Original Article

Effect Replacing Sugar With Date Powder On Biscuit Quality

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Abstract

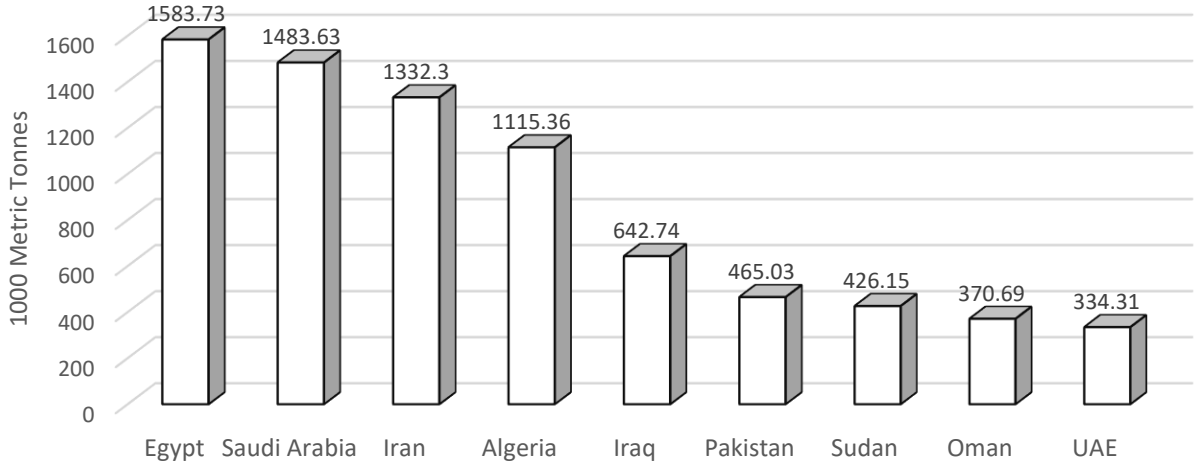
Fruits of date palm (Phoenix dactylifera L.) are consumed throughout the world and are a vital component of the diet in most Arabian countries. Date powder of el-shamia and sakkoti was used to replace sugars in biscuit recpies with 20%,30% and 50% The results obtained indicated that water absorption was gradually increased by increasing the levels of date powder; Meanwhile, mixing tolerance index and dough weakening were decreased in all treatments, while dough stability time increased as compared with the control sample. results showed dough extension energy, dough extensibility, dough resistance to extension and proportional number were found to increase in all samples compared with control. The chemical composition of biscuits showed that ash and fiber contents were gradually increased as the percent replacement with date powder increased . However, the minerals content progressively increased by increasing the level of date powder. it could be concluded that incorporation of date powder has improved the color of biscuit sample by reducing the browning reaction, which is responsible for the dark brown appearance a biscuit . Sensory tests biscuit with 30% sugar replacement as acceptable more than other biscuits produced by other replacement ration with no significant differences between two Date varieties.

Key words: date powder, browning index, add value, biscuits, and supplementation.

1. Introduction

Phoenix dactylifera L. (Date, Date palm), a species of the family Arecaceae are reflected as one of the most suitable crops for exportation when they are harvested and marketed at three stages of their development Khalal, Rutab, and Tamar (Bekheet and El-Sharabasy, 2015). Adroit Market Research (2019) reported that 9,366.06 kilotons of Date palm fruits were consumed worldwide in 2018 and are expected to reach 13,482.48 kilotons by 2025. Egypt is the first Date producer of the top ten countries as mentioned **by sidhu,2006 FAO,2009 ; and Alharbi et al. (2021)**. In 2019, Egypt's production of Dates was approximately 1.6 million metric tons **(Galal, 2021).**

Fig (1) Shows the Date Production in some Arabic Countries for the Year 2021(Alharbi).



Date palm (phoenix dactyliferous L.), are one of the most important treasures within the Middle easterner Republic of Egypt, which has been celebrated for its dietary esteem within the desert gardens and numerous rural ranges of Egypt through all the ages.

In spite of Egypt's tall rank in terms of date production that sums to more than 1.7 million tons, almost 21% of the world production estimate at 8 million tons, its export contribution of the international dates market is low. This can be explained in the context of several factors related to the date value chain starting from date palm planting to harvesting manufacturing, packaging and distribution processes designed for local markets or for exportation.

Date palm is widely distributed in different districts of the world. There are over 3000 varieties of dates grown world-wide. Dates are important traditional crops.

(Gustavsson, 2011) clears up the difference between food waste and losses. Food losses refer to the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption. While food waste relates to retailers' and consumers' behavior.

Kummu et al. (2012) reported that more than 24% of produced food worldwide is lost through production chains, and stated that reducing food losses and waste is considered to be one of the most promising measures to improve food security in the coming decades. In recent years, interest in food waste has been internationally increased to produce added-value products**(Papargyropoulou et al., 2014) (Fikry et al., 2021)**. The assessment and assurance of the quality attributes of Dates is a key factor in increasing the competitiveness and consumer acceptance of this fruit**(Ibrahim et al., 2021)**.

