



## EFFECT OF UTILIZATION OF DATE FIBER FROM DATE SYRUP MANUFACTURE ON ORGANOLEPTIC PROPERTIES OF CHOCOLATE CAKE AND EXTENDING THE STORAGE LIFE OF THE PRODUCT

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### ABSTRACT

This investigation is aimed to enrich chocolate cake with date fibers from date syrup manufacture. The fibers were dried and grounded and replaced for wheat at rates of 5, 10, 15 and 20% (weight: weight) for the treatments A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub>, A<sub>5</sub> respectively. The treatments were compared to standard recipe (A<sub>1</sub>) for chemical composition, organoleptic properties and volume. The bacterial count was conducted for the treatments after frozen storage (-15°C) and refrigerated storage (7°C). Both ash and fibers contents increased significantly (P<0.05) for A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub>, A<sub>5</sub> to reach maximum values of 3.30 and 3.22% respectively for A<sub>5</sub> as compared to 1.25, 0.73 % respectively for control (A<sub>1</sub>). These rates of fat, protein and caloric values were decreased relatively as compared to control (A<sub>1</sub>). There were insignificant differences for cake volume (height) between different treatments, while the volume of cake decreased as increasing of fiber percentage, except (A<sub>2</sub>) treatment where the volume reach to 3.11% as compared with the control (A<sub>1</sub>). There was a significant difference for sensory properties among the treatments A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub> and A<sub>5</sub> for freshness and overall acceptance, while treatment A<sub>3</sub> was superior for the appearance as compared to other treatments. The bacterial examination for treatment stored at freezing and refrigeration, the obtained results showed that bacterial growth decreased with increased level of added fiber during frozen storage for 28 days and refrigeration for 21 days. It can be concluded that the added fiber to chocolate cake had positive impact as far as health storage and sensory properties.

**KEY WORDS:** Date fibers, fibers, cellulose, chocolate cake.

### INTRODUCTION

Dates are considered as one of the more important produced fruits especially in Iraq and Arabian Gulf countries. The estimated amount of average dates consumption by an Arabian person near 9.6 kg/ year<sup>-1</sup> and this equals to 26 gram of dates daily and this provides 2% of requirement of medium activity person of calories and this ratio is considered very little and there is need to encourage persons to increase it by using the possible means due to the large nutrition advantages of dates. Iraq is the important Arabic country in dates cultivation and dates production, so dates manufacturing factories were established to produce many miscellaneous products such as dates syrup, vinegar, liquid sugar, yeast and alcohol. The secondary products of these products are dates remnants such as dates kernel and date paste, which are remained after dates pressing operation, these remains are good fibers source that may be used in enrichment of some poor fibers foods or non fibers foods to increase their nutrition value and make them more advantage to human body<sup>[1,2]</sup>.

Fibers are considered as important food component due to their role in body protection from heart diseases and cancer and fat level regulation in blood, besides regulation of glucose absorption, insulin secretion and constipation curing<sup>[3]</sup>. The nutrition fibers may be defined as the indigestible plant part that may reach the large intestine without targeted by digestion and absorption processes compared with starches, saccharides, fats and proteins which may be digested and absorbed for providing the

body by the required biological energy by human body fibers found in the outer part of seeds, fruits and legumes and peeling of fruits in foods processing result in loss of these parts that have nutritional important fibers<sup>[4]</sup>.

The nutrition fibers are classified according to their solubility capability to soluble dietary fibers (SDF) which include hemicellulose, pectin, gums, and insoluble dietary fibers (IDF) such as cellulose and lignin<sup>[5,6]</sup>.

Now days, the consumers focus on eating low calories cholesterol and fats foods that are called healthy foods beside preferring the highly fiber foods content or fibers enriched foods<sup>[7]</sup>. Many studies were done by using different kinds of fruits and vegetables fibers to improve the rheological properties of some of baked products besides their importance from medical point of view.<sup>[8]</sup> Sochit *et al.*, used used banana peels in butter cake production at different ratios and they reported that adding peels powder at 5% rate (w/w) improved the sensory and rheology properties of the product compared with free fibers Cake. Kohajdova *et al.* tested effect of adding carrot core powder to wheat flour on the rheological properties of paste when the powder was added to wheat flour with 1,3,5 and 10% replacement ratio and examining effect of the replacing ratio on the produced loaf quality<sup>[9]</sup>. The present study aimed to use different dates fibers resulted from dates syrup production after treating and adding to chocolate cake to enrich it with this nutrition element and improve the product sensory properties besides study their effects on microorganisms growth that cause cake degeneration.

