dry ingredients were weighed in a sanitized mixing bowl followed by the addition of oil, water, fresh liquid whole egg, and vanilla extract Table 1. The mixing bowl with ingredients mixing by kitchen mixer (Moulinex, Easymax model) for 1 min, speed-2 with scrapping after first 30 s. Brownie batter (~250 g) was gently poured into trays of round tins, which were 4.5 cm in diameter (~ 15 gm for each tins) by using a sanitized spatula placed into a conventional oven to (160 °C). After 10 min of baking, baked brownies biscuits were removed from the oven, followed by 15 min of ambient air cooling (Unger et al., 2021).

Specific volume

The volume was measured using rapeseed displacment method according to the AACC (2002). Then, the specific volume was measured by dividing the volume of the biscuit by its weight.

Texture analysis

A texture analyzer (Brookfield CT3 Texture Analyser Operating Instructions Manual No. M08-372-C0113, Stable Micro Systems, USA) was used to measure the texture profile of brownies soft biscuit in terms of hardness (N) and resilience of the samples according to the method described by (Gomez

(Gomez et al., 2007).

Sensory evaluation of biscuit

Biscuits were judged for Shape, crust color, crumb grain, crumb texture, taste and odor as described in (AACC, 2002). Ten experienced judges from the staff of the food Tech. Res. Institute, Agric. Res. Center, Giza, Egypt, were asked to test and check how much did he or she like the characteristic under test and also to show their attitude by checking the point that best described their feeling about the characteristic.

Statistical analysis

The Data were analyzed using CoStat, version 3.03 for personal computers according to (Ott, 1988). The tests used were ANOVA test and descriptive statistics test. A treatment effect was assumed to be statistically significant at $P < 0.05$.

Table 1. Brownies soft biscuits ingredients made using different levels of date molasses.

Material \ Treatment	C1	C 2	1	2	3	4	5	6	7	8	9	10	11	12
Whole corn flour	100		100	100	100	100	100	100						
White rice flour		100							100	100	100	100	100	100
Powdered sugar (30 %)	*	*												
Date molasses			20%	30%	40%	50%	60%	70%	20%	30%	40%	50%	60%	70%
Fresh Eggs (40%)	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Corn oil (30%)	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Baking powder (2.5%)	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Vanilla (1.6 %)	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Table salt (0.2%)	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Anise (2%)	*	*	*	*	*	*	*	*	*	*	*	*	*	*

(*) All ingredients added as a ratio from corn or rice flour.

3. Results and Discussion

Proximate composition of date molasses and other raw materials

Table 2. presents chemical composition of date molasses (DM). Moisture, ash, protein, total lipids, crude fiber, and carbohydrates of DM were 27.82, 2.95, 1.47, 0.00 and 94.22% respectively. The results are in line with the results that stated by (Farahnak et al., 2016). The results showed that moisture, ash, protein, and fat content of date syrup were 24.07, 2.18, 1.43, and 0.005%, respectively.

Table 2. Proximate composition of date molasses and other raw materials used for brownies soft biscuits production on dry weight basis.

Raw material \ Nutrient	Protein	Total lipids	Ash	Crude fiber	Moisture	Carbohydrates
Whole raw egg	50.63	40.62	3.81	0.00	75.33	4.94
Whole corn flour	8.90	4.33	1.63	1.18	10.91	83.96
White rice flour	7.88	0.73	0.71	0.54	9.55	90.14
Date Molasses	1.47	1.36	2.95	0.00	27.82	94.22

Table 3. Minerals facts of date molasses and other raw materials for serving size of 100 g used for preparing of soft biscuits on dry weight basis.

Minerals / Raw Material	Potassium*	Calcium	Phosphorus	Magnesium	Iron	Zinc	Manganese
Whole raw egg	242	98	356	20	2.88	2.2	0.048
Whole corn flour	315	7	272	3	0.97	1.73	0.46
White rice flour	115	28	115	35	2.21	1.09	1.088
Date Molasses	667	347.24	22.29	189.3	8.12	0.68	1.55

* Minerals measured as mg / 100 g

Concerning the chemical composition of the used raw materials Table 2. It could be noticed that the highest protein content was observed for whole egg (12.4%), while the lowest content was recorded for date molasses (10.06%). However, corn flour and rice flour showed approximately the same protein contents (7.93 and 7.13%, respectively). These results are close to those which found by (Oppong, et al., 2021) who found that the mean crude protein and fat contents of normal maize flour were found to be 7.22% and 4.31%, respectively. The protein contents of the whole raw egg were 12.49% while moisture content was 75.33%. Mineral composition of date molasses is presented in Table 3., and the results observed that date molasses showed high contents of P, Ca, Mg, Fe and Zn comparing with other materials under study. So, the addition of date molasses to rice or corn flour could be resulted in an increment of the minerals content in the produced soft biscuit. The results obtained corresponded to (Arshad et al., 2019) who reported mineral composition for date macro and micro minerals. It contained 156.66 mg/100 g calcium, 849.33mg/100 g potassium, 12 mg/100 g sodium, 50.32 mg/100 g magnesium, 5.4 mg/100 g iron and 1.4 mg/100 g zinc. (Al-Khateeb, 2008) analyzed date syrup and the results were valued by mg/100 g as the following, 338, 202.8, 13, 143 and 7.8 for calcium, potassium, sodium, magnesium, and iron respectively. These results are in line with the current findings. Rice is a source of essential minerals; it is rich in calcium and magnesium. The initial mineral content of whole rice flour (Ca, Fe, Zn, and Mn) was 15.02, 1.21, 0.97 and 1.14 mg/100 gm rice flour (Chis et al., 2020).

Sensory evaluation of produced brownies soft biscuits

Brownies soft biscuits containing date molasses at different levels were evaluated for their sensory attributes (i.e., shape, crust color, crump grain, crumb texture, taste, and odor). Each point was precisely defined with differences between the average scores which shown in Table 4. and Figure 1. Generally, most of the judges liked the biscuits with high percentages of date molasses more than the biscuits with low percentages of molasses or control sample and this can be attributed to the improvement action taken by date molasses in the taste and smell of the products as presented in Table 4., there was no significant difference was found for shape, crust color and crumb grain parameters. RF+60%DM describing the extreme sensory points followed by RF+70%DM then CF+60% then CF+70% DM with no significant differences between previous biscuit types. These results explained by (Ayoubi and Porabolghasem, 2016) who attributed that the functional groups which found in date molasses compared with sucrose, resulted in the formation of more hydrogen bonds, which caused the reduction in the mobility of free water and therefore make an increase in moisture and more palatable products, So increasing the percentage of date syrup in formulation lead to decreasing of weight loss, while, both of moisture and volume were increased. They found also that the color of the cake is due to the Maillard and caramelization reactions during baking. A key element of in Maillard reaction is reducing sugar which is abundant in date syrup and able to enhance the brown color. According to sensory evaluation results presented in Table 4., brownies

Table 4. Sensory evaluation of produced brownies soft biscuits made from corn or rice flours with different levels of date molasses.

