Nutrition and Quality Properties of Low-calorie Cake Made by Low-calorie Fat Formula

Rafiq Mohammed Salih Rashid
Department of Food Sciences and Quality Control /Sulaimani University /College of Agricultural Engineering Sciences, Kurdistan Region-Iraq
rafiq.rashid@univsul.edu.iq

Aveen Jalal Ahmed Barqi
Department of Food Sciences and Quality Control /Sulaimani University /College of Agricultural Engineering Sciences, Kurdistan Region-Iraq
aveen.ahmad@univsul.edu.iq

ARTICLE INFO
Submission date: 24/12/ 2019
Acceptance date: 17 / 2 / 2020
Publication date: 31/ 3 / 2020

Abstract

The present study was conducted to produce a low-calorie fat (LCF) characterized by normal specification of commercial fat and acceptable quality properties, to be used in making low calorie cakes with Low-calorie fat. The low- calorie fat formulated by blending of beeswax and sunflower oil in three different ratios (25:75, 50:50, 75:25) w/w. The physiochemical properties of Low-calorie fat and nutritional, caloric and sensory properties of prepared cakes were evaluated. The properties of melting point and peroxide value are significantly increased ($P \leq 0.05$) for the three formulated fats. While the values of free fatty acids and acid value, their values are higher in A25:75 and C 75:25 samples as compared with B 50:50 sample. Inversely, the blending level of 25:75 had a higher smoke point score. The sensory properties of prepared cakes all are insignificant ($p>0.05$) for control A, B and C samples in terms of Taste, Favor, Crumb color, Crumb softness, texture and overall score. A nutritional content sash, protein, carbohydrate, caloric value, caloric decreasing percentage values are significantly ($P \leq 0.05$) influenced by control, A, B and C samples. The caloric value of all cake samples is significantly ($P \leq 0.05$) decreased with respect to control sample.

Keywords: Low-calorie Cake (LCC),Low-calorie Fat (LCF), Beeswax, Sunflower Oil.

Introduction

Saturated Fat intake is the cause of an increased risk of cardiovascular diseases (CVD) Coronary heart disease (CHD), diabetes, Obesity and so on. This effect is thought to be the main causative to increase concentration of LDL cholesterol[1]. For these risks prevention it has been necessary to focus on reducing in high calorie fat intake as a means of lowering LDL cholesterol concentration level through using of replacement by other nutrients. The recommended intakes of saturated fatty acids by the international guidelines was below 10% of total energy , and poly unsaturated fatty acids from plant oil, seeds Nuts, of 5-11% of total energy [2], [3].

Dietary solid fats are products made completely of oil and fat either straight or in mixture of the two for the preparation of food items. Fats are used for cooking, frying, and as an ingredient in food products such as cake, pastries, cookies, and others. Dietary fat acts as carriers for fat soluble vitamins moreover provides essential fatty acids and improving the quality and palatability of food products[4].

Beeswax is unrivaled mixture of both saturated and unsaturated complex and linear monoester, free fatty acids, free fatty alcohols, hydrocarbons and other secondary exogenous substances [5].Beeswax is produced by the honey combs of bees (Fam.apidae, e.g .Apismellifera L.). Beeswax is insoluble in water andit is an extremely complex material containing over 300 different substances[6]. Research reports that long chain fatty alcohols obtained from plant waxes have been reported to lower cholesterol in humans. Beeswax and many plants derived foods lower LDL cholesterol 21% to 29% and raise HDL cholesterol by 15%.[7].

Sunflower oil is pale yellow Oil compressed from common sunflower seeds (helianthus annus)used chiefly in foods. Sunflower oil has oleic acids (omega a-9) and linoleic (omega a- 6) which are superior monounsaturated and polyunsaturated fats [8]. These fatty acids reduce the LDL cholesterol and total cholesterol, decreasing the enhance of coronary heart disease[9]. The main objective of this study is to produce low-calorie cakes by using fat with low-calorie fat formula(LCF)made from Beeswax and sunflower oil in three different ratios by ordinary blending in order to reduce the total calorie and energy taken in food.

