Tikrit Journal for Agricultural Sciences (2020) 20 (2):57-67
https://doi.org/10.25130/tjas.20.2.6

IRAQI Academic Scientific Journals
العراقية المجلات الأكاديمية العلمية

ISSN:1813-1646 (Print); 2664-0597 (Online)
Tikrit Journal for Agricultural Sciences
Journal Homepage: http://tujas.tu.edu.iq
E-mail: tjas@tu.edu.iq

TJAS
Tikrit Journal for Agricultural Sciences

Noor K. Mageed*;

Bayan Y. Al-Abdullah

Food Sci .Dept., College of Agriculture, University of Tikrit, Tikrit, Iraq

KEY WORDS:

Mono and Diglycerides, Low Energy Cake, Margarine, Calorie

ARTICLE HISTORY:

Received: 24/06/2020

Accepted: 28/08/2020

Available online: 15/12/2020

Manufacturing of Low Fat and Calorie Cake and Study its Qualitative and Storing Characteristics

ABSTRACT

A low – fat and calories cake was manufactured by replacing fat with margarine and oil in levels (25, 50, 75 and 100%) , with the cake improver in levels (1, 3, 5, and 7%) with adding 25% resistant starch (RS) instead of fat, also MDG is used in (0.1, 1, 2 and 3%) with adding 25% RS instead of fat. Chemical tests were done and some sensory Characteristics of the cake were estimated. The results showed an increase in the moisture content of the produced cake resulted from the replacement of fat with margarine, oil and MDG by (25,50,75,100) %. Ash value increase when replaced cake improver and margarine by 100% and a high percentage of fat increase when substituted margarine by (25,100) %and reached (21.33,20.8) %, respectively. Also, high protein values where observed when replacing fat with oil and MDG. The results showed an increase in the percentage of carbohydrates when replacing the improver with (25 and 50) %, which reached (64.01 and 63.07) %, respectively. The results indicated that replacing the fat with improves, margarine, oil, or MDG with 100% improved the quality of the produced cake. Calories were estimated and some staling evaluations of the laboratory cake were studied. The penetration test showed that there were significant differences between the results of the studied treatments, as significant differences appeared in the fat replacer treatments for the improver and margarine at (25,100)% which had to (14.0,9.33,14.33,10.33)% mm, respectively, as well when replacing the MDG with (0.1,3)%which is (16.0,11.0)% mm, respectively. The results showed the possibility of processing a low fat and calorie cake in good specifications and the same shelf – life of the commercial ordinary cake.

INTRODUCTION

Wheat is one of the most important food crops, as hundreds of millions of people around the world depend on the various foods produced from it (Garrard *et al*, 2010).

Wheat covers the largest agricultural area of any other food crop. Canada, China, France, India, Russia, Ukraine, the united states of America, and other major countries producing wheat, with the above-mentioned countries producing wheat from 749.5 % million tons (FAO, 2016).

Wheat contains 67.9% of carbohydrates, 17.0% protein, 3.0% fat, as well as minerals and vitamins (Joiamaand Zlatica , 2012; Raven, 2017). Some types of wheat are suitable for producing bread while others are suitable for making pastries, including, biscuits and cake.

The cake is a preferred product because its special sensory characteristics and acceptability of all ages. Recently people increased the rate of consuming it. Kinds of cake and its processing are many, and it has a good commercial market (Jordan, 2013). Cake may be defined as a semi- dry foam resulted from stabilization or hardening a liquid medium leavened by gases produced from the

* *Corresponding author: E-mail*: nourkamel1992@gmail.com

reaction of chemical materials or stretched air or water vapor. Gas bubbles and their membranes held part of gas or air till the evaporation of water involved in membranes or its binding with other components in the mixture (Pyler,2015).

There are three main factors that determine the quality of the cake. The appropriateness of the ingredients used to manufacture the required type of cake, the percentage of ingredients included in its mixture, and the manufacturing method used, especially in the mixing and baking stages (Smith, 2006). The history of the cake dates back to ancient times as the ancient Egyptians were the first people to care about making some cake-like products. In the middle Ages, the manufacture of this product developed in England, but it didn't reach. The traditional cake currently recognized and was close to the bread product withe difference in the shape and method of manufacture (Musili , 2006).