The importance of perception was human nutrition, because it is an integral food source that is nutritionally valuable. Nutritional necessity and health for human need dates as fruits in nutritious value because they contain multiple nutrients, mainly carbohydrates, high amounts of sugars, water and mineral elements,etc. They contain many important vitamins and various amino acids. Not only this, but also the many benefits they inoculate **(EL-Sharabasy and Rizk, 2019).**

Dates are a decent source of some vitamins (A,B1,B3,C) and macro-elements such as phosphorus, iron, potassium and calcium **(Ahmed and Ramaswamy , 2006; Elleuch et al.,2008;Kulkarni et al.,2008;Biglari et al., 2009 and Iqbal et al .,2011).** Such as they are also being exceptionally rich in potassium and very low in sodium; may be a desirable food for hypertensive persons who are advised to consume low sodium diets.

the date processing industries are still following traditional methods of production and have not yet caught up with other modern agricultural industries **(Al-Hooti Et Al., 2002 And Sidhu Et Al., 2003 And Ahmed; Ramas Wamy, 2006).** Hence, dates deserve better commercial utilization for producing the value-added food products. Recently, there has been renewed interest in the date's fruit and their products as a component of new food formulation /preparation. Date natural product preparing businesses create different date items like date-paste, date syrup, date- plunge, date-honey, date-jam, date-vinegar, etc.

Dates also help to protect against many chronic diseases including cancer and heart disease **(Arshad et al., 2019).** Many studies have reported that the extract of date fruit is useful in reducing blood cholesterol levels **(Ali et al., 2012).** In Middle Eastern countries, it is believed that the consumption of dates, especially in the morning on an empty stomach, has many therapeutic values **(Benmeddour, Mehinagic, Le Meurlay, and Louaileche, 2013)**.

The broad pharmacological effects of P. dactylifera may be attributed to the powerful and beneficial ingredients including phenolic, flavonoids, carotenoids, vitamins, minerals, amino acids, fatty acids, and organic acids.

Following figure (2) represent the percentage distribution of the different aspect of date fruit consumption , while table (1) shows the different types of produced date fruits in Egypt (Ministry of Agriculture and land Reclamation 2014)

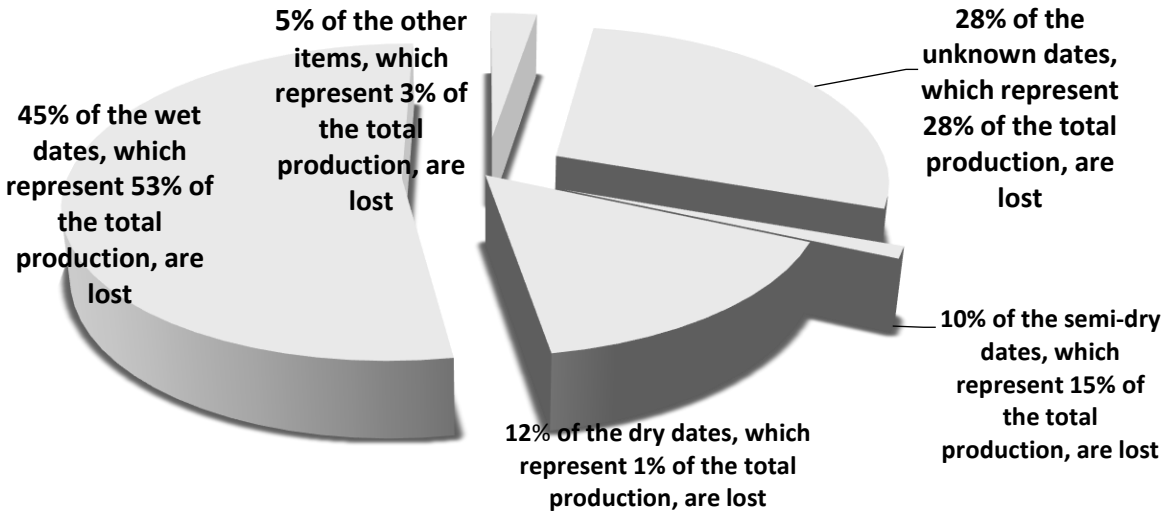


Figure (2) represent the percentage distribution of the different aspect of date fruit consumption

The aim of this work was to utilize some of the low quality date varieties to produce date powder,from. Sakkoti shamia . the dry date cultivars were used for producing date powder by applying simple technology.

2. Materials and Methods

2.1 Materials

Date palm fruits (Phoenix dactylifera L.) of shamia -beida and El Sakkoti varieties at (tamr stage) in march 2021. Flour, sugar, sodium bicarbonate, fern butter and eggs (whole and fresh) purchased from local market, Giza, Egypt.

Were obtained drum repairing mading from in a cabinet dries (date processing unit At the Food Technology Research Institute (FTRI), Giza, Egypt)

Date powder Processing

El Sakkoti and Shamia-Beida dates were air dried at 70°C for 10 minutes and cooled at room temperature rested on a wooden board to settle down and to eliminate rehydration, then the cores were separated and using to separate the cores. Then it was ground with a grinder and packaged under a vacuum to prevent moisture gain. The processing line has a daily capacity of 2 tons raw materials.

The limiting step in the whole process is the dehydration in the drying oven which can be operated overnight for the required time to achieve the appropriate moisture content of date flesh suitable for the following step.

Washing of incoming dates or the processed date pits (preferable by sprinkling water) requires drainage which is already available at the date packing house.

Grinding equipment made of Stainless steel with 5 hp and 3000 rpm milling machine with 500 kg/hours capacity was used to obtain date flour.

Recipes of biscuit mixes

Hard sweet biscuit was prepared by partially replacement of the sucrose with, 20%, 30 %, and 50% for the selected treatments of date powders. The recipe of the prepared biscuit was carried out according to the method of Magdy et al., (2021) with some modification as Shown in Table (1):

Table (1) Recipes of biscuit mixes by replacing the sugar with date powder

	control	**20%**	**30%**	**50%**
Flour (soft, 72%)	1000	1000	1000	1000
Sugar	300	240	210	150
Date powder	-	60	90	150
Fern butter	600	600	600	600
Vanillin	1	1	1	1
Egg (whole, fresh)	300	300	300	300
Sodium bicarbonate	3	3	3	3

2.2 Biscuit processing

The sugar and butter were creamed in the mixer for 2min., The percentage of the date powder (20-30 -50%) was cut from the percentage of the sugar in the biscuits formula .whole egg are added one by one, while the vanillin were blended for 2 min. Flour and baking powder were mixed and added, the mixture was gently mixed for 5 min by using a wooden rolling pin.. Shaping and baking are done at 200°C for 12-15 min in a rotary Baking oven (shof, Egypt).