## MATERIALS & METHODS

### Dates fiber preparation

Alzehde dates type was used and the sugar syrup was firstly extracted to produce of dates syrup then, the residue of dates was taken and dried in electrical oven (circular air influx) at 50 C° reaching to the dryness state and constant weight. Grinding of the fibers was done followed by sieving by very fine sieve.

### Producing of chocolate cake

A laboratory producing of chocolate cake was done and a standard cake mixture that put by <sup>[10]</sup> was used by adding the following materials.

100 gram of flour, 66 gram hydrated plant fat 150 gram of sugar, 100 gram eggs, 5 gram baking powder, 68 ml of milk, 18 gram cacao, 1 gram salt and 2ml vanilla and, then wheat flour was replaced by dates fibers using the written materials ratios in table (1).

**TABLE 1:** Ratio of wheat flower replacement by date fibers

Weight of dates fibers (gm)	Weight of Wheat flour (gm)	Treatments symbol	Replacing rate
-	<b>100</b>	A <sub>1</sub>	<b>0</b>
<b>5</b>	<b>95</b>	A <sub>2</sub>	<b>5</b>
<b>10</b>	<b>90</b>	A <sub>3</sub>	<b>10</b>
<b>15</b>	<b>85</b>	A <sub>4</sub>	<b>15</b>
<b>20</b>	<b>80</b>	A <sub>5</sub>	<b>20</b>

Cake was prepared by using the traditional method and an electrical mixer according to <sup>[11]</sup>, the flour, baking flour and salt were sieved and vanilla was added to the milk and then fat was mixed at medium speed for one minute, sugar then added and mixing was done for one and half minute, egg was added and mixed for one minute, third quantity flour was added alternately with third milk quantity, the addition repeated twice and then the mixture was mixed for 45 second. 300 gram samples were taken and put in 15 cm diameter fatted, circled molds, and then they were baked at oven (200 centigrade) for 20 minutes. The cakes were pulled out the oven and cooled, the cake size was measured and three replicate were used.

### The chemical composition of the produced cake moisture determination

The cake moisture was determined according to the method that mentioned by <sup>[12]</sup> two to three gram cake sample was put in known weight can in electrical oven at 105C° until getting constant weight ,then the can was cooled at weighted.

### Ash determination

Ash was determined by using the method that mentioned by <sup>[12]</sup>, the cake sample was burned in muffle furnace at 525 C° until its color changed to greyish close to white.

### Protein determination

Protein was determined by using Kjeldahl the method that was mentioned by <sup>[12]</sup>, the total nitrogen ratio was determined and then it was multiplied by the factor (6.25) to get protein percentage value.

### Fat determination

Fat ratio was determined by using Oscillate instrument to extract fats according to the method that was mentioned by <sup>[12]</sup> and using the oily ether to extract fats.

### Fibers determination

Two gram of cake samples was weighted and crude fibers contents were determined using the method that mentioned by <sup>[12]</sup>.

### Energy estimation

Energy was estimated according to that one gram fat may produce 9 calories and one gram of protein may produce 4 calories and one gram carbo hydrates may produce 4 calories.

### Total carbohydrates determination

It was determined with fibers by using the calculation difference as it is mentioned by <sup>[13]</sup>.

### The physical tests

#### Cake size measurement

Cake size was measured in sign of its standing height (S.H) according to <sup>[11]</sup>. Two centimeter thick slide of middle of cake was taken and put on paper and its shape was bounded by using a pencil and then five columns were drawn, one column in the middle of the slide and two on each of the right and left halves of the slide in symmetrical positions inside the form of the drawn slide on the paper. The lengths of drawn columns were measured in centimeter unit by using a ruler and added and divided on the columns number to get the average of the numbers that represent the standing height value.

#### Sensory evaluation

The sensory evaluation of the shortened cake was done by fifteen evaluators who were from the specialized staff of the Domestic Economic Department by using evaluation questionnaire to <sup>[11]</sup> and using Hedomic scale (1 to 7), where 7,6,5,4,3, 2,1 represent excellent, very good , good, medium, pass , bad , very bad respectively. The shortened cake was evaluated after freezing by studying the following properties, appearance, texture, freshness, flavor, general acceptance.

#### The bacteriological tests and the storage experiment.

The storage experiment of the cake was done after cooling storage for 4,14, and 21 days at 4 C° and also for the freezing storage for 7,14,21 and 28 days at -18C°. The total microorganism's numbers was counted by using the standard plate count method that is mentioned by <sup>[14]</sup>, the nutrient agar was casted in plates at duplicate for each sample.