The cake is a nutritive product for its good contents of main components, some vitamins, minerals, and calories. The nutrition value is increased by adding fruit pieces and nuts (GSS, 2015).This product became very popular socially , being the first product to be presented on various occasions , young children also prefer it for its popular eating quality despite its high the nutritional value provided by the cake to the body, However, most nutritionists advise against excessive consumption as it leads to increased body weight, obesity, and high cholesterol levels in the blood (Nourmohammadi and Peighambordoust, 2015)

In Iraq, the researchers did not pay attention to the importance of cake. Most papers dealt with substitution of flour with the flour of other cereals. The purpose of the recent study was to the manufactured cake by substitution of fat and study its impact on the qualitative characteristics, chemical composition and storing traits by monitoring staling and the amount of reduction in calories.

MATERIALS AND METHODS

Materials

The method of AACC (1983) with some modifications was followed to determine materials used, which were as follows on the based-on flour weight: flour 100g, sugar 140g, fat 50g, egg 50g, baking powder 5g, skim milk 12g, salt 3g and water 120ml.

Fat Replacers:

The percentage of fat used in the mixture is based on the weight of the flour, the 50 g. Fat was replaced by (25,50,75,100) % with the followed materials.

1_ Cake improves: 1,3,5,7g+ 25g Rs
2_ Margarine: 12.5,25,37.5,50 g.
3_ Oil: 12.5,25,37.5,50 g.
4_ MDG: 0.1,1,2,3 g + 25g Rs

Processing procedure

Sugar was added to the fat, and mix well till obtaining homogenized mixture, eggs were added and mixed well. In other containers, baking powder, salt, and milk were added to the flour and mixed well. Flour mixture was gradually added to the sugar – fat mixture with continuous stirring. Water was added to the mixture with continuous stirring to obtain the homogenized cake. The mixture was poured into a pan (6.2 cm height X 4 cm base diameter) painted with fat and faded with flour. Samples were baked at 170 – 175 C for 40 min (AACC, 1983).

After cooling at room temperature for 2 h, the volume of the resulting product was measured, packed in polyethylene bags, and kept at 25 C to carry some tests in two storing periods (6 and 15 days).

Chemical tests

Moisture, ash, fat ,and protein were determined according to the standard methods (AACC, 2000). Carbohydrates were computed by the difference method (Pearson, 1970):

Carbohydrates (%) = 100 – (moisture% + ash% + protein% + fat%)

Energy determination

Calculated by the method of measuring the output of the components by calories % (carbohydrates×4 + protein ×4+fat ×9) (Baskaran *et al*., 1999)

Sensory evaluation

A sensory evaluation of fresh cake product was done according to the evaluation sheet shown in table1. Marks were distributed for the inner and outer characteristics of cake to gain the total marks (100). Sensory evaluations were done using 15 persons from lecturers and graduate students (AACC, 1983).

Table (1) Sensory evaluation of the cake manufactured

Marks	15	10	15	15	10	15	20	100
characteristics of the manufactured cake	Taste	Aroma	Crust color	Nature of crust	color of baking	Grain of crumb	Symmetry of form	

Volume of cake

Cake volume measured using the method of removing millet seeds (Ranasalva, Visvanathan, 2014).

Staling tests

Penetrability was measured using special instrument according to Al – Hamad (2013), Cake penetrability was estimated during storage for at 25 C using a local instrument specified to this test by measuring the depth (in mm) that the metallic cone fixed in the instrument done away from the measuring ruler fixed in its side.

RESULTS AND DISCUSSION

Table 2 shows the results of the chemical composition of the produced cake. When fat was substituted with the improver in a ratio of 7% with the addition of 25% RS instead of fat, margarine and oil in ratios of 25,50, 75 and 100% and MDG in ratios of 0.1, 1, 2 and 3% with the addition of 25% RS instead of fat, the moisture of samples was high (19%) as compared with control treatment.