2.3 Rheological Properties of The Blended Flour Investigated:

Dough produced from different blended flours was assessed for its Farinograph and Extensograph properties according to the method described by A.A.C.C. (2007).

2.4 Chemical Analysis:

Moisture, protein, Starch, fat, fiber and ash contents were determined according to the method described by A.O.A.C. (2005) Rang ana (1977). Also, Minerals (calcium CA, magnesium Mg, Na and K) were determined according to the method described by A.O.A.C. (2005).at the Food Technology Research Institute (FTRI), Giza, Egypt.

Also, Minerals (iron, zinc and copper) and total sugars (reducing and non-reducing) were determined according to the method described by A.O.A.C. (2019).

2.5 Physical characteristics

The diameter (D) and thickness (T) of four biscuits were measured by placing them edge to edge and by stacking one above the other respectively. To obtain the average, measurements were made By rearranging and restacking. Average weight (W), diameter (D) and thickness (T).

2.6 Color measurement:

Objective evaluation of surface color for biscuit samples was measured using (Minolta Data Processor Dp-301 For Chroma Meter Cr -300 Series) Color coordinates X, Y and Z were converted to corresponding Hunter L*, a* and b* color coordinates according to formula given by manufacturer. The Chroma (C) represents color saturation or purity was calculated from $C = (a^2+b^2)½$ and total color intensity $(a^2+b^2+L^2)½$.

2.7 Biscuits Sensory Evaluation

Sensory evaluation of obtained biscuits was averred according to

International Standards ISO6658-Sensory Analysis Methodology.

International standards ISO 14299-Sensory analysis Methodology- profile.

International standards ISO 11036-Sensory analysis Methodology texture profile.

International Standards ISO5492- Sensory analysis- Vocabulary.

International Standards ISO 3972- Sensory analysis- Methodology – Method of investigating the sensitivity of taste.

A verification test (profile test) had been implemented at Food and Agric. Industries Technology Center (FAITC) on July, 2021 for six samples of Biscuit with date powder divided into three samples from type Sakkoti date (sample 1) and three samples from type Shamia-Beida date (sample 2) to verify the results obtained from the panelists that were selected from staff members of FAITC and FTRI who could discriminate the various attributes according to screening methods ISO 3972:1991 Sensory Analysis / Methodology (Method of investigating the sensitivity of taste and confirm differences in the scorecard).

Biscuit with date powder samples was evaluated for: odor, crust color, crumb color, texture, roughness, crunchiness, taste, sweetness, adhesiveness, Moistness, mouth feel, after taste, and acceptability. The sample was coded and presented to panelists in suitable amounts. The profile sensory test was designed to evaluate all attributes of four samples that can be evaluated .The mean values were calculated for panelists' perceptions of each attribute.

3. Result and Discussion

3.1 Characteristics for fresh date fruits:

Table (2) shows the obtained results for the chemical composition of fresh date (Elshamia- Sakkoti)
As seen, there were no remarkable differences in moisture content, lipids, ash and acidity between the fresh fruits of the tested/date varieties. However, Sakkoti date two variety contained more protein, lower reducing sugars and Total Soluble Solids than Elshamia date variety.
Sakkoti date fruits showed higher hardness value (49.59N) than that of Elshamia (41.70 N). Based on these information, the crushing and milling energy for modeling date powder will be higher for Sakkoti variety than that required for El shamia.

Table (2) Chemical composition of raw Materials

Properties chemical	**date fresh(Elshamia)**	**date fresh (Sakkoti)**
Moisture Content (%)	9.330	8.47
Ph	5.330	5.54
Acidity (%)	0.240	0.23
Protein (%)	2.923	4.3

Reducing Sugars (%)	63.349	58.57±0.884
Non-Reducing Sugars (%)	3.866	7.450
Total Sugars (%)	67.215	66.01 ± 0.62
Lipids (%)	0.377	0.36
Fiber	2.92	3.90
Tss%	79.150	74.93
Ash	2.650	2.59
Hardness(N)	41.70	49.59

3.2 Mineral content of Sakkoti and El-shamia date varieties:

Table (3) Shows the mineral content of the two tested date varieties. That Sakkoti date fruit contained higher content a mineral such as calcium, magnesium, sodium, potassium, Iron, Zinc and Cupper than those of Elshamia date variety. However, El-shamia date fruits contains more phosphorus than did Sakkoti variety.

Table (3) show Minerals Content of the two tested date varieties

Minerals	**date fresh(Elshamia)**	**Date fresh (sakkoti)**
Calcium (Ca)	26.50	74.72
magnesium (MG)	19.80	60.207
sodium (Na)	6.10	29.36
potassium (K)	46.10	71.29
phosphorus (P)	23.20	19.23
Iron (fe)	12.54	11.925
Zinc(zn)	1.52	1.32
Cupper (cu)	1.32	1.11

3.3 Rheological characteristics of biscuit dough as affect by date powder addition:

Rheological properties of dough are important for the quality of the intended product. Farinograph and Extensograph tests demonstrate the dough development, the necessary water amount for obtaining dough, the flow ability, elasticity and tensile resistance of the dough and its ability to keep gases inside the final product.