#### Statistical analysis

Statistical Analysis System <sup>[15]</sup>. SAS program was used in data analysis to study effect of the different treatments in the studied properties according to the completely randomized design (CRD). The significant differences were compared between the mediums by test the least significant difference (LSD).

## RESULTS & DISCUSSION

Table (1) shows effect of replacement of wheat flour by different ratios of dates fibers on the approximate chemical structure of the produced cake. it may be observed that although of the slight increase of moisture and carbohydrate contents but there were no significant differences ( $p < 0.05$ ), while, the ash and fibers ratios significantly increased, and the ash and fibers percentages in control treatment were 1.52% and 0.73% respectively and increased to 3.30% and 3.22% respectively in the 20% replacement ratio ( $A_5$ ) treatment. It may be also noticed that the mineral ratio increased because Dates are

considered as mineral rich source beside the fibers<sup>[16]</sup>. The results show also non-significant decline in fat ratios with increasing replacement ratios, and the fat content in the control treatment ( $A_1$ ) was 18.26% and declined to 16.09% in 20% replacing ratio ( $A_5$ ) treatment, the protein and energy percentage declined significantly with increase of replacement ratios. The protein percentage decreased from 6.85% to 4.57% fats, and protein contents declines with increase of replacing ratio may be due to decline of their contents in dates as they were considered as protein and fat poor sources<sup>[3]</sup>.

**TABLE 1:** Effect of replacement of wheat flour by different ratios of dates fibers on the approximate chemical structure of the produced Cake (%).

Treatment	*Moisture%	*Ash %	*Fat %	*Protein %	*Fiber %	Carbohydrates %	Energy %
$A_1$	21.08a ±1.67	1.52c ±0.04	18.26a ±0.29	6.85a ±0.46	0.73d ±0.03	52.29a±0.84	400.9a±0.76
$A_2$	21.45a ±1.09	1.96bc ±0.07	17.86a ±0.88	6.22a ±0.39	1.24cd ±0.05	52.51a±0.75	395.66a±0.94
$A_3$	21.97a ±1.74	2.45abc ±0.04	17.12a ±0.19	5.63ab ±0.48	1.92bc ±0.05	52.83a±0.90	387.92ab±0.83
$A_4$	22.32a ±1.06	2.97ab ±0.06	16.76a ±0.77	5.14ab ±0.32	2.47ab±0.06	52.81a±0.87	382.64b±0.91
$A_5$	22.86a ±2.36	3.3a ±0.06	16.09a ±0.82	4.57b ±0.41	3.22a±0.05	53.18a±0.62	375.81b±0.84
LSD	3.885 NS	1.077*	2.738 NS	1.534*	1.055*	4.711 NS	16.473*

NS: ( $P < 0.05$ ), Medium ± standard error

Average of duplicate

Table (2) shows effect of wheat flour replacement by different ratios of dates fibers on cake size by using its erect height as indicator, besides the increase and decrease percentages. The results referred to size decline with increase of replacement ratio except  $A_1$  treatment (replacing ratio 5%), although the recorded decrease ratio had not significant differences between the different treatments, as may know that size decline ratio ranged between (0.58-5.06%), while increase of cake height was noticed in 5%- replacing ratio ( $A_2$ ) treatment and size

increase ratio was 3.11%. The reason of cake size decline with increase of replacement ratio may be attributed to gluten ratio decrease especially the Gluten is considered as an essential factor in formation of the suitable structure and consistency paste, and gluten network works on swelling gases save especially  $CO_2$  and that means the formatted paste was less cohesion when gluten percentage decline and this makes swelling gases leak in larger quantity<sup>[17]</sup>.

**TABLE 2:** Effect of wheat flour replacement by different ratios of dates fibers on the standing height of the produced cake (cm)

Treatments	Cake size height (**)	Variation ratio (%)
$A_1$	5.13a±0.29	-
$A_2$	5.29a±0.32	3.22a±0.16
$A_3$	5.10a±0.17	0.58b±0.06
$A_4$	4.94a±0.13	3.70c±0.12
$A_5$	4.87a±0.26	5.06c±0.24
LSD	0.729 NS	2.409*

NS: ( $P < 0.05$ )\*, Medium ± standard error

\*\*Average of triplicate

Table (3) shows effect of wheat flour replacement by different ratios of dates fibers on the sensory properties of the produced cake. The results show non-significant differences ( $p < 0.05$ ) between the different treatments in appearance property in spite of the superior that appeared in the replacing treatments, the 10% replacing ratio ( $A_3$ ) treatment got best degrees which was 6 while, in texture, freshness and flavor properties then were non-significant differences between control treatment ( $A_1$ ) and  $A_2$ ,  $A_3$  and  $A_4$  treatments. But there were significant differences between the last treatments  $A_5$  treatment (replacing ratio

20%). Table (5) shows also non-significant differences in the general acceptance degree except the  $A_5$  treatment (replacing ratio 20%) got the highest value (5.7) followed by  $A_1$  and  $A_2$  treatments which got (5.6) degree and  $A_5$  treatment got the lowest value which was 4.2, that may be due to fiber ratio increase which in turn affected on the specific size of the produced cake, the fibers characterized by its high capability to connect with water and then on gluten network formation and decline of the cake specific size and this affected on the general acceptance degree of the product<sup>[18]</sup>.