The moisture was less than this value in improver substitution ratios of 1, 3 , and 5% with an addition of 25% RS instead of fat.These results were within the range mentioned in Iraqi standard qualification No. 4085/ 2010 for cake, which indicated the percentage of moisture in the cake 15 – 25% except for sponge cake (20 – 27 %)(ISQ, 2010). Water plays an important role in bread and pastry as it is the medium of solving sugars, baking powder ,and other materials. In addition , the optimum form of these products cannot be achieved unless liquid materials are found. Water is considered as the means in which different components like proteins and sugars are dispersed in to gain the final product with ideal characteristics (Stradiety, 2004).

For ash, the percent was high when fat was substituted with the improver in a ratio of 7%, margarine in a ratio of 100% ,and MDG in all ratios. These differences may be ascribed to the additional effect of the materials used in treatments. Ash may be considered as a representation of the nutritional mineral content (Edmund, 2010).

Fat content was high when fat was replaced by margarine in ratios of 25 and 100% (221.33 and 20.8%, respectively). The reduction of fat percent when fat was substituted with oil may be due to the oil leakage after production, and this is one of the drawbacks of using oil; thus, emulsifiers must be used with oils (O'Brien, 2009).

It can be seen that protein percent was increased when fat was substituted with oil and MDG in all ratios as compared with control treatment , the percent was 7.90% which is very close to Abbas (2012) who found that protein ratio was 7.88% when the cake was produced by substitution of wheat flour with cowpea flour . For carbohydrates, the ratio was almost the same in all studied treatments.

Table 2 Chemical composition of the treatments

Treatments / Chemical composition	Treatments of Cake improver	Treatments of Margarine	Treatments of Oil	Treatments of MDG
Moisture (%)				
0	**19.0**	**19.0**	**19.0**	**19.0**
%25	**16.5**	**21.7**	**20.0**	**23.0**
%50	**15.5**	**24.3**	**25.0**	**23.2**
%75	**20.5**	**24.7**	**21.0**	**24.0**
%100	**22.5**	**25.0**	**22.0**	**24.3**
Ash (%)				
0	**1.51**	**1.51**	**1.51**	**1.51**
%25	**1.14**	**1.22**	**1.28**	**1.52**
%50	**1.17**	**1.05**	**1.30**	**1.56**
%75	**1.20**	**1.16**	**1.33**	**1.59**
%100	**1.55**	**1.58**	**1.38**	**1.63**
Fat(%)				
0	**19.3**	**20.6**	**20.6**	**19.5**
%25	**10.60**	**21.33**	**14.8**	**9.84**
%50	**12.53**	**18.0**	**15.3**	**10.65**
%75	**14.55**	**19.0**	**16.6**	**12.55**
%100	**16.53**	**20.8**	**18.6**	**12.70**
Protein%				
0	**7.90**	**7.88**	**7.90**	**7.88**
%25	**7.75**	**7.67**	**8.35**	**8.40**
%50	**7.73**	**7.78**	**8.38**	**8.42**
%75	**7.70**	**7.80**	**8.40**	**8.45**
%100	**7.67**	**7.83**	**8.43**	**8.48**
Carbohyd.%				
0	**52.29**	**51.01**	**50.99**	**52.11**
%25	**64.01**	**47.99**	**55.57**	**57.24**
%50	**63.07**	**48.87**	**50.02**	**56.17**
%75	**57.25**	**47.34**	**52.67**	**53.41**
%100	**53.3**	**44.79**	**49.59**	**52.89**
Cake improver (1, 3, 5, 7 + 25% RS)				
MDG (0.1, 1, 2, 3 + 25 %RS)				

From table 3 it can be seen the significant decrease in cake volume when the fat was substituted with the improver in ratios of 1, 3, and 5% with the addition of 25% RS instead of fat as compared with control treatment which was 605 cm^3 , whereas the highest values for substitution treatments were 447.5 and 622.7 for 7% improver and 100% margarine, respectively. Tables 4 and 5 also showed the height of the cake for all substitution treatments of fat with oil (25, 50, 75 , and 100%) and with MDG (1, 2 , and 3% with the addition of RS). These differences in cake volume may be due to the occurrence of emulsifying agents which have a role in improving pastry characteristics (Berglund et al., 2009).