Table (4) shows the effect of date powder incorporation on rheological parameters (Farinograph and Extensograph) of biscuit dough and Figure (4) represent the obtained diagrams. The result could be interoperated as follows:

3.3.1 **Water absorption %:** is the amount of necessary water to produce dough with a consistence of 500 BU. As seen, the amount of water necessary for dough of the control sample was 59 cm^3 H_2o /100g flour. This amount was gradually decreased to the level of 42 cm^3 H_2o /100g flour by increasing the amount of incorporated date flour in the dough.

The reason for the lower amount of water could be referred to the high amount of reducing sugar (mainly fructose) in the incorporated date flour, which build up a viscous mass upon dissolving and help in reaching the 500 BU, while control sample needs much water to hydrate starch and protein molecules in the flour, where they are responsible for the viscous structure of the dough. The water absorption was reduced by increasing the amount of fructose in the added date flour.

3.3.2 **Arrival time:** is the time elapsed from start of mixing until the Farinograph curve (Farinogram) touch the line of 500 BU. As seen, the arrival time was increased from 1 min for control dough to the level of 1.5-2 min by incorporating date flour in the formula of biscuit mix.

3.3.3 **Dough development time**: is the time elapsed from start of mixing to the time, at which the Farinograph reaches the maximum value on brabender scale and before the Farinograph curve starts to decline. Figure (4) and table (4) shows that the dough of control mix (without sugar replacement) requied 2 minutes to get the maximum coristence,

while incorporation of date fruit powder strongly increased the required time to the level of 6.5 min to 9.5 min, probably because the relatively high fiber content of the date flour and to its rougher particles which required longer mixing time to be completely mixed and integrated in the dough matrix.

3.3.4 **Dough stability time**: the dough stability time was started from the time where the Farinograph curve starts to touch the line of 500 BU (arrival time) until the time, at which the curve starts to decline and leave the 500BU- line.

As seen in Table (4) and Figure (4), the stability time of the date powder free dough (control) was 2.5min. This time was increase to the level of 9.5 to 16 min as a result of partial replacing the formula sugar content with different ratios of Sakkoti and Elshamia date fruit powder.

The reason for this long stability time could not be referred to difference in protein and gluten content But rather to high viscosity of the developed dough (high Fructose content of replaced mixes), which stics longer time at the rotating axis of the mixer until the dough starts to weaken.

3.3.5 **Degree of softening**: is the difference in Barbernder units (BU) between line of 500 BU and the BU. level of the Farinograph curve12 minutes later after point of the maximum viscosity recorded on the curve.

Result given in table (4) and figure (4) revealed remarkable difference in the levels of softening degree between the tested samples. Dough of control mix showed softening level of 70 BU. Incorporation of Sakkoti powder did increase the softening degree to 80 BU, while incorporation of Elshamia date powder did reduced the degree of softening of the level of only 40 to 60 BU.

Parameter of Extensograph test consists of forming the dough by mixing and rolulriliting it to a piece of cylinder form, loading it on holder proofing and then subjecting the dough to reverse tensile text in the Extensograph until cutting.

The necessary parameters for evaluating rheological properties from the obtained Extensograph are the "maximum deformation" or extensibility" which express the increase in dough sample elongation until separation ; resistance to extension "Elasticity " expressing the force (in BU) , which gradually increase during the test until the dough sample reaches maximal deformation and then falls to zero and the energy required to deform the dough samples (BU*mm) , which could taken from the area under the Extensogram curve in (cm^2) .

Date given in table (4) and Figure (4) demonstrates the extensograph test results obtained for the tested dough samples. The result revealed that the control biscuit dough showed a maximal deformation (extensibility) of 85mm, required high force (580 BU) and high energy (55cm^2) to deform the dough.

Incorporation of date fruit powder in the formula of biscuit production did increase the extensibility (deformation length) to the level of 105to 110mm except those with 30% of el shamia powder, reduced the required tensile force (elasticity) to the level of 280 to 540 BU and consequently reduced the tensile energy to the level of 30 to 60 cm^2. The most optimal blending ratio for formulating biscuit mix is the use of 20% and 30% powder from Elshamia date fruit.

The corresponding dough showed the lower degree of softeness (60 and 40 BU), suitable extensibility for forming the dough (105 and 70mm) as well as energy value between 60 and 30 cm^2. The R.N ratio number (R.N) given in Table (5) expresses the ratio between elasticity, from rheological stand point, and the elastic modulus of the obtained dough, which decreased with date powder incorporation.

The obtained result agree with those reported by **El sharnoby et al., (2012) and Karra et al., (2020)**. They reported similar dough developing time (1.88 to 2.10 min) to those given in the present work. Also, the dough stability was substantially increased upon incorporation of date powder, from 1.88min to 20.25 min. They also mentioned the role of date phenolic compounds, as antioxidants, in strengthen the biscuit dough. They suggested that stability time higher than 8 min and mixing tolerance lower than 60 BU are characteristics for high quality flour suitable for biscuit production.