Product	Shape (15)	Crust color (10)	Crumb grain (15)	Crumb texture (20)	Taste (20)	Odor (20)	Overall accept (100)
Soft Biscuits made from corn flour with date molasses							
Control CF*	13.2 ± 0.4 (a)	13.0±0.7 (ab)	12.7±0.9 (a)	12.1±0.5 (abc)	15.0±0.7 (d)	11.8±1.3 (c)	77.8±2.2 (c)
CF + 20% DM**	12.4±0.5 (a)	12.4±0.5 (ab)	13.4±0.9 (a)	11.2±0.8 (c)	16.8+1.3 (bc)	12.5±0.7 (c)	78.7±3.6 (c)
CF+ 30% DM	12.8±0.8 (a)	13±0.7 (ab)	13.2± 1.1 (a)	12.2±0.4 (abc)	17.2±1.1 (abc)	14±1.8 (bc)	82.4±4.4 (bc)
CF+ 40% DM	13±1.1 (a)	12.4±0.8 (ab)	13.0±1 (a)	13.2±0.8 (ab)	17.6±0.5 (abc)	16.4±0.5 (ab)	85.6±3.3(abc)
CF+ 50% DM	13±0.7 (a)	13±0.7 (ab)	13.2±0.8 (a)	13.34±0.8 (ab)	18.8±0.4 (ab)	17.4±0.5 (ab)	88.74±1.9(ab)
CF+ 60% DM	13.2±1.9 (a)	13.4±2.1 (ab)	13.2±1.3 (a)	13.8±0.9 (a)	18.8±0.8 (ab)	18.4±0.4 (a)	90.8±5.7 (ab)
CF+ 70% DM	13±0.7 (a)	13.7±0.6 (ab)	13.8±0.4 (a)	13.4±0.8 (ab)	18.6±0.5 (ab)	17.2±1.9 (ab)	89.7±3.3 (ab)
Soft Biscuits made from rice flour with date molasses							
Control RF***	13.1 ± 0.6 (a)	13.6±0.8 (ab)	12.6±0.8 (a)	13.4±0.4 (ab)	16.4±2.4 (c)	16.4±0.9 (ab)	85.5±4.2 (abc)
RF+ 20% DM	12.4±0.8 (a)	12.0±1 (b)	13.6±0.5 (a)	11.6±0.5 (bc)	17.0±1 (bc)	16.2±0.8 (ab)	82.8±4.4 (bc)
RF+ 30% DM	13.6±0.9 (a)	13.4±0.8 (ab)	13.5±0.7 (a)	13.3±0.6 (ab)	18±0.1 (abc)	17.2±0.7 (ab)	89±2.1 (ab)
RF+ 40% DM	13.0±1.4 (a)	13.0±1 (ab)	13±1.2 (a)	12.6±1.6 (abc)	17.8±0.4 (abc)	15.8±3.8 (ab)	85.2±8.6 (abc)
RF+ 50% DM	11.0±4.1 (a)	13.1±2.5 (ab)	12.8±1.1 (a)	13.3±1.4 (ab)	18.4±0.9 (ab)	16.4±3.6 (ab)	84.9±8.9 (abc)
RF+ 60% DM	13.8±0.4 (a)	14.6±0.8 (a)	13.6±0.5 (a)	13.6±1.1 (ab)	19.2±0.8 (a)	18.8±0.4 (a)	93.6±2.8 (a)
RF+ 70% DM	13.8±0.4 (a)	14.2±0.4 (ab)	13.6±0.5 (a)	13.8±1.3 (a)	18.8±0.4 (ab)	18.6±0.5 (a)	92.8±2.2 (a)
L.S.D.	1.798	1.4544	1.4578	1.221	1.2487	2.1615	5.9328

Values in columns not sharing the same superscript letter are significantly different from each other ($p < 0.05$)
*CF: Corn flour **DM: Date molasses ***RF: Rice flour

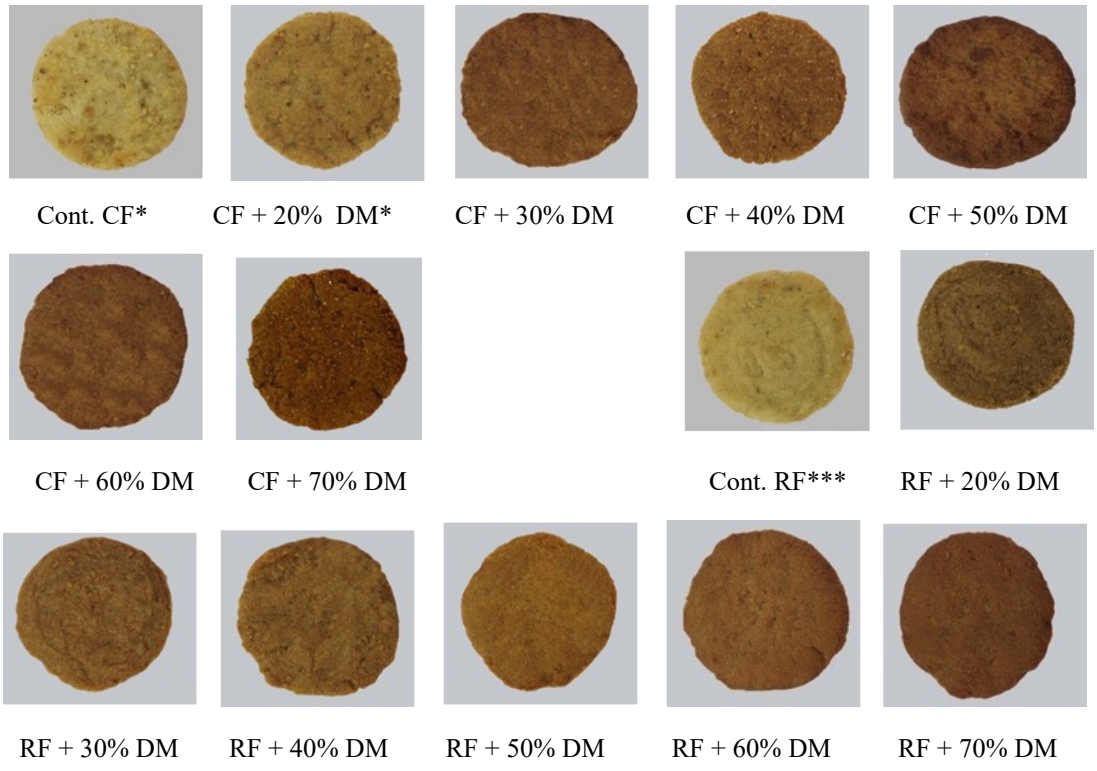

Figure 1. Brownies soft biscuits made from corn and rice flours using different levels of date molasses.
*CF: Corn flour **DM: Date molasses ***RF: Rice flour

Physical properties of produced soft biscuits

The effects of using of different levels of DM on the physical properties of soft biscuits such as volume, weight and specific volume are presented in Table 5. It was found that the volume of biscuits significantly increased ($p<0.05$) with increasing the added levels of DM up to 60% with rice flour and 70% with corn flour to produce soft biscuits, Also an significant increase in the volume of biscuits made from rice flour reached to 12.57 when 50% of DM was added to the rice flour.

Table 5. Physical properties of produced brownies soft biscuits made from corn and rice flours with different levels of date molasses.