For taste and aroma, it can be seen that taste was decreased when fat was substituted with improver and margarine and the ratios 25, 50 , and 75% of oil, but it increased at 100% (The values were 11.7, 12.7 and 12.3, respectively). These values were close to the results of Al-Sabbagh (2012) who reported that the value of taste for the Cupcake in which lentil used in substitution as a protein

source was 14 and decreased to 10.8 when substitution with MDG at 3% level with the addition of 25% RS instead of fat. Averages of sensory evaluation values for odor are almost the same for taste; hence, they decreased in the levels 25, 50 , and 75%, then they rose when all fat was substituted. The decrease in the above levels may be due to the importance of fat in taste and aroma which are come from fat's being as retention factor for the flavor and is being responsible for the desired mouth feel (Abida et al., 2014).

From table 3, it can be noted the significant decrease in the values of crust color when fat was substituted with improver at 3 and 5% levels with the addition of 25% RS instead of fat , it were10.7 and 10.4, respectively as compared with the values of this characteristic which were 11.3 and 11.9 for the Control treatment and 7% substitution treatments, respectively. This evaluation was repeated for crust color for the rest treatments. The value of the color of baking was decreased in the same manner, but it recorded fewer values comparing with the color of the crust. control treatments in 100% fat recorded 7.8, 8.0, 7.6, and 7.9 and they were improved at 100% substitution level of improver, margarine and, oil treatments (8.1, 8.3, and 7.9, respectively). These values were approximate to that of Al-Gholam (2017) who observed that the value of the color of baking of stone loaf became 6.7, while it was persisted at 7.9 when he used mono – and diglycerides.

Table 3 also showed the decreased in the values of Grain of crumb comparing with the control treatment (11.5) when fat was substituted with improver at 1, 3 and 5% substitution with the addition of 25% RS instead of fat, but they rose to 12.3 for the improver at 100% substitution. The same trend was noted for margarine (10.6, 10.9 , and 12.9 for the substitution ratios of 25, 75 , and 100%, respectively), and oil (11.4, 11.1 , and 12.9) substitution treatments. This means that the total substitution of fat with margarine, oil and MDG had no adverse effect and, to some extent, kept the sensory and quality characteristics for the cake.

Table 3 Sensory evaluation of cake produced by substituting fat with improver in ratios of 1, 3, 5 and 7% with addition of 25% resistant starch (RS)

Degrees		15	10	15	10	15	15	20
Quality elements / **Cakes models**	**volume cm^3**	**Taste**	**aroma**	**Crust color**	**the color of baking**	**Nature of crust**	**Grain of crumb**	**Symmetry of form**
Fat %0 + %100 Cake improver	605.0 a	11.3 ab	8.1 b	11.3 b	7.8 b	10.4 b	11.5 b	14.5 b
Fat %1+%75 Cake improver %25 + RS	407.5 c	10.2 c	8.4 ab	11.1 b	7.2 c	10.4 b	10.5 c	13.3 d
Fat + %50 3 %Cake improver %25 + RS	400.0 cd	10.9 b	8.2 b	10.7 c	7.8 b	10.5 b	10.3 c	13.8 c
Fat %5 + %25 Cake improver %25 + RS	387.5 d	10.4 b	8.2 b	10.4 c	7.00 b	10.2 b	10.7 c	13.3 d
Fat %7 + %0 Cake improver %25 +RS	447.5 b	11.7 a	8.6 a	11.9 a	8.1 a	12.3 a	12.3 a	16.7 a

Tables 3, 4,5 and 6 showed a slight reduction in Sensory evaluation characteristics for the substitution ratios of 25, 50 and 75% for all treatments, but they were elevated in 100% substitution ratio except for MDG treatment.. These results are close to that of Majeed et al. (2006) when they produced bread improved by addition of malt and antioxidants.

A significant reduction in the value of Symmetry of form comparing with control treatment (14.5) was obvious in fat substitution treatment with improver (1, 3 , and 5%with the addition of 25% RS) from table 2. The same reduction was also noted in the level 25% of substitution of fat with oil and MDG in a ratio of 0.1%. This value was significantly elevated at 100% substitution level for all

treatments (16.7, 16.8, 17.3 , and 16.3). This elevation may be ascribed to the ratio of the emulsifiers which led to the retention of water and decrease evaporation rate and hence it was not permitted for crumb cells to expand. As a consequence , the softness of texture was decreased (Izzet et al., 2019).