Table (4) Effect of Replace Date Powder on Farinograph and Extensograph Parameters of Biscuit Dough

Test Results										
		Farinograph					Extensograph			
Samples name	**Test methods**	**Water absorption %**	**Arrival time(min)**	**Dough development (min)**	**Stability time (min)**	**Degree of softening (B.U)**	**Elasticity (B.U)**	**Extensibility (min)**	**P.N**	**Energy(CM^2)**
Control	**A.A.C.C**	59	1	2	2.5	70	580	85	6.82	55
Sakkoti 20%	**(2007)**	50	1	6.5	9.5	80	420	105	4	50
Sakkoti 30%		46	2	6.5	7.5	80	280	110	2.54	40
Elshamia 20%		49.5	1.5	7.5	12	60	540	105	5.14	60
Elshamia 30%		42.	1.5	9.5	16	40	400	70	5.71	30

3.4 Chemical composition biscuits

Table (5) depicts the chemical composition of the obtained biscuit samples after baking. The moisture content of all samples was in the range of 4.11 to 4.83%. The moisture remaining in biscuit is in the form of found water covering the hydroxyl, hydrogen and carboxyl groups of the sugar, starch, protein, fats and fiber chains with a mono H_2O. molecules to prevent oxidation of these compounds and , hence , the water activity of the dry biscuit is enough to prevent microbial contamination, but did not protect the product from browning reaction and fat oxidation , which are still active even under very low a_w . Values. No remarkable changes in protein and starch contents have been observed. However, biscuit samples produced by replacing a part of sugar with date fruit powders showed higher content in crude fiber and reducing sugars and lower content a non-reducing sugar compared with control sample.

Table (5) proximate composition of produced biscuit samples (g/100g)

Properties Chemical	**Control**	**Biscuit (Elshamia)20%**	**Biscuit (Elshamia)30%**	**Biscuit (Sakkoti)20%**	**Biscuit (Sakkoti)30%**
Moisture Content (%)	4.49	4.59	4.83	4.11	4.27
Protein (%)	9.987	9.99	10.005	9.021	9.451
Starch	33.88	34.02	35.59	33.98	34.89
Ash (%)	0.598	0.756	0.900	0.656	0.757
Crude Fiber (%)	1.09	1.12	1.15	1.11	1.25
Fat%	41.891	40.788	39.921	38.991	37.886
Total Carbohydrate	73.89	73.00	72.55	73.02	72.98
Total Sugars (%)	14.36±36	14.89±0.14	15.20±0.14	14.89±0.14	15.20±0.14
Reducing Sugars (%)	4.72±0.07	6.74±.012	7.74±.012	6.74±.012	7.72 ± 0.12
Non-Reducing Sugars (%)	9.64	8.15	7.46	8.15	6.08

3.5 Mineral content of date powder supplement biscuits

Analysis of the minerals content (Table6) showed that incorporation of El-shamia date powder in the biscuit formula had lower sodium content. Increased magnesium content, while incorporation of Sakkoti powder remarkably increased the potassium making biscuit more health beneficial than did the control biscuit samples. Also essential elements such as ferrous, zinc and cupper were increased by increasing the replacement ratio, especially when powder of el-shamia date fruit was used. Consumption of biscuit with replaced date powder will be more beneficial for health than the one produced by sucrose sugar.

Similar trend in Chemical Corporation of biscuit samples has been observed by **karra et al., (2020),** except that their fiber content was higher than those reported in the present work due to the difference in date varieties used. Also, **El-sharnoby et al., (2012)** reported an increase in Fe, Zn and cu in biscuits containing date fruit powder.

Table (6) Minerals Content of Sakkoti and El-shamia biscuits (mg /100g)

Test methods	Minerals (mg100g)	control	Biscuit (Elshamia)20%	Biscuit (Elshamia)30%	Biscuit (Sakkoti)20%	Biscuit (Sakkoti)30%
A.O.A.C (2005)	**Calcium (Ca)**	37.07	38.05	39.39	37.89	38.32
	Magnesium (MG)	19.95	25.98	30.74	20.97	23.795
	sodium (Na)	29.52	15.22	10.22	27.23	24.23
	potassium (K)	174.75	175.00	175.23	210.55	233.06
	Iron (Fe)	1.46	1.65	1.82	1.47	1.48
	Zinc(Zn)	0.77	0.79	0.82	0.74	0.75
	Cupper (Cu)	0.15	0.159	0.16	0.16	0.17

3.6 Physical characteristics of biscuit samples:

Table (7) shows the Physical characteristics (weight, length, width and thickness) of the obtained biscuit samples. As seen, there are some variation in both length and weight of the final product as a result of non-uniform shaping of the dough before baking.

However, their a reduction in the width of biscuit samples containing date powder (28.45mm to 34.37mm) compared with the control sample (42.86mm). Also, the thickness of the biscuit samples prepared by partial substitution of sugar with date powder were, in general, lower than those of control sample (14.20 to 19.74 mm) versus 20.3mm.

Both values (width and thickness) were used to calculate the spread ratio, which is an important parameter for the appearance and judging quality of biscuit. As seen, the majority of the tested biscuit samples showed lower spread ratio values than that of control sample (2.11). The reason could be refered to the ability of date fibers and sugar to bind water and restricting ability spread of biscuit dough during baking.

According to Cheng and Bhat (2016), lower spread ratio value is a sign for bitter rising ability of biscuit during packing process the obtained results agree with those reported by **El sharnouby et al., (2012) and Karra et al., (2020)**. Similar results were also obtained by kenawi et al., (2016). they reported a decrease in the specific volume of biscuit formulated with powder of tamer el-wadi date fruit.