Product	Weight	Volume	Specific volume
Soft Biscuits made from corn flour with date molasses			
Control CF*	10.71±0.21 (bc)	15.63±0.75 (bc)	1.45±0.04 (b)
CF + 20% DM**	12.18±0.05 (ab)	14.61±1.81 (c)	1.19±0.15 (c)
CF+ 30% DM	12.20±0.27 (ab)	19.16±0.21 (b)	1.57±0.03 (b)
CF+ 40% DM	12.38±0.24 (ab)	17.86±0.63 (bc)	1.44±0.06 (b)
CF+ 50% DM	11.83±0.06 (abc)	17.46±0.11 (bc)	1.47±0.01 (b)
CF+ 60% DM	12.12±0.17 (ab)	24.26±0.25 (a)	2.022±0.01 (a)
CF+ 70% DM	12.15±0.29 (ab)	24.26±0.31 (a)	1.99±0.02 (a)
Soft Biscuits made from rice flour with date molasses			
Control RF***	10.41±0.14 (c)	14.7±0.11 (c)	1.41±0.01 (b)
RF+ 20% DM	11.38±0.09 (abc)	16.1±0.46 (bc)	1.41±0.04 (b)
RF+ 30% DM	13.17±2.06 (a)	16.18±3.78 (bc)	1.22±0.19 (c)
RF+ 40% DM	12.22±0.28 (ab)	19.23±0.25 (b)	1.57±0.03 (b)
RF+ 50% DM	12.57±0.69 (a)	19.06±2.97 (b)	1.51±0.16 (b)
RF+ 60% DM	11.82±0.06 (abc)	17.53±0.05 (bc)	1.48±0.01 (b)
RF+ 70% DM	12.37±0.65 (ab)	24.26±0.25 (a)	1.96±0.08 (a)
L.S.D.	**1.0558**	**2.3642**	**0.1449**

Values in columns not sharing the same superscript letter not sharing the same superscript number are significantly different from each other ($p < 0.05$).

Generally specific volume expresses the density of the biscuit, lower density or higher specific volume biscuits are crispier and have more acceptable mouthfeel (Majzoobi et al., 2016). Determination of the biscuit density Table 5. showed that the biscuits became significantly ($P< 0.05$) denser as the DM ratio declined. Several factors can affect biscuit specific volume including dough rheological properties, starch gelatinization and retrogradation behavior and the moisture content. Dough with soft texture may expand rapidly during baking, but it may shrink quickly after baking as it cools down at ambient temperature resulting in a dense structure. It was the case for the samples prepared with sugar (control CF and RF) and low DM Figure 1. particularly at levels lower than 50% DM for corn and rice flours. These results are agreement with those found by (Majzoobi et al., 2016). In addition, the decrease in the moisture content of the DM biscuits can positively affect the crispness by increasing the specific volume and volume. No significant differences were found for weight of biscuits samples due to stabilizing the weight of the dough added to the round frame. Similar results were observed by (Penjumras et al., 2021) who reported that brownies are highly aerated and gives higher specific volume and that's because of decrease of flours ratio in the dough when sugar substituted with liquid date molasses.

Texture characteristics of produced soft biscuits

Textural parameters (firmness, adhesiveness, and resilience) of the tested brownie soft biscuits samples were analyzed at room temperature.

Lower values of firmness and adhesiveness expresses the lack of freshness and hardness of the product, while adhesiveness expresses stickiness in the mouth. Results obtained in Table 6. showed that firmness at zero time were lower for CF+ 50% DM (14.69), CF+ 60% DM (8.53), RF+ 50% DM (13.22) and RF+ 60% DM (7.74), while with low level of DM in soft biscuits, firmness showed high values regardless of the type of flour used. It was noted that the firmness values of the biscuit samples clearly higher after 3 months compared to the same values at zero time. (Houjaij et al., 2009) reported that firmness (hardness) is the peak force during compression related to the force required to bite, to masticate and to compress the bolus with the tongue and to push it through the back of the mouth into the pharynx, So we can consider that the lower firmness value of the product are the best for the consumer.

Table 6. Texture characteristics of produced brownies soft biscuits made from corn and rice flours with different levels of date molasses

Sample	Hardness (N)		Adhesiveness(mj)		Resilience	
	Zero time	After 3 months	Zero time	After 3 months	Zero time	After 3 months
Soft Biscuits made from corn flour with date molasses						
Control CF*	11.84	54.56	1.1	0.1	0.1	0.08
CF + 20% DM**	16.36	51.17	0.9	0.1	0.12	0.12
CF+ 30% DM	20.29	38.21	0.9	0.2	0.12	0.13
CF+ 40% DM	20.27	33.14	0.5	0.2	0.16	0.19
CF+ 50% DM	14.69	25.41	0.3	0.1	0.24	0.21
CF+ 60% DM	8.53	20.03	0.2	0.1	0.23	0.21
CF+ 70% DM	17.25	32.80	0.4	0.2	0.23	0.23
Soft Biscuits made from rice flour with date molasses						
Control RF***	18.87	52.78	0.2	0.1	0.2	0.10
RF+ 20% DM	17.82	36.04	0.2	0.2	0.18	0.20
RF+ 30% DM	18.87	35.44	0.3	0.2	0.17	0.21
RF+ 40% DM	19.25	36.14	0.2	0.1	0.18	0.22
RF+ 50% DM	13.22	32.71	0.3	0.2	0.17	0.12
RF+ 60% DM	7.74	31.14	0.2	0.2	0.21	0.23
RF+ 70% DM	15.22	36.04	0.9	0.1	0.24	0.11

Adhesiveness values showed a little variation at zero time, but overall remained somewhat higher for control CF, CF+20% DM, CF+30% DM and RF+70% DM. The best adhesiveness occurred with RF+40, 50 and 60% DM for biscuits made from rice flour and with CF+ 50 and 60%DM for biscuits made from corn flour, So biscuits made from CF+40, 50 and 60% DM and RF+50 and 60% DM are the most successful samples to meet freshness perception. In general, the results in Table 7. showed that the values of adhesiveness decreased when measured after three months of storage. The obtained results indicated that samples contained high levels of DM had a sticky tendency according to (Houjaij et al., 2009) who reported that the adhesive property will resist the pulling back of the compression plate creating a negative pressure. Resilience Table 6. were higher for CF+ 50, 60, 70% DM and RF+ 60, 70% biscuits (tested at 25°C) as compared to the values obtained for the other samples.

Resilience Table 6. were higher for CF+ 50, 60, 70% DM and RF+ 60, 70% biscuits (tested at 25°C) as compared to the values obtained for the other

So, as conclusion regarding to texture properties test, brownies soft biscuits samples made from 50 and 60% date molasses for both types of flours (corn or rice) recorded the best results for texture parameters and therefore its means higher quality. However, it was observed that the storage process of the brownie's biscuit had little effect on the resilience factor.

Chemical composition of produced brownies soft biscuits

From Table 7. it could be noticed that increasing of DM ratio in preparation of soft biscuits lead to decrease protein, total lipids, and crude fiber ratios, while increase of ash, moisture, and N.F.E contents were increased whether for biscuits made from CF or RF. Also from same results, almost no differences in protein or crude fiber change can be observed with increase of DM ratio, between samples made from rice flour or samples made from corn flour.