Table 4 Sensory evaluation of cake produced by substituting fat with margarine in ratios of 25, 50, 75 and 100%

		15	10	15	10	15	15	20
Quality elements / **Cakes models**	volume cm3	Taste	aroma	Crust color	the color of baking	Nature of crust	Grain of crumb	Symmetry of form
Fat%0 +%100Margarine	609.0 b	11.5 b	8.0 a	11.1 bc	8.0 a	11.6 b	11.7 b	16.1 b
Fat %25+%75Margarine	547.5 d	10.4 c	7.4 b	11.4 b	7.3 b	11.1 c	10.6 c	13.7 b
Fat %50+%50Margarine	567.7 c	11.2 b	7.3 b	11.0 c	7.3 b	11.6 b	10.8 c	14.1 b
Fat %75 + %25 Margarine	544.3 d	11.6 b	7.6 b	11.5 b	7.1 b	11.4 bc	10.9 c	13.7 b
Fat %100 + %0 Margarine	622.7 a	12.7 a	8.3 a	12.2 a	8.3 a	12.8 a	12.9 a	16.8 a

Table 5 Sensory evaluation of cake produced by substituting fat with oil in ratios of 25, 50, 75 and 100%

		15	10	15	10	15	15	20
Quality elements / **Cakes models**	volume cm3	Taste	aroma	Crust color	the color of baking	Nature of crust	Grain of crumb	Symmetry of form
Fat %0 + %100 Oil	607.0 d	11.3 b	7.3 c	11.2 bc	7.6 ab	11.6 b	11.6 b	15.5 b
Fat %25+%75 Oil	745.0 b	11.0 b	8.2 ab	11.4 b	7.9 a	10.4 c	11.4 b	13.7 d
Fat %50 + %50 Oil	730.0 b	11.3 b	7.9 b	10.8 c	7.2 c	11.2 b	10.9 c	15.1 b
Fat %75 + %25 Oil	735.0 b	11.2 b	8.0 b	10.0 d	7.4 bc	9.6 d	11.1 bc	15.5 b
Fat %100 + %0 Oil	855.0 a	12.3 a	8.5 a	11.9 a	7.9 a	12.4 a	12.9 a	17.3 a

Table 6 Sensory evaluation of cake produced by substituting fat with mono and diglycerides fat in ratios of 0.1, 1, 2 and 3%

Degree limits		15	10	15	10	15	15	20
Quality elements / **Cakes models**	volume cm3	Taste	aroma	Crust color	the color of baking	Nature of crust	Grain of crumb	Symmetry of form
Fat %0 + %100 MDG	605 d	11.2 a	7.8 a	11.3 a	7.9 a	11.2 a	11.3 b	15.1 c
Fat+%75 0.1 %MDG + %25RS	595 d	10.5 bc	7.8 a	10.6 b	7.7 a	9.9 b	9.4 c	13.8 d
Fat %1 + %50 MDG + %25RS	625 c	10.5 b	7.8 a	11.2 a	7.9 a	9.4 b	11.3 b	15.8 b
Fat %2 + %25 MDG + %25RS	645 b	10.2 c	7.3 a	9.6 c	7.0 b	9.2 b	9.5 c	10.9 b

It was apparent from table 7 that the calorie value (C.V.) was decreased when fat was substituted with the improver, margarine, oil , and MDG in all substitution levels under study as compared with the control treatment (420.96 kcal/ g). This decrease may be due to that the value of calculated energy is affected by the percent of the other chemical components. It is expected more reduction in energy values in improver and MDG treatment as the percent of resistant starch was not included in gross energy estimation. Many studies refer to that the resistant starch is considered as fibers which do not be digested in the gut. As a result , it does not utilize as physiological energy (Raigond et al., 2015

Table 7 Energy values of fat substitution treatments

Treatments / Energy	Treatments of Cake improver	Treatments of Margarine	Treatments of Oil	Treatments of MDG
0	414.46	420.96	420.96	415.46
%25	382.44	414.97	388.88	351.12
%50	395.97	388.6	371.3	354.21
%75	390.75	391.56	393.68	360.39
%100	392.65	397.68	399.48	359.78

From table 8 it can be seen that there are significant differences among the averages of penetrability values for the standard and the substitution treatments with the improver in ratios of 1, 3, 5 , and 7% with the addition of 25% RS instead of fat. The same table showed the averages of storage periods which were decreased with time. The results indicated significant differences among treatment averages (14.8, 12.4 , and 10.2 mm).