Table (7) Physical characteristics of biscuit samples

	Weight (g)	Length(mm)	Width(mm)	Hight(mm)	Spread ratio
Control	12.56	68.865	42.8625	20.3	2.11
El shamia 20%	11.98	70.76	29.58	19.74	1.50
El shamia 30%	14.00	95.74	28.45	17.89	1.59
El shamia 50%	15.76	70.48	29.06	14.20	2.05
Sakkoti 20%	11.49	67.56	34.37	26.09	1.32
Sakkoti 30%	14.62	96.74	28.91	17.56	1.65

Sakkoti 50%	15.61	67.78	31.52	14.86	2.12

3.7 Color parameters of biscuit samples:

Appearance of biscuit is one of the factors building the impression of consumer about the quality and acceptability of the product color characteristics of the result are given in Table (8). As seen, color parameters are evaluated for the face and back sides of the final biscuits. Lightness of the control biscuit sample (L- value) was 69.96 and it was gradually decreased to the levels of 57.66 and 55.89 by replacing 50% of the formula sugar by El-shamia or Sakkoti date powder, respectively. The loss in lightness of the biscuit samples prepared by 50% incorporation of date powder, was accompanied by decrease in yellowness (b-values) and increase in reduces values as could be observed in Table (8). This means, that the treated biscuit was slightly darker in color than the control samples. Correspondly, chroma values were reduced from level of 26.38 to lower values (19.9 and 20.41) By replacing 50% of sugar with powders of El shamia and sakkoti dates respectively. Changes in total color index (ΔE) were of negative sign, meaning that the treated samples showed less items color than that of control sample. The hue of the control biscuit sample showed a full yellow color (hue=90.49), but this color type was slighted toward yellow-orange as the hue- value was reduced to the level of 86.68˚ and 76.58˚ by replacing 50% of sugar with date powder of elshamia and sakkoti date, respectively.

Browning index is a parameter the degree of brown shade resulting from reduced sugars with amino acids during the baking process. The browning index of control biscuit sample (containing the maximum amount of sucrose sugar) was 47.73. this value was reduced to the level of 42.35 and 37.72 by increasing the ratio of incorporation date powder to 30% the reason for the reduction in browning index could be refered to the high ketonic sugar "fructose" from date powder, which did not have the aldehyde group necessary to read with the NH_2 group of the amino acids of the flour to build up the brown color.

Color parameters of the back side of biscuit samples are also given in table (8). Lightness of the backside (L-value) were much lower than that of face side (52.29) and this value was slightly decreased to the levels of 49.26 and 47.96 by replacing 50% sugar with date powder. Also, the back side of the control sample showed higher redness (a – value) than that of face side (6.19) but this value was reduced to the level of 7.81 and 3.91 by increasing the replacement ratio of date powder may be due to the aforementioned reason (less browning reaction). Similar trend was also observed for yellowness (b-values) and Chroma. The hue-value of the back side for control sample was 76.03(yellow-orange) and much lower than that of face side, due to the formed browning reaction products in the all sugar control sample. The hue was increased in the treated samples (79.81 and 83.07) for biscuit samples containing date powder. It seems that the less browning reaction shift the hue two sides the yellow control. Also, back side of the control sample showed the height value for browning index (71.56) and this value was reduced to the level of 49.63 and 47.57 by incorporating powder of El shamia and Sakkoti date, respectively.

The obtained results agree with those of **Alsenaie' etal. (2015) and Karra etal. (2020).** They reported reduction in l, b, c and hue- value and an increase in a-values by replacing a part of sugar or flour in the formula of biscuit and cookies by date fruit powder. At should also be mentioned that the induce color darkness is not an only result of maiuard browning reactions, but with less extent due to direct sugar caramelization and oxidation induced by the phenolic components of date powder incorporation in the biscuit formula **(Alsenaien et al.,2015)**

Table (8) the Color parameter of Biscuits

Treatments	**L**	**A**	**B**	**Totalcolor intensity**	**ΔE**	**chroma**	**Hue^{o}**	**Brown Index**
								1- face side color parameter
Control	67.96	-0.225	26.375	72.8989	73.00	26.37596	90.49	47.73
El shamia 20%	64.23	1.07925	23.21	68.3034	4.60	23.23508	87.34	45.044
El shamia 30%	61.61	0.75	21.345	65.2070	7.69	21.35817	87.99	42.35
El shamia 50%	57.655	1.1525	19.88	60.9970	11.90	19.91338	86.68	42.69
Sakkoti 20%	69.475	-0.12	21.83	72.8240	0.075	21.83033	90.31	36.65
Sakkoti 30%	62.99	-2.4375	19.7875	66.0698	6.83	19.93707	97.02	37.72

Sakkoti 50%	55.8925	2.4775	20.405	59.5522	13.35	20.55485	76.58	48.35
2- back side color parameter								
Control	52.2875	6.19	24.8825	58.2360	58.24	25.64088	76.03	71.56
El shamia 20%	55.5075	4.19	20.555	59.3392	1.10	20.97771	78.48	50.85
El shamia 30%	53.8125	3.4725	19.32	57.2809	0.96	19.62959	79.81	48.3
El shamia 50%	49.2625	4.8125	17.285	52.4282	5.81	17.94245	74.44	49.63
Sakkoti 20%	57.775	2.39	19.655	61.0735	2.84	19.79978	83.07	43.76
Sakkoti 30%	59.69	2.2875	21.675	63.5447	5.31	21.79537	83.97	46.89
Sakkoti 50%	47.965	3.9075	16.38	50.8351	7.40	16.83962	76.58	47.57

3.8 Sensory evaluation of biscuits:

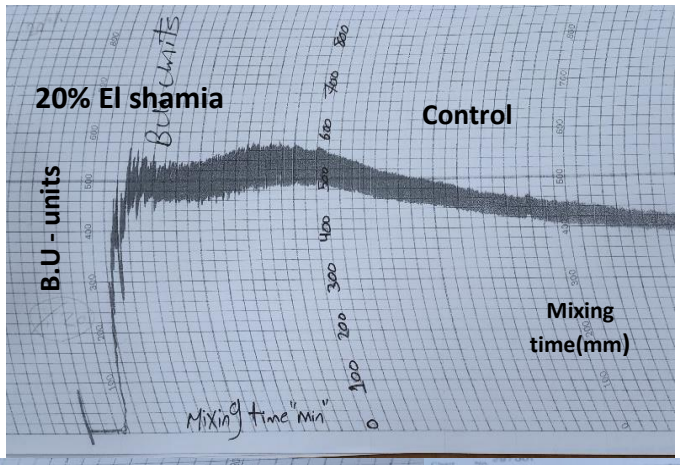
Result for sensory attributes of tested biscuit samples are given in table (9). 13 different sensory perceptions were evaluated from the panelists. The biscuit samples with incorporated date powder showed lower roughness and higher mouth feel scores than those of control samples. The result reveald that biscuit samples with 30% substitution sugar with date powder recorded higher sensory scores and closer to the control sample, compared with those of 20% and 50% substitution.