Table 7. Chemical composition of soft biscuits products made from corn and rice flours with different levels of date syrup on dry weight basis

Products / parameter	On dry weight basis					
	Protein	Total lipid	Crude fiber	Ash	Total carbohydrates	Moisture
	(%)	(%)	(%)	(%)	(%)	(%)
Control CF**	10.65	23.37	0.68	2.27	63.03	20.74
CF + 20% DM***	11.45	25.11	0.74	2.72	60.00	22.53
CF+ 30% DM	10.41	22.44	0.65	2.56	63.95	17.51
CF+ 40% DM	9.93	21.05	0.61	2.51	65.91	16.10
CF+ 50% DM	9.55	19.90	0.58	2.49	67.50	15.18
CF+ 60% DM	9.00	18.45	0.54	2.41	69.60	12.42
CF+ 70% DM	8.79	17.73	0.51	2.41	70.56	12.53
Control RF****	10.30	21.70	0.35	1.79	65.87	21.81
RF+ 20% DM	10.90	22.97	0.36	2.18	63.58	22.41
RF+ 30% DM	9.96	20.59	0.33	2.08	67.05	17.63
RF+ 40% DM	9.49	19.30	0.30	2.06	68.84	16.15
RF+ 50% DM	9.25	18.47	0.29	2.09	69.90	16.29
RF+ 60% DM	8.68	17.05	0.26	2.04	71.96	13.15
RF+ 70% DM	8.51	16.42	0.25	2.06	72.76	13.48

Total carbohydrates.: calculated by differences ** CF: Corn flour. ***DM: Date molasses ****RF: Rice flour

Mineral contents

The results of the minerals analyses (Table 7) showed that the biscuits produced with adding of 70% date molasses to corn flour contained 349.02 mg potassium (K) per 100 of produced biscuits, which is considered the highest value of K within the fourteen produced samples, followed by biscuits produced with adding of 70% date molasses to rice flour which contained 267.82 mg K per 100 of produced biscuits, while biscuits made from rice flour without addition of date molasses (Control CF**) showed lowest value of potassium (190.66 mg/100g). Consumption of 100 g of soft biscuits prepared from rice flour with different levels of date molasses give about 6.5 to 10.5 of total RDA of K which required for male and female as indicated in Tables 8 and 9 and Figs. 1, 2, 3 and 4. Celiac disease patients meals should have suitable amounts from different nutrients specially vitamins and minerals which very important for their health life, calcium and phosphorus are very important nutrients. Table 7. pointed to effect of added different levels of date molasses calcium contents of different produced products. RF+70%DM recorded the highest value of calcium which recorded 182.92 mg/100 gm. CF+70%DM calcium content was

174.4 mg/100 gm. In the same direction Tables 8 and 9., cleared that male and female have same daily needs of calcium and phosphorus (800 mg daily) according to (Food and Nutrition Board, 2001), RF+70% DM biscuits provide 24% of calcium daily needs for male or female. Calcium is very essential in muscle contraction, building strong bones and teeth, blood clotting, nerve impulse, transmission and regulating heart beat and fluid balance within cells. The requirements are greatest during the period of growth such as childhood, during pregnancy and when breast feeding (Pravina et al., 2013), so it can be considered that providing palatable bakery products by using natural sources for fortification such as date molasses is one of the good ways to help people suffering from a lack of calcium. Because the presence of phosphorus in both corn and rice flour is higher than that of date molasses Table 2., when the percentage of addition of date molasses raised, a decrease in the phosphorous percentage appears, (Figures 2, 3, 4 and 5). However, CF+20% contained 209.53 mg which present the highest value of phosphorous in manufactured products Table 7., It gives 23.5 % from RDA followed by CF+30% Table 8. Biscuits products made from rice flour recorded lower values comparing with those produced from corn flour in the same addition levels. Micronutrients like magnesium (Mg), zinc (Zn) and manganese (Mn) contents were determined. There was a direct relationship between the increase in the proportion of date molasses and the increase in the values of magnesium and manganese in the produced biscuit samples that were indicated in Table 7. and (Figures. 2, 3, 4 and 5). Concerning zinc, the results indicated that little changes were observed between biscuit samples, despite the difference in the proportions of added date molasses. RF+70% DM presented the highest ratio from daily recommended needs of Mg and Mn which recorded 23.6% and 24% respectively as displayed in Table 8., (National Health Service, 2000) reported that Magnesium is a mineral that helps to convert the food to energy, help the parathyroid glands that produce essential hormones for bone health and work normally. Manganese helps to activate some the enzymes in the body, such as enzymes responsible for breaking down food. Zinc helps to make new cells and enzymes processing carbohydrate, fat and protein in food wound healing.

Iron percentage according to RDA for different ages.

Iron (Fe) is an essential element for virtually all-living organisms. It is the most abundant transition metal in Biology. Iron plays a central role in the formation of hemoglobin and myoglobin and in many vital biochemical pathways. (Igartua et al., 2012).

The results which presented in Table 11. clarified that iron contents of the soft biscuits samples i.e. RF+ 70% DM, RF+ 60% DM and CF+ 70% DM were 3.85, 3.67 and 3.35 mg/100 gm biscuit products respectively. They give the highest values of iron contents in all produced samples.

Celiac disease patients' meals should have suitable amounts from different nutrients specially vitamins and minerals which very important for their health life, calcium and phosphorus are very important nutrients. Table 7. pointed to effect of added different levels of date molasses calcium contents of different produced products. RF+70%DM recorded the highest value of calcium which recorded 182.92 mg/100 gm. CF+70%DM calcium content was 174.4 mg/100 gm. In the same direction Tables 8 and 9., cleared that male and female have same daily needs of calcium and phosphorus (800 mg daily) according to (Food and Nutrition Board 2001), RF+70% DM biscuits provide 24% of calcium daily needs for male or female.

Calcium is very essential in muscle contraction, building strong bones and teeth, blood clotting, nerve impulse, transmission and regulating heartbeat and fluid balance within cells. The requirements are greatest during the period of growth such as childhood, during pregnancy and when breast feeding (Pravina et al., 2013). So, it can be considered that providing palatable bakery products by using natural sources for fortification such as date molasses is one of the good ways to help people suffering from a lack of calcium.

Table 8. Minerals quantities of soft biscuits products made from corn and rice flours with different levels of date molasses on dry weight basis.

Mineral / Sample	K*	Ca	P	Mg	Fe	Zn	Mn
Control CF**	190.66	90.53	197.51	3.42	1.25	1.11	0.23
CF + 20% DM***	268.03	130.37	209.53	22.88	2.13	1.23	0.40
CF+ 30% DM	287.37	140.88	200.46	30.95	2.42	1.20	0.45
CF+ 40% DM	304.92	150.42	192.22	38.27	2.69	1.18	0.50
CF+ 50% DM	320.92	159.12	184.71	44.95	2.93	1.16	0.55
CF+ 60% DM	335.56	167.08	177.84	51.06	3.15	1.14	0.59
CF+ 70% DM	349.02	174.40	171.52	56.67	3.35	1.12	0.63
Control RF****	93.72	100.71	121.40	18.93	1.85	0.80	0.53
RF+ 20% DM	166.14	141.07	129.55	39.18	2.76	0.90	0.72
RF+ 30% DM	190.42	151.06	124.35	46.46	3.02	0.89	0.76
RF+ 40% DM	212.45	160.13	119.64	53.06	3.26	0.88	0.79
RF+ 50% DM	232.54	168.40	115.33	59.09	3.47	0.87	0.83
RF+ 60% DM	250.93	175.97	111.40	64.60	3.67	0.87	0.86
RF+ 70% DM	267.82	182.92	107.78	69.66	3.85	0.86	0.89

Minerals measured as mg / 100 g sample on dry weight basis.** CF : Corn flour ***DM : Date molasses ****RF: Rice flour

Table 9. RDA values obtained from 100 g of fresh soft biscuits products made from corn flour with different levels of date molasses.