Table 8 Penetrability values (mm) of test cake produced by substitution of fat with the improver in ratios of 1, 3, 5 and 7% with addition of 25% RS instead of fat

Type of treatment	Storage period			
	first day	sixth day	fifteenth day	The average Type of treatment
Fat 100 % + 0 Cake improver	19.0 a	16.0 a	13.0 a	15.6 a
Fat %1 + %75 Cake improver + % 25 RS	16.0 b	14.0 a	12.5 a	14.0 a
Fat %3 + %50 Cake improver + %25RS	15.0 ab	12.0 ab	10.0 ab	12.3 b
Fat %5 + %25 Cake improver + %25RS	13.0 c	11.0 b	9.0 b	11.0 c
Fat 0 + Cake improver + %25 %7RS	12.0 cd	9.0 c	7.0 c	9.33 d
Average duration of storage	14.8 a	12.4 b	10.2 c	
*Similar letters mean that there are no significant differences at the level p < 0.05				

Table 9 Penetrability values (mm) of cake produced by substitution of fat with margarine in ratios of 25, 50, 75 and 100%

Type of treatment	Storage period			
	first day	sixth day	fifteenth day	The average Type of treatment
Fat 0 + %100 Margarine	18.0 a	15.0 a	13.0 a	15.33 a
Fat %25+%75Margarine	17.0 a	14.0 a	12.0 a	14.33 a
Fat %50+%50Margarine	16.0 ab	13.0 ab	10.0 ab	13 ab
Fat %75+%25Margarine	15.0 ab	12.0 b	9.0 b	12 b
Margarine0+ %100Fat	13.0 c	10.0 c	8.0 bc	10.33 c
Average duration of storage	15.8 a	12.8 b	10.4 c	
*Similar letters mean that there are no significant differences at the level p < 0.05				

Tables 8, 9 and 10 showed no significant differences existed among averages of penetrability values of control treatment and substitution treatments with margarine in ratios of 25, 50 and 75%, substitution treatments with oil in ratios of 25, 50, 75 and 100%, and substitution treatments with MDG in ratios of 0.1, 1 and 2% with the addition of 25% RS instead of fat. The same tables refer to the existence of significant differences among averages of storage periods for all treatments. Solid fats are distinguished from liquid oils by reducing the amount of air entering the mixture with a significant increase in firmness (Andrade et al., 2016). It can be noted from the results of the same tables a decrease in penetrability values for all treatment at all studied levels with storage period and this may be due to staling. The reason for the lower permeability values of the treatments in which the fat is substituted with MDG is that this substance will prevent the reflux of amylopectin, which

leads to the preservation of the spongy appearance of the bread products for a longer period during storage (Laxmi and Shalini, 2012).

Table 10 Penetrability values (mm) of cake produced by substitution of fat with oil in ratios of 25, 50, 75 and 100%

Type of treatment	Storage period			
	first day	sixth day	fifteenth day	The average Type of treatment
Fat 0 + %100 Oil	19.0 a	17.0 a	15.0 a	17.0 a
Fat %25+ %75 Oil	18.0 a	16.0 a	14.0 a	16.0 a
Fat %50+%50Oil	17.0 ab	15.0 ab	13.0 ab	15.0 ab
Fat %75+%25Oil	16.0 b	13.0 b	10.3 b	13.1 b
Oil0+%100Fat	15.0 c	12.0 bc	10.6 bc	12.53 b
Average duration of storage	17.0 a	14.6 b	12.58 c	
*Similar letters mean that there are no significant differences at the level p < 0.05				

Table 11 Penetrability values (mm) of cake produced by substitution of fat with MDG in ratios of 0.1, 1, 2 and 3% with addition of 25% RS instead of fat