The obtained results agree with those of **El sharnoby et al., (2012) and kenawi et al.,(2016).** They indicated that the addition of date powder to the biscuit as a sugar substitutes resulted in improvement in the sensory attribute of the product till 30% replacement ratio. On other side, Alsenaien et al. ;(2015) suggested that date powder could be used commercially to produce date – based cookies.

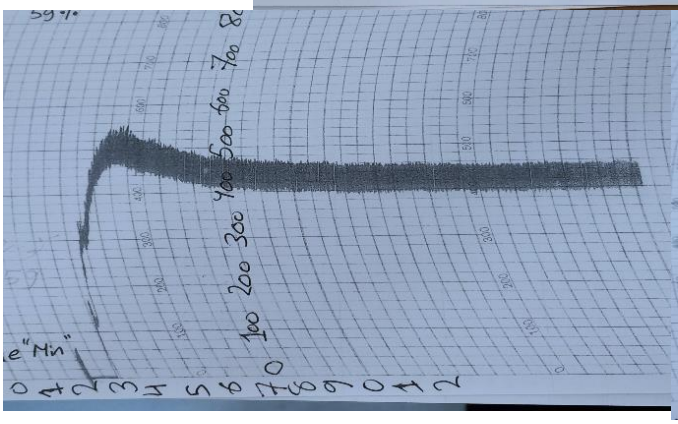
Table (9) Sensory attributes of biscuits

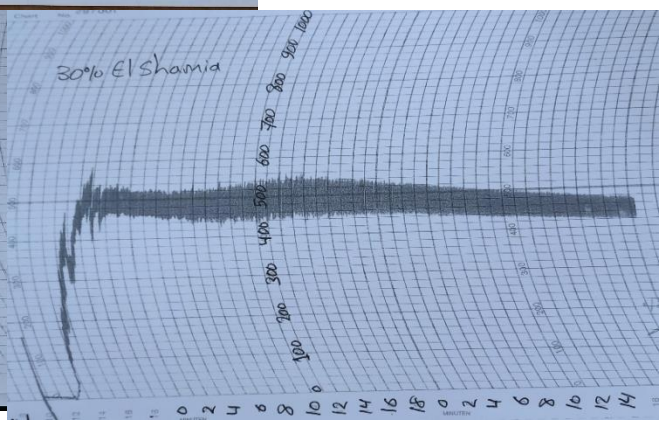
Treatments	**Odour**	**crust colour**	**crumb colour**	**texture**	**roughness**	**cruchness**	**adhesiveness**	**taste**	**sweetness**	**Moistness**	**mouth feel**	**after taste**	**acceptability**
control	6.67	6.56	7.80	7.20	7.80	6.70	6.80	6.70	6.80	6.33	6.50	6.70	6.67
Sakkoti 20%	6.77	6.88	7.11	6.44	6.44	6.55	6.66	6.33	6.22	5.66	5.88	6.44	6.33
Sakkoti 30%	6.78	6.67	7.00	7.60	6.80	7.22	6.66	7.33	7.11	6.70	7.00	7.11	6.89
Sakkoti 50%	6.33	6.22	6.11	5.88	5.77	6.00	6.22	5.88	6.00	5.66	5.33	5.33	5.33

control	6.67	6.56	7.78	7.22	7.78	6.78	6.78	6.78	6.78	6.33	6.56	6.78	6.67
Shamia 20%	6.66	6.88	6.77	6.55	6.77	6.55	6.66	6.77	6.44	6.33	6.44	6.22	6.44
Shamia30%	6.78	6.33	7.44	7.44	6.44	7.11	6.56	7.44	7.22	6.89	7.11	7.44	7.44
Shamia 50%	6.33	6.11	6.55	6.33	6.00	6.00	6.88	6.77	6.66	6.11	6.77	6.66	6.44