Parameter	RDA***		Percentage of the total needs provided by the product/RDA													
			Control CF****		CF + 20% DM*****		CF + 30% DM		CF + 40% DM		CF + 50% DM		CF +60% DM		CF + 70% DM	
	M*	F**	M	F	M	F	M	F	M	F	M	F	M	F	M	F
			%	%	%	%	%	%	%	%	%	%	%	%	%	%
Potassium	3500	3500	5.0	5.0	6.9	6.9	7.6	7.6	8.1	8.1	8.6	8.6	9.1	9.1	9.5	9.5
Calcium	800	800	10.3	10.3	14.6	14.6	16.2	16.2	17.5	17.5	18.6	18.6	19.8	19.8	20.8	20.8
Phosphorus	800	800	22.4	22.4	23.5	23.5	23.1	23.1	22.4	22.4	21.6	21.6	21.1	21.1	20.4	20.4
Magnesium	350	280	0.9	1.1	5.9	7.3	8.2	10.2	10.2	12.7	12.0	15.0	13.9	17.3	15.4	19.3
Iron	10	15	11.4	7.6	19.1	12.8	22.3	14.9	25.0	16.7	27.4	18.3	29.9	19.9	31.9	21.2
Zinc	15	12	6.7	8.4	7.4	9.2	7.4	9.2	7.3	9.1	7.2	9.0	7.2	9.1	7.1	8.9
Manganese	3.5	3.5	5.9	5.9	10.2	10.2	11.9	11.9	13.4	13.4	14.7	14.7	16.1	16.1	17.2	17.2

* M: male ** F: Female *** RDA: Recommended Dietary Allowance according to Food and Nutrition Board
**** CF: Corn flour ***** DM: Date molasses

Table 10. RDA values obtained from 100 g of fresh soft biscuits products made from corn flour with different levels of date molasses.

Parameter	RDA***		Percentage of the total needs provided by the product/RDA													
			Control RF****		RF + 20% DM*****		RF + 30% DM		RF + 40% DM		RF + 50% DM		RF +60% DM		RF + 70% DM	
	M*	F**	M	F	M	F	M	F	M	F	M	F	M	F	M	F
			%	%	%	%	%	%	%	%	%	%	%	%	%	%
Potassium	3500	3500	2.4	2.4	4.3	4.3	5.0	5.0	5.6	5.6	6.2	6.2	6.8	6.8	7.3	7.3
Calcium	800	800	11.4	11.4	15.8	15.8	17.4	17.4	18.6	18.6	19.6	19.6	20.8	20.8	21.7	21.7
Phosphorus	800	800	13.7	13.7	14.5	14.5	14.3	14.3	13.9	13.9	13.4	13.4	13.2	13.2	12.8	12.8
Magnesium	350	280	4.9	6.1	10.0	12.6	12.2	15.3	14.1	17.6	15.7	19.6	17.5	21.9	18.9	23.6
Iron	10	15	16.8	11.2	24.8	16.5	27.9	18.6	30.3	20.2	32.4	21.6	34.8	23.2	36.5	24.3
Zinc	15	12	4.8	6.0	5.4	6.8	5.5	6.8	5.5	6.8	5.4	6.8	5.5	6.8	5.4	6.8
Manganese	3.5	3.5	13.8	13.8	18.4	18.4	19.9	19.9	21.1	21.1	22.0	22.0	23.2	23.3	24.0	24.0

*M: male **F: Female ***RDA: Recommended Dietary Allowance according to Food and Nutrition Board
**** RF: Rice flour ***** DM: Date molasses

Because the presence of phosphorus in both corn and rice flour is higher than that of date molasses Table 2., when the percentage of addition of date molasses raised, a decrease in the phosphorous percentage appears, (Figs 2, 3, 4 and 5). However, CF+20% contained 209.53 mg which present the highest value of phosphorous in manufactured products Table 7., It gives 23.5 % from RDA followed by CF+30%. Table 8. Biscuits products made from rice flour recorded lower values comparing with those produced from corn flour in the same addition levels. Micronutrients like magnesium (Mg), zinc (Zn) and manganese (Mn) contents were determined. There was a direct relationship between the increase in the proportion of date molasses and the increase in the values of magnesium and manganese in the produced biscuit samples that were indicated in Table 7. and Figs. 2, 3, 4 and 5. Concerning zinc, the results indicated that little changes were observed between biscuit samples, despite the difference in the proportions of added date molasses. RF+70% DM presented the highest ratio from daily recommended needs of Mg and Mn which recorded 23.6% and 24% respectively as displayed in Table 8., (National Health Service, 2000) reported that Magnesium is a mineral that helps to convert the food to energy, help the parathyroid glands that produce essential hormones for bone health and work normally. Manganese helps to activate some the enzymes in the body, such as enzymes responsible for breaking down food. Zinc helps to make new cells and enzymes processing carbohydrate, fat, and protein in food wound healing.

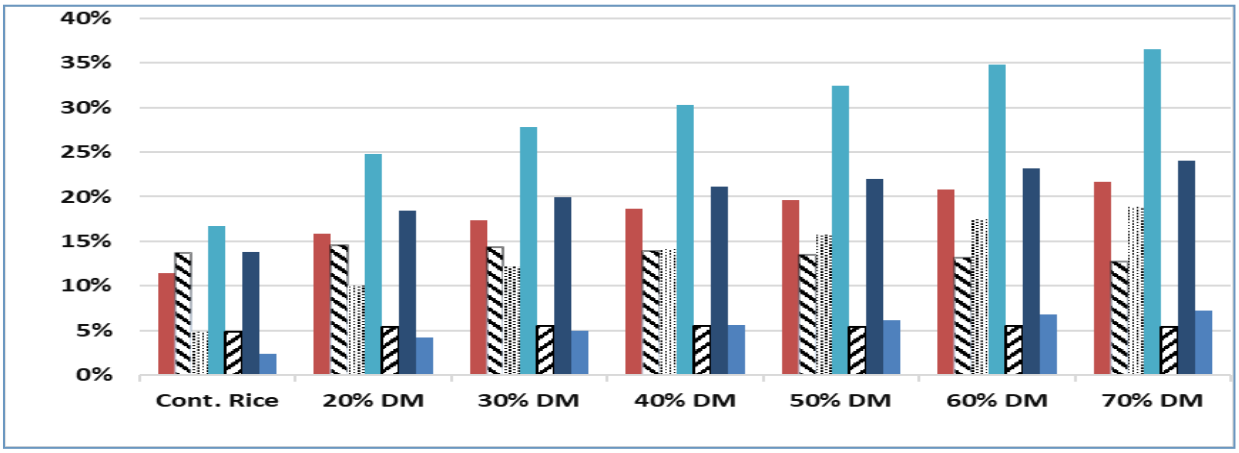

Figure 1. The Percentage of minerals according to male RDA total needs offered from serving 100 g of fresh soft biscuits products made from rice flour with different levels of date molasses.