Type of treatment	Storage period			
	first day	sixth day	fifteenth day	The average Type of treatment
Fat0 + %100 MDG	19.0 a	17.0 a	15.0 a	17.0 a
Fat%0.1+ %75 MDG %25+ RS	18.0 a	16.0 a	14.0 a	16.0 a
Fat%1+ %50 MDG %25+ RS	16.0 ab	14.0 b	12.9 ab	14.3 ab
Fat%2+ %25 MDG %25+ RS	15.0 b	13.0 bc	12.0 b	13.33 b
MDG %25+ %3 RS 0 + Fat	13.0 c	11.0 c	9.0 c	11.0 c
Average duration of storage	16.2 a	14.2 b	12.58 c	
*Similar letters mean that there are no significant differences at the level p < 0.05				

REFERENCES

AACC (1983). American Association of Cereal Chemists. St. Paul. M.N, USA.

AACC (2000). American Association of Cereal Chemists. St. Paul. M.N, USA.

Abaida , M.A , Fereidoon S. , and Abrehem A. (2014). Lipid – Derived flavours and off-flavours in food.

Abbas, W. F. (2012). Effect of substitution of wheat flour with germinated chickpea flours on the quality characteristics of cake. Iraqi Journal of Market Research and Consumer Protection 4 (2).

Al – Gholam, A. S. S. (2017). Effect of the Substitution with Barley (*Hordiumvulgare*) on the Processing, Nutritional and Storing Traits of Stone Loaf Produced from Wheat

(*Triticumaestivum*) Flour. M.Sc. thesis. Food Science Department, Agriculture College, Tikrit University.

Al – Hamad, A. I. S. (2013). Study the Characteristics of Bread Keeping and the Microbiological Quality of Flour and Bread Produced in Tikrit. M.Sc. thesis. Food Science Department, Agriculture College, Tikrit University.

Al –Sabbagh, A. A. A. (2012). Supplementation of Cup Cake with chickpea flour as protein source and elevation of nutrition content of the product. Al – Anbar J. Vet. Sci. 5 (2).

Andrade , F.J. , Farias M.D. , Vieira S.K. , Egito A.S. , and Carneiro-da-cunha (2016). Fat content evaluation in physical properties and texture profile of cakes.

Baskaran , V. , Malleshi , N. G. , Shankara , R. , and Lokesh , B. R. (1999). Acceptability of Supplementary foods based on popped Cereals and legumes suitable for rural mothers and Children. J. plant foods for Human Nutrition 53:237-247.

Berglund , K. , Rodriguez-Garcia , J. , Sahi , S.S. , and Hernando I. (2014). Functionality of lipase and emulsifiers in low-fat Cakes with Inulin. LwT-food Sci Technol. 58,173-182.

Edmund , J.T.(2010). Soft wheat quality .In : food engineering Aspects of baking sweet goods. Servet G.S. and serpil S. pp 1-30 , CRC press.

FAO http // www.fao-org (2016).

Garrard, A.N., Colledge , Hunt, G. , and Montague R. (2010) Environment and subsistence during the late Pleistocene and early Holocene in the azraq basin Paleorient , Vol. 14 Issue 14-20.

Gulf States Standard Specifications (GSS). (2015). No. 342. "Cake".The Gulf Cooperation Council Standardization Organization.

Iraqi Standard Specifications (ISS). (2010). No. 4085. Ready Cake. Ministry of Planning and Development Cooperation. Central Organization for Standardization and Quality Control, Iraq.

Izzet , O. , Kubra , C. , and Mustafa , F. (2019). The effects of emulsifiers and their different forms on the physical , Chemical and textural properties of sponge cakes. Int. Journal Eng. Trends and Tech. , vol. 67.

Joiama , W., and Zlatica ,F . (2012). wheat food, cereal science Technology (5) (7).

Jordan , E.A. (2013). Cakes from Acient to contemporary times.

Majeed, G. H., Al – Abdullah, B. Y. and Al – Shatti,S. M. H. (2006). Production of bread improver. J. Tikrit University 5 (10), 12 – 29.

Musili , H., A (2006). food Grains: Produce , store , and manufacture their products. Damascus, Syria.