Materials and Methods

The experiment was conducted in the Department of Food Sciences and Human Nutrition, College of Agricultural Sciences /University of Sulaimani/Iraq. Some of the physical and chemical characteristics of the produced low-calorie fat formula from beeswax and sunflower oil were studied. The LCF was used in production of low-calorie cakes. Sensory, nutritional and calorie properties of LCCs were carried out.

Formulation of LCFs

Local honey beeswax obtained from markets in the city of Sulaimani. The fat processing included blending of local beeswax and refined sunflower oil. The sunflower oil was used type (Nawras) was bought from a local market which has imported from turkey/Mersin. The beeswax was melted by a water bath (65℃) with continues stirring. The sunflower oil was added and stirred. The melted beeswax and sunflower oil were blended in three different ratios based on W/W. The ratios used were 25:75, 50:50, and 75:25 respectively. A certain quantity of each blend were prepared and kept in a plastic container later they were stored in cold temperature (4C) until some physical and chemical tests were carried out.

Physical and chemical tests of LCFs

Some physical and chemical tests on the LCFs, Beeswax, Sunflower oil were carried out. These tests include smoke point, melting point, peroxide value (PV), acid value and free fatty acid (FFA).

Smoke point

The smoke point was determined according to AOCS official method No.Cag-48[10].

Melting point

The melting point is the temperature at which a solid melt and becomes a liquid**.** The melting points of the samples were determined according to the AOCS official method Cc 1-25[11].

Peroxide value (PV)

Peroxide value is the number of active oxygen expresses, in milliequivalents, the quantity of peroxide contained in 1000 g of the substance[12]. The peroxide value of the samples was determined according to the AOAC method [11].

P.V. = (b-a) x N x 1000/ S

Where:

b = Volume of sodium thiosulphate required for blank (ml).

a = Volume of sodium thiosulphate required for oil sample (ml).

N = Normality of sodium thiosulphate.

S = Weight of oil sample used (g).

Acid value and Free Fatty Acid (FFA)

Acid value is defined as the number of potassium hydroxide (mg) required to neutralize the free acids in 1.0 g of the substance [13].

Free Fatty Acid FFA

Determination of Free Fatty acids was carried out according to the AOAC method [11]. The following formula was used in calculation:

FFA = (V) ml x N x 28.2/ S

Where:

V = Volume of KOH used (ml).

N = Normality of KOH.

28.2 = Molecular weight of oleic acid

S = Weight of oil sample used.

The acid value was calculated from the expression below:

Acid Value (mg KOH/g oil) = FFA * 1.99

Preparation of Cakes

Cakes were prepared according to the AACC (2000)approved method 10-90 [14],with some modifications as research requirement. All materials and their sources were: wheat flour (Nawras/ Co./Mersin, Turkey), shortening (BilBak, dicle, Co./ Turkey), sugar (local retail product), dry milk (Almudhish, Oman Co.), baking powder (Nawras/ Co./Mersin, Turkey), vanilla flavoring (Nawras/ Co./Mersin, Turkey), and fresh whole egg. This main recipe was used to process the control cake. While the shortening fat was replaced by LCFs in three different ratios in the experiment recipes. All recipes were prepared in the same procedure as follows:

The whole eggs were beaten for 2 min at medium speed in a speed (3) by professional kitchen-Aid mixer. Sugar and fat were added and mixed in the same speed. The other blended dry ingredients (flour, dry milk, baking powder, and vanilla) and water

were added with continuous mixing. The cakes ndough was transferred to a baking pan (20.4 cm) and baked at 180c for 40 min.

Table (1): Formula of low calorie cakes prepared using LCFs.

Ingredients (g)	Control cake	Replacement ratios		
		25:75*	50:50**	75:25***
Flour	122	122	122	122
Sugar	221	221	221	221
Shortening	100	-	-	-
LCFs	-	100	100	100
Eggs	169	169	169	169
Dry milk	70	70	70	70
Baking powder	10	10	10	10
Vanilla	10	10	10	10
Water	130	130	130	130

*25:75 (25gm Beeswax: 75gm Sunflower oil). **50:50 (50gm Beeswax: 50gm Sunflower oil). ***75:25 (75gm Beeswax: 25gm Sunflower oil).