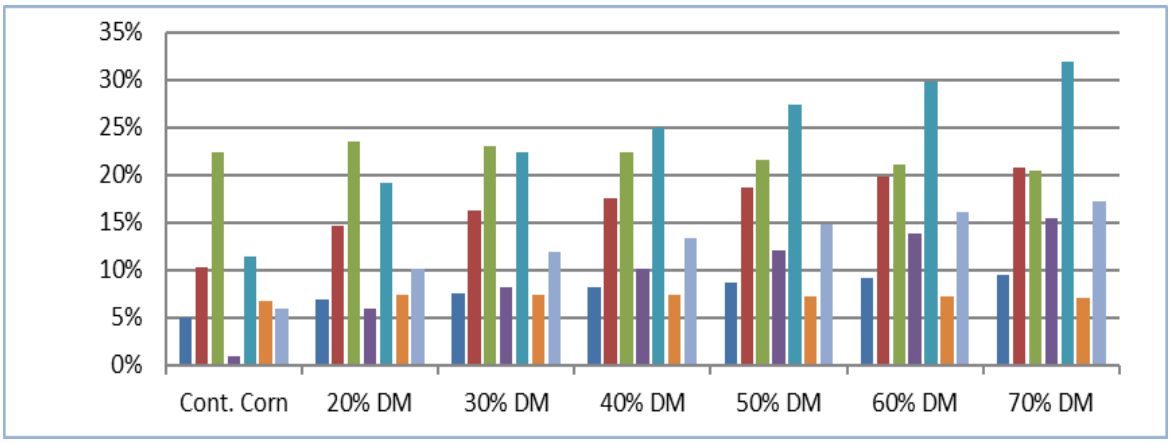

Figure 2. The Percentage of minerals according to male RDA total needs offered from serving 100 g of fresh soft biscuits products made from corn flour with different levels of date molasses

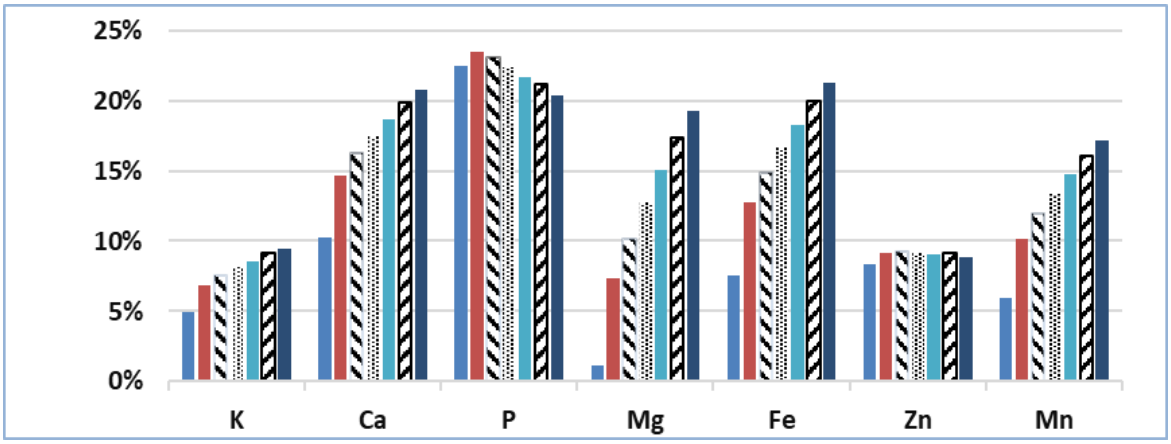

Figure 3. The Percentage of minerals according to female RDA total needs offered from serving 100 g of fresh soft biscuits products made from corn flour with different levels of date molasses

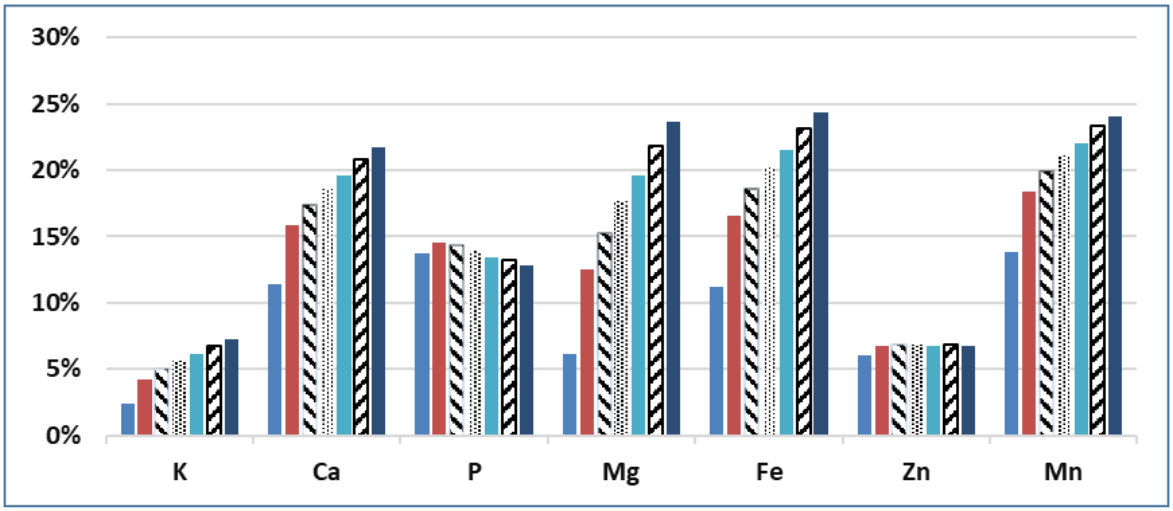

Figure 4. The Percentage of minerals according to female RDA total needs offered from serving 100 g of fresh soft biscuits products made from rice flour with different levels of date molasses.

biscuit samples, despite the difference in the proportions of added date molasses. RF+70% DM presented the highest ratio from daily recommended needs of Mg and Mn which recorded 23.6% and 24% respectively as displayed in Table 8., (National Health Service 2000) reported that Magnesium is a mineral that helps to convert the food to energy, help the parathyroid glands that produce essential hormones for bone health and work normally. Manganese helps to activate some the enzymes in the body, such as enzymes responsible for breaking down food. Zinc helps to make new cells and enzymes processing carbohydrate, fat and protein in food wound healing.

Iron percentage according to RDA for different ages

Iron (Fe) is an essential element for virtually all-living organisms. It is the most abundant transition metal in Biology. Iron plays a central role in the formation of hemoglobin and myoglobin and in many vital biochemical pathways. (Igartua et al., 2012). The results which presented in Table 11. clarified that iron contents of the soft biscuits samples i.e. RF+ 70% DM, RF+ 60% DM and CF+ 70% DM were 3.85, 3.67 and 3.35 mg/100 gm biscuit products respectively. They give the highest values of iron contents in all produced samples. It could be noticed that adding of date molasses to the dough mixture by at least 50% give almost 2.39 – 3.35 mg iron/100 gm for samples made from rice flour, Whereas, to get approximately the same amount of iron in every 100 g of biscuits made from rice flour, it is enough only to add 30% - 70% to get about 3.02 – 3.85 mg iron/ 100g. This is due to the fact that rice flour contains a large amount of iron (2.21 mg/100g) comparing with corn flour (0.97 mg/100 gm), as it was signed in the Table 2.

Iron is an essential micronutrient, as it is required for adequate erythropoietic function, oxidative metabolism and cellular immune responses. Although the absorption of dietary iron (1-2 mg/day) is regulated tightly. Therefore, internal turnover of iron is essential to meet the requirements for erythropoiesis (20-30 mg/day). Increased iron requirements, limited external supply, and increased blood loss may lead to iron deficiency (Igartua et al., 2012). From the previous article, the natural sources of iron which play important role as external supply of iron should increased in human meals.