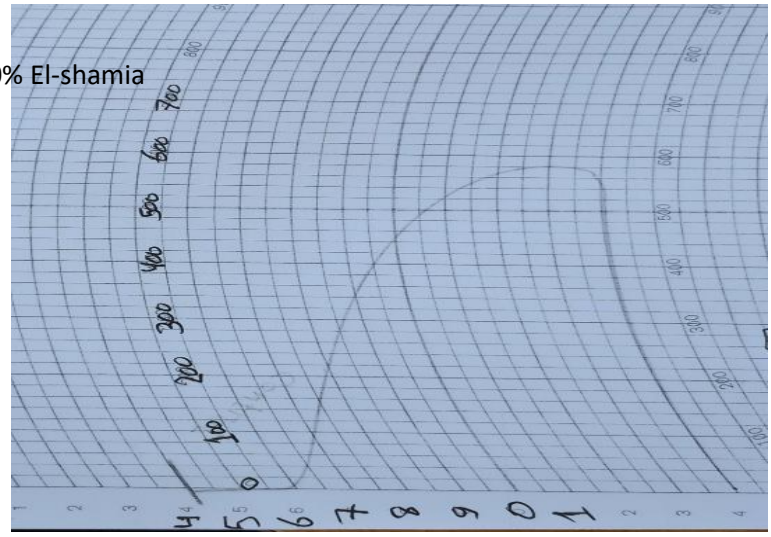


30% El shamia





20% El-shamia



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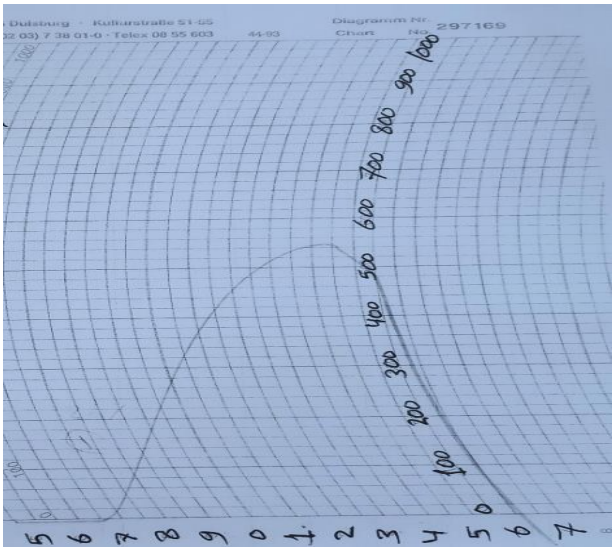
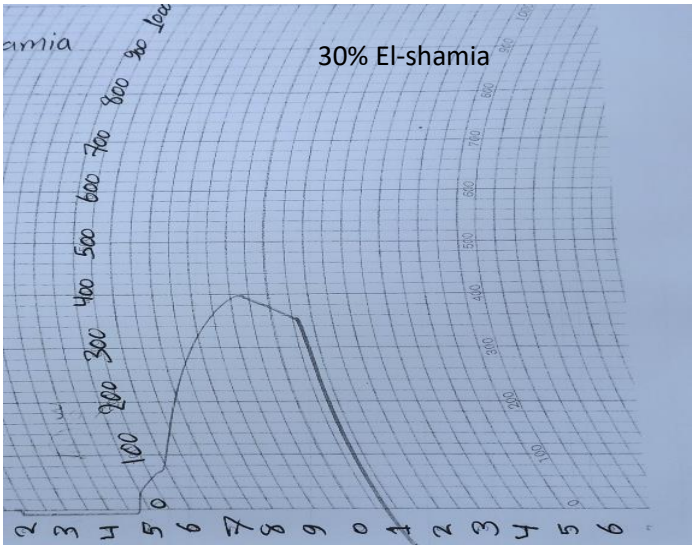
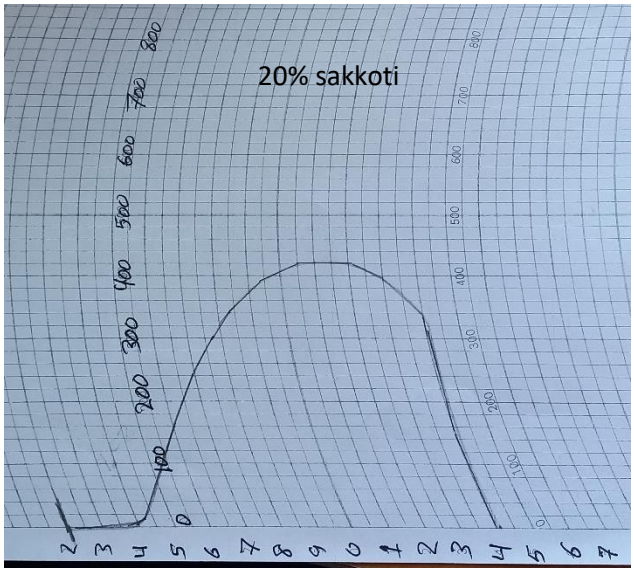


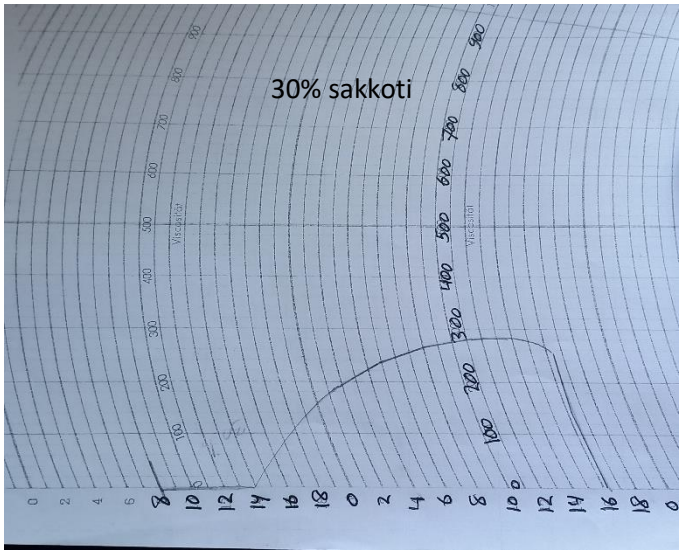
30% El-shamia



20% sakkoti



30% sakkoti



Extending time(mm)

Figures (4) effect of Replacing sugar with Date Powder on Farinograph and Extensograph Parameters of Biscuit Dough samples

CONCLUSION

From the above results it could be concluded that 30% of date powder was the best supplementation because It improved the general appearance, taste, and texture and crust color compared with control. On the other hand, it increased the minerals content, especially potassium, calcium, phosphor and iron

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