**TABLE 3:** Effect of wheat flour replacement by different ratios of dates fibers in the sensory properties of the produced cake

Treatments	Appearance	Texture	Freshness	Flavor	General acceptance
A <sub>1</sub>	4.9ab ±0.12	5.4 ±0.12	5.8a ±0.19	5.7 ±0.17	5.6 ±0.15
A <sub>2</sub>	5.4ab ±0.17	5.2±0.19	5.3a ±0.16	5.3 ±0.16	5.6 ±0.18
A <sub>3</sub>	6.00a ±0.26	5.6 ±0.17	5.3a ±0.20	5.2 ±0.13	5.7 ±0.18
A <sub>4</sub>	5.2ab ±0.14	5.4 ±0.22	5.5a ±0.16	5.2 ±0.15	5.5 ±0.12
A <sub>5</sub>	3.6b ±0.11	4.2 ±0.18	3.9b ±0.09	4.1 ±0.11	4.2 ±0.08
LSD	2.07*	0.966*	1.127*	0.895*	1.047*

NS, (P&lt;0.05)\*, Medium ± Standard error

\*- Average of sensory evaluation that done by fifteen evaluators

\*\* Using Hedonic scale that consisted from 7 degrees as a maximum limit and one degree as minimum limit

7= excellent, 6= very good, 5= good, 4= medium, 3= pass, 2= bad, 1= very bad

Table (4) shows effect of wheat flour replacement by different ratios of dates fibers on the microbial load of the produced and frozen storage chocolate cake, it may be seen that the product was free of contamination after 7 days of frozen storage in all the treatments, while there was a bacterial growth at the 14th day of the frozen storage in the A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> and A<sub>4</sub> treatments. The treatment (A<sub>1</sub>) recorded the highest microbial number (25, 40 and

86)\*10<sup>3</sup> CFU from the day (14) to the day (28) respectively of the frozen storage compared with the (A<sub>5</sub>) treatment which had no microbial growth at the day (14) while growth of bacteria appeared at the 21 and 28 days with 35.9 \*10<sup>3</sup> CFU /g of bacterial number respectively. Generally, it may be noticed that the bacterial numbers decreased in growth with increase of cake fibers ratio during the frozen period.

**TABLE 4:** Effect of wheat flour replacement by different ratio of dates fibers on the microbial load (CFU /g) of the produced and the frozen storage (-18 C<sup>o</sup>) cakes for different times.

Replacement NO.	Microbial number			
	CFU /g * 10 <sup>3</sup>			
	7 days	14 days	21 days	28 days
A1	No growth	Mild growth 25	40	86
A2	No growth	Mild growth 16	27	79
A3	No growth	6	19	72
A4	No growth	2	13	58
A5	No growth	No growth	9	35

\*It represents the average of duplicates

**TABLE 5:** Effect of wheat flour replacement by different ratio of dates fibers on the microbial load (CFU g<sup>-1</sup>) of the produced cake and the cooling storage cake for different times.

Replace ratio	Microbial number			
	CFU /g*10 <sup>3</sup>			
	7 days	14 days	21 days	Notes
A <sub>1</sub>	17	37	65	Presence of mild mold and viscosity
A <sub>2</sub>	Mild growth	23	53	Presence of viscosity and mold
A <sub>3</sub>	Mild growth	19	47	No mold with mild viscosity
A <sub>4</sub>	No growth	Mild growth	36	No mold
A <sub>5</sub>	No growth	Mild growth	25	No mold

Table (5) shows the microbial numbers in the frozen storage cake for 21 days, it may be seen a mild growth of microbes starting from the 7<sup>th</sup> day in the treatment (A<sub>1</sub>) which was 7\*10<sup>3</sup> CFU /g to reach 65\*10<sup>3</sup> CFU g<sup>-1</sup> in the 21th day with appearance of molds and viscosity, while the bacterial growth in the A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub> and A<sub>5</sub> treatments declined with fibers ratio increase during the period of the frozen storage.

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