Table 11: Iron content of soft biscuits products made from corn and rice flours with different levels of date molasses on dry weight basis.

Samples	Fe
Control CF**	1.25
CF + 20% DM***	2.13
CF+ 30% DM	2.42
CF+ 40% DM	2.69
CF+ 50% DM	2.93
CF+ 60% DM	3.15
CF+ 70% DM	3.35
Control RF****	1.85
RF+ 20% DM	2.76
RF+ 30% DM	3.02
RF+ 40% DM	3.26
RF+ 50% DM	3.47
RF+ 60% DM	3.67
RF+ 70% DM	3.85

Tables (10 and 11) shows the recommended dietary Fe supply to prevent Iron Deficiency Anemia (IDA) at different ages and physiological states. It's included the calculated of the percentage of iron element offered by intended products in this research attributed to the recommended dietary allowance (RDA) of male and female at different ages according to (Food and Nutrition Board 2001). The obtained data illustrated that consumption of 100 gm of CF+50% DM providing 39.1 mg iron for children aged between 9 – 13 years and the elderly adults (51 or older) for both male and female, which mean that consumption of almost 9 units of biscuits give primary and prep school aged children about 40 % of their needs from iron (table 4 pointed that average biscuit weight are 11 gm). While it cannot be considered that the produced biscuit samples are a sufficient source of iron for pregnancy, as the sample of biscuits that contained the highest values of iron gave only 14.3% from iron pregnancy RDA.

Table 12. Calculated percentage of iron according to RDA total needs offered from serving 100 g of soft biscuits products made from corn flour with different levels of date molasses on dry weigh basis.

Parameter	Age	RDA***		Percentage of the total needs of iron provided by the product/RDA													
				Control CF****		CF + 20% DM*****		CF + 30% DM		CF + 40% DM		CF + 50% DM		CF +60% DM		CF + 70% DM	
		M*	F**	M	F	M	F	M	F	M	F	M	F	M	F	M	F
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Children	1-3 years	7	7	17.9	17.9	30.4	30.4	34.6	34.6	38.4	38.4	41.9	41.9	45.0	45.0	47.9	47.9
Children	4-8 years	10	10	12.5	12.5	21.3	21.3	24.2	24.2	26.9	26.9	29.3	29.3	31.5	31.5	33.5	33.5
Children	9-13 years	8	8	15.6	15.6	26.6	26.6	30.3	30.3	33.6	33.6	36.6	36.6	39.4	39.4	41.9	41.9
Adolescents	14-18 years	11	15	11.4	8.3	19.4	14.2	22.0	16.1	24.5	17.9	26.6	19.5	28.6	21.0	30.5	22.3
Adults	19-50 years	8	18	15.6	6.9	26.6	11.8	30.3	13.4	33.6	14.9	36.6	16.3	39.4	17.5	41.9	18.6
Adults	51 years and older	8	8	15.6	15.6	26.6	26.6	30.3	30.3	33.6	33.6	36.6	36.6	39.4	39.4	41.9	41.9
Pregnancy	All ages	-	27	-	4.6	-	7.9	-	9.0	-	10.0	-	10.9	-	11.7	-	12.4

* M: male ** F: Female *** RDA: Recommended Dietary Allowance according to Food and Nutrition Board (2001).
**** CF: Corn flour ***** DM: Date molasses

- M: male ** F: Female *** RDA: Recommended Dietary Allowance according to Food and Nutrition Board (2001)
- **** RF: Corn flour ***** DM: Date molasses

Table 13. Calculated percentage of iron according to RDA total needs offered from serving 100 g of soft biscuits products made from rice flour with different levels of date molasses on dry weigh basis.

Parameter	Age	RDA***		Percentage of the total needs of iron provided by the product/RDA													
				Control RF****		RF + 20% DM*****		RF + 30% DM		RF + 40% DM		RF + 50% DM		RF +60% DM		RF + 70% DM	
		M*	F**	M	F	M	F	M	F	M	F	M	F	M	F	M	F
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Children	1-3 years	7	7	26.4	26.4	39.4	39.4	43.1	43.1	46.6	46.6	49.6	49.6	52.4	52.4	55.0	55.0
Children	4-8 years	10	10	18.5	18.5	27.6	27.6	30.2	30.2	32.6	32.6	34.7	34.7	36.7	36.7	38.5	38.5
Children	9-13 years	8	8	23.1	23.1	34.5	34.5	37.8	37.8	40.8	40.8	43.4	43.4	45.9	45.9	48.1	48.1
Adolescents	14-18 years	11	15	16.8	12.3	25.1	18.4	27.5	20.1	29.6	21.7	31.5	23.1	33.4	24.5	35.0	25.7
Adults	19-50 years	8	18	23.1	10.3	34.5	15.3	37.8	16.8	40.8	18.1	43.4	19.3	45.9	20.4	48.1	21.4
Adults	51 & older	8	8	23.1	23.1	34.5	34.5	37.8	37.8	40.8	40.8	43.4	43.4	45.9	45.9	48.1	48.1
Pregnancy	All ages	-	27	-	6.9	-	10.2	-	11.2	-	12.1	-	12.9	-	13.6	-	14.3

-M: male ** F: Female *** RDA: Recommended Dietary Allowance according to Food and Nutrition Board (2001)
-**** RF: Corn flour ***** DM: Date molasses

There is a big difference between the male's iron needs (RDA) at the age of 19-50 years (8 mg/day) and the female's needs at the same age (18 mg iron per day). Consumption of 100 gm CF+50%DM or CF+60%DM give 36.6 and 39 mg iron for male, while give 16.3 mg and 17.5 mg iron for female respectively for the previous age groups. For male and female adolescents (14-18 years), CF+50% DM, CF+ 60% DM, RF+50% DM and RF+ 60% DM recorded 26.6, 28.6, 31.5 and 33.4% iron as a ratio from RDA for male, while recorded 19.5, 21, 32.1 and 24.5% iron as a ratio from RDA for females. Generally previous results illustrated that consumption of 100 gm of biscuits made by addition of 50 or 60 % of date molasses in the biscuits dough give about 26.5 to 34.4 % for adolescent males and 19.5 to 24.5% for adolescent females.) Zimmermann and Hurrell 2007) reported that early adolescence is rapid growth period. In females, the blood loss that occurs with menstruation adds to the increased Fe requirement of adolescence. Men absorb and excrete about 0.8 mg of Fe per day and women during childbearing years should absorb almost twice as much (1.4 mg per day) to cover menstrual losses.

4. Conclusion

From the obtained results it could be concluded that addition of date molasses to both of corn or rice flour lead to produce biscuits samples rich in minerals especially CF or RF + 60% & 70% DM, and the best addition levels according to the sensory evaluation tests were RF+70% DM. Such addition levels covered up to 36.5% for male and 24.3% for female of RDA of iron, 21.7% for both male and female of RDA of calcium, 18.9% for male and 23.6% for female of RDA of mg, 24.0% for both male and female of RDA of manganese. Moreover, the free gluten produced biscuits are more suitable for celiac disease patients.

References

AACC (2002). Approved method of the American Association of Cereal Chemists Published by American Association of Cereal Chemists Inc. st. paul, Minnesota, U.S.A.