Sensory Evaluation of Cakes

Evaluation of cakes were carried out according to AACC (1983) approved method [15]. Sensory evaluation of all study samples was performed by seven of the panelists who were staff members of Food Sciences and Human Nutrition Department /College of Agricultural Sciences/Sulaimani University. Panelists were selected according to their interest and experience. Cakes were evaluated after 24h of baking. Cake samples were randomly coded and served to each panelist in secession. They were supplied with cold water to rinse their mouth before starting and between samples. Cakes were evaluated according to the following scores: (taste 30 score, flavor 25 score, crumb color 15 score, crumb softness 15 score, texture and mouthfeel 15 score).

Nutritional Value of Cakes

Crude protein, Crude fat, crude ash, and moisture content of cakes were determined according to the methodology recommended by [16] official method. Protein content was analyzed using kjeldahl method, fat content by soxhlet, and using muffle furnace and oven assay to determine ash and moisture contents respectively. Carbohydrate content was calculated by difference: 100 – (protein% + fat% +ash %+ moisture %). The calculation of caloric value was done by multiplied the percentage of crude lipid, protein, and total carbohydrate by a factor of 9 (kca. g^{-1}) for lipid, and 4 (kcal. g^{-1}) for protein and [17].

Statistical analysis

All data are expressed as means ±SE. Triplicate of each sample was statistically analyzed by (ANOVA)using XLSTAT (2016.02.28451) program. Least Significant differences (Duncan) test were determined to separate the means at (0.05) significant level.

Results and Discussion

The physical and chemical properties of sunflower oil and beeswax used in the experimental blends of LCFs are shown in table (2). In general, all results were within the normal range and acceptable levels of (S.P, M.P, P.V, FFA, and A.V) [18], [6].The smoke point of the beeswax was not measured in this study because it was not estimated before for in previous studies and there was not standard range for it. The melting point obtained was (63.3℃) which was within the normal range of (62-65℃) found by [6]. The peroxide value was (4.8 meq/kg). Free fatty acids% and acids value results were (9.0 % and 18.0 mgKOH/g) respectively. As reported in [6] the melting point, peroxide value, and acid values of beeswax were (61-65, at least 8, and 18-23) respectively. The smoke point of the used sunflower oil was (179.6℃).which is near of those standard sunflower oil reported in [18]. The peroxide value was (1.0 meq/kg).While the free fatty acids and acids values were (0.1% and 0.19 mgKOH/g) respectively [18].

Table (2): physical and chemical properties of beeswax and sunflower oil

Parameters	Beeswax	Sunflower oil
Smoke points (S.P) ˚C	-	179.6
Melting Points (M.P) ˚C	63.6	-
Peroxide value (P.V)meq/kg	4.8	1.0
Free Fatty Acids (FFA) %	9.0	0.1
Acid value (A.V) mgKOH/g	18.0	0.19

-There is no smoke point for Beeswax and no melting point for sunflower oil

Physical and Chemical Properties of LCFs; Table (3) shows the physical and chemical properties of prepared low calorie fats (LCFs) for A 25:75, B 50:50 and C 75:25 samples in terms of smoke point, melting point, peroxide value , free fatty acids and acid values. Most of results are significantly ($p \leq 0.05$) different for all samples. Results of Smoke points recorded a highest score in (A25:75) treatment, which was (177.66℃), inversely, the treatment (B50:50) had a lower smoke point (167.00 ℃), followed by treatment (C 75:25) which had a lowest smoke point (164.66℃).The results of melting points shows that the blending level (A25:75) had a lowest melting point (50.33°C) that means by increasing Beeswax proportion the melting points will increase. While the blending level (C75:25) had a highest melting point (60.66 ℃) due to the increasing of the Beeswax level, which took a longer time to melt.T he treatment A (25:75) had a melting point more feel within the range of the commercial shortening (50.33°C) and these results is agree with those found by [19].The PV value of (A 25:75) treatment was (3.06 meq/kg) while it was (4.03 and 4.26 meq/kg) in treatments (B50:50) and (C 75:25) respectively. The values of free fatty acids and acid, were higher in A25:75 (1.26%), and C 75:25 (1.43%) samples as compared with B 50:50 sample (0.63%).The PV value of all samples were within the normal range of initial PV of shortening, Beeswax and sunflower oil [6], and these results are agreed with the codex standards [20]. According the codex PV of oil and fats should be less than 10 (meq/kg). The increasing in FFA and PV as a result of adding the Beeswax which had a FFA and AV of about (18-24mgKOH/g), and (8-12) respectively as normal ranges[21].