Nourmohammadi , E. , and Peighambardouts , S.H. (2015). A Comprehensive study on the effect of malitol and oligo fructose as alternative sweeteners in sponge cakes. Int. J. food Eng. 4:557-562.

O'Brien , R.D. (2009). Fats and oils : Formulating and processing for applications. Technol.publishingcompany , Inc. PA. pp:251-383.

Pearson , D. (1970). The chemical analysis of food sixth editor journal and Agriculture , Churchill , London.

Pyler , E.J. (2015). Baking Science and technology , third editor so sland publ. Co. Merriam , KS.

Raigond , P. , Rajarathnam , E. , Brajesh , S. , Som , D. , Joshi , A. , and Rinki , A. (2015). Resistant starch production technologies – Areview.

Ranasalva,N, and Vis Vanathan, R. (2014). Development of Bread from Fermented peart Millet Flour. J. F. Pr. Technology. 5:5.237,1_5.

Raven , J. (2017) wheat quality: cereal foods World 32: 313-319.

Shalini , K.G. , and Laxmi , A. (2012). Influence of additive on rheological characteristics of whole wheat dough and quality of chapatti (Indain unleavened flat bread). Food Hydrocol. 21:110 - 117.

Smith , R. (2006). Use of European style butter in bakery foods. Am. Ins. Baking Tech. Bull 15(10) : 1-6.

Stradiey , L. (2004). History of cookies united states copyright Tx 5 : 517-900.

انتاج كيك منخفض الدهن والسعرات الحرارية ودراسة صفاته النوعية والخزنية

نور كامل مجيد الحديثي وبيان ياسين العبدالله

قسم علوم الاغذية / كلية الزراعة / جامعة تكريت

المستخلص

تم انتاج كيك منخفض الدهن والسعرات الحرارية من استبدال الدهن بالمارجرين والزيت وبالنسب(25 و 50 و 75 و 100)% والمحسن بالنسب (1 و 3 و 5 و 7% مع اضافة25% نشأ مقاوم (RS) بدلا من الدهن) ومزيج الكليسيريدات الاحادية والثنائية(MDG) بالنسب (0.1 و 1و 2 و3% مع اضافة 25% RS بدلا من الدهن) ، وتم اجراء التقديرات الكيميائية ودراسة بعض الصفات الحسية للكيك المختبري المنتج. ، وبيَّنت النتائج ارتفاع نسبة الرطوبة للكيك المنتج من استبدال الدهن بالمارجرين، والزيت والـ MDG بالنسب (25 و 50 و 75و100)%، وارتفعت قيم الرماد عند استبدال المحسن والمارجرين بنسبة100%،ولوحِظ ارتفاع نسبة الدهن عند الاستبدال بالمارجرين بنسبتي (100و25)%، وقد بلغتا (21,33و 20,8)% على التوالي، كما لوحِظ ارتفاع قيم البروتين عند الاستبدال بالزيت والـ MDG. وبيَّنت النتائج ارتفاع نسبة الكربوهيدرات عند استبدال المحسن بنسبتي (25و 50)% واللتان بلغتا(64,01و 63,07)% على التوالي، وأظهرت النتائج أنَّ استبدال المحسن والمارجرين والزيت والـ MDG بنسبة 100% حسَّنت جميع عناصر النوعية. كما تم تقدير السعرات الحرارية ودراسة بعض طرائق متابعة التجلد للكيك المختبري المنتج. وبيَنت نتائج الاختراقية وجود فروق معنوية بين متوسطات المعاملات المدروسة، في حين ظهرت فروق معنوية في معاملات استبدال الدهن بالمحسن والمارجرين بنسبتي (25و 100)% والبالغة (14.0و9,33و 14,33و 10,33) ملم على الترتيب، وكذلك عند استبدال الـ MDG بنسبتي (0.1و 3)% والتي بلغت (16,0و 11,0) ملم على التوالي ، بينت النتائج امكانية انتاج كيك منخفض الدهن والسعرات الحرارية بمواصفات جيدة وبنفس فترات الصلاحية المثبتة تجاريا لإنتاج الكيك الاعتيادي.

الكلمات المفتاحية: الكليسريدات الأحادية والثنائية ، الكيك، منخفض الطاقة ، المارجريـن ، السعرات الحرارية.