Abbesa, F; Kchaoua, W.; Bleckerb, C.; Ongenac, M.; Lognayd, G.; Attiaa, H. and Besbesa, S. (2013). Effect of processing conditions on phenolic compounds and antioxidant properties of date syrup. Industrial Crops and Products. Vol. 44(1): 634-642.

Al Ghwass, M.M.E.; Halawa, E.F.; Sabry, S.M. and Ahmed, D. (2015). Iron deficiency anemia in an Egyptian pediatric population: A cross-sectional study. Annual of African Medicine. Vol. 14 Issue , P. 25-31.

Al-Khateeb, A.A. (2008). Enhancing the growth of date palm (Phoenix Dactylifera) in vitro tissue by adding date syrup to the culture medium. Sci. J. King Faisal University (Basic Appl. Sci.) 19, 71–85.

AOAC (2000). Official Methods of the Association of Official Analytical chemists 15th Ed. Published by the Association of Official Analytical chemists. Arlington Virginia, U.S.A.

Arshad, M.S.; Batool, S.M.; Khan, M.K.; Imran, M.; Ahmad, M.H. Anjum, F.M. and Hussain, S. (2019). Bio-evaluation of functional date bars using rats as model organism against hypercholesterolemia. Lipids in Health and Disease 18:148. https://doi.org/10.1186/s12944-019-1087-3.

Ayoubi, A. and Porabolghasem, M. (2016). Substituting sugar with date syrup in cupcake. Iranian food science and technology research journal. 10.22067/ifstrj.v1395i0.55738.

Baker R.D and Greer, F.R. (2010). The committee on nutrition. Clinical report: diagnosis and prevention of iron deficiency and iron deficiency anemia in infants and young children (0-3 years of age). Pediatrics, 126 :1040-1050.

Cann, T.H. and Day, L. (2013). Effect of sodium chloride on gluten network formation dough micro structure and rheology in relation to bread making. J. Cereal Sci. 57:444–452.

Chan, Y.J.; Lu, W.C.; Lin, H.Y.; Wu, Z.R.; Liou, C.W.; Li, P.H. (2020). Effect of rice protein hydrolystates as an egg replacement on the physicochemical properties of flaky egg rolls. Foods. Vol. 9, P. 245.

Chis, M.S.; Paucean, A.; Man, S.M; Bonta, V.; Pop, A. Stan, L.; Beldean, B.V.; Rodica, C.; Mure¸ V. and Muste, S. (2020). Effect of Rice Flour Fermentation with Lactobacillus spicheri DSM 15429 on the Nutritional Features of Gluten-Free Muffins. Vol. 9, 822.

Fabian, C., and Ju, Y.H. (2011). A review on rice bran protein, Its properties and extraction methods. Critical Reviews in Food Science and Nutrition, 51: 816-827.

Farahnaky, A.; Mardani, M.; Mesbahi, G.H.; Majzoobi, M. and Golmakani, M. T. (2016). Some Physicochemical Properties of Date Syrup, Concentrate, and Liquid Sugar in Comparison with Sucrose Solutions. J. Agr. Sci. Tech. Vol. 18: 657-668.

Food and Nutrition Board, Institute of Medicine (2001). Iron dietary reference intakes for vitamin A, vitamin K, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington D.C.: National Academy Press, 290.

Gomez, M.; Ronda, F.; Coballera, A.P.; Blanco, A.C. and Rosell, C.M. (2007). Functionality of different hydrocolloids on the quality and shelf life of yellow layer cakes. Food Hydrocolloids, 21(2), 167–173.

Houjaij, N.; Dufresne, T.; Lachance N. and Ramaswamy, H.S. (2009). Textural characterization of pureed cakes prepared for the therapeutic treatment of dysphagic patients. Vol.12: 45–54.

Hurrell, R.F. (2022). Ensuring the Efficacious Iron Fortification of Foods: A Tale of Two Barriers. Nutrients. Vol. 14, 1609. https:// doi.org/10.3390/nu14081609

Igartua, E.U.; Borque, L. and Marcen, J.F.E. (2012). The new age of iron: New knowledge and parameters and other related pathologies. Trace elements: action on health and its role in the pathologies. Research signpost, (1): 165-193.

Majzoobi, M; Mansouri1, H.; Mesbahi, G.H.; Farahnaky, A. and Golmakani, M.T. (2016). Effects of sucrose substitution with date syrup and date liquid sugar on the physicochemical properties of dough and biscuits. J. Agr. Sci. Tech. Vol. 18: 643-656.

Masure, H.G.; Fierens E. and Delcour, J.A. (2016). Current and forward looking experimental approaches in gluten-free bread making research. Journal of Cereal Science, 67: 92-111.

National Health Services (2000). Food Fortification as a Global Public Health Intervention: Strategies to Deal with Barriers to Adoption, Application and Impact Assessment. Chapter, Food Fortification as a Global Public Health Intervention: Strategies to Deal with Barriers to Adoption. https://www.nhs.uk/conditions/Vitamins-and-minerals/iron.

Oppong, D.; Panpipat, W. and Chaijan, M. (2021). Chemical, physical, and functional properties of Thai indigenous brown rice flours. Plos one 16(8): e0255694. https://doi.org/10.1371/journal.

Ott, L. (1988). An introduction to statistical methods and data analysis. 3rd ed. PWS-Kent, Boston, M.A.

Penjumras, P.; Thongfathamrong, P.; Umnat, S.; Chokeprasert, P. Wattananapakasem, I. and Phaiphan, A. (2021). Gluten free brownies made with composite rice flour. Earth and Environmental Science 756. doi:10.1088/1755-1315/756/1/012075.

Pravina, P.; Sayaji, D. and Avinash, M. (2013). Calcium and its Role in Human Body. Inter. J. Res. in Pharm. and Biomed. Sci. Vol. 4 (2): 659 – 668.

Rosell, C.M. and Garzon, R. (2015). Chemical composition of bakery products. In: Cheung, P.C.K., Mehta, B.M. (Eds.), Handbook of Food Chemistry. Springer-Verlag, Berlin Heidelberg, pp. 192-222.

Siang, T.E.; Chao, K.S. and Shahid, S.M. (1989). Determination of Iron in Foods by the Atomic Absorption Spectrophotometric and Colorimetric Methods. Pertanika 12(3), 313-322.

Stoltzfus, R.J. and Dreyfuss, M.L. (1998). Guidelines for the use of iron supplements to prevent

and treat, iron deficiency anemia: Overview of interventions for controlling iron deficiency anemia. International Nutritional Anemia Consultative Group (INACG). International Life Sciences Institute.

Timotijevic, L.; Timmer, A. and Ogunlade, A. (2013). Food fortification as a global public health intervention: Strategies to deal with barriers to adoption, application and impact Assessment

Unger, P.; Channaiah, L. H.; Singh, H.; Sekhon, A. S.; Babb, M.; Yang, Y. and Michael, M. (2021). Validation of brownie baking step for controlling Salmonella. Food Science and Nutrition, Wiley. (1): 1-10.

United Nations International Children′s Fund "UNICEF" (2002). Iron deficiency anemia worldwide. Available at: https://www.unicef.org.

World Health Organization (2023). Calls for accelerating action to reduce anemia. Geneva: WHO.

Zimmermann, M.B. and Hurrell, R.F. (2007). Nutritional iron deficiency. Lancet, (8): 370, 511.