Table (3): Physical and chemical properties of LCFs

Samples	Smoke point (°C)	Melting point(°C)	Peroxide value(meq/kg)	Free fatty acids(%)	Acid value (mg KOH/g)
A 25:75	176.66±0.86[a]	50.33±0.47[c]	3.06±0.04[c]	1.26±0.05[a]	2.43±0.13[a]
B 50:50	167.00±1.21[b]	56.33±0.66[b]	4.03±0.06[b]	0.63±0.08[b]	1.16±0.19[b]
C 75:25	164.66±1.17[b]	60.66±0.70[a]	4.26±0.06[a]	1.43±0.05[a]	2.66±0.12[a]

-Means with different letters in the same column differ significantly at (P≤ 0.05)

Sensory Properties of Cakes; Table (4) shows the sensory results of cakes prepared with LCFs as compared with control sample. These sensory properties are all insignificant (p>0.05) for control A, B and C samples in terms of Taste, Favor, Crumb color, Crumb softness, texture and overall score. Furthermore panelists assumed that all treatments were acceptable for all replacement levels by LCFs, without any significant differences (P≥ 0.05) for total score. Sensory properties of the experimental cakes were found to be very similar to those of control sample.The results indicated that LCFs could be used in the formulation of cakes as a shortening replacer.The findings of Table (4) are in agreement with replacer types for prepared cakes in[22].

Table (4): Sensory properties of cakes prepared with LCFs

Samples	Taste 30 score	Flavor 25 score	Crumb color 15 score	Crumb Softness 15 score	Texture 15 score	Total 100 score
Control	25.00±0.88[a]	21.85±0.69[a]	12.14±0.57[a]	12.28±0.61[a]	12.42±0.51[a]	83.71±2.50[a]
A	25.42±0.88[a]	22.57±0.61[a]	12.42±0.57[a]	12.14±0.61[a]	12.85±0.51[a]	85.42±2.50[a]
B	26.14±0.88[a]	22.42±0.69[a]	12.85±0.57[a]	12.00±0.61[a]	12.42±0.51[a]	85.85±2.50[a]
C	26.00±0.88[a]	22.00±0.69[a]	13.00±0.57[a]	12.28±0.61[a]	12.51±0.51[a]	85.85±2.50[a]

-Means with different letters in the same column differ significantly at (P≤ 0.05)

Nutritional Value of Cakes; Table(5)shows the nutritional and caloric composition of prepared cakes by LCFs in terms of moisture, ash, fat, protein, carbohydrate, caloric value and decreasing calorie percentage. Ash, protein, carbohydrate, caloric value, decreasing percentage values are significantly (P≤ 0.05) influenced by control, A, B and C samples. On the other hand, there was no significant difference (p>0.05) between samples in terms of moisture and fat, the increasing of Beeswax level in the blends did not affect the moisture, fat contents of the experimental cakes. However, [23] reported that fat content significantly decreased (P≥ 0.05) by increasing of replacement levels but it not affected by replacement types.

Control cake has the lowest (p>0.05) moisture and ash contents among other treatments[24]. A mostly gradual increasing in moisture, ash and protein contents were associated with the increase in various weight ratios of Beeswax and sunflower oil blends of A, B and C samples that were higher than the control cake as mostly similar as findings of prepared cakes in [25],[26]. Meanwhile the total carbohydrates (%) of cakes were affected significantly (P≤ 0.05). the different levels of used LCFs affect the carbohydrates content, the highest carbohydrate content (%) was shown in control cake

(43.39%) and the lowest carbohydrate in content was in Sample C (36.48%) decreased by increasing of Beeswax level, Besides Carbohydrate content was affected by replacement types as reported by [23]. The caloric value of A, B and C cakes is significantly ($P \leq 0.05$) decreased with respect to control sample. The sample A ($P \leq 0.05$) had a highest caloric value (364.12 kcal/g) among other treatments. As a result of increased of Beeswax level used in sample C, it had a lowest caloric value (245.84 kcal/g). Accordingly, A, B and C samples have significant decreasing calorie means of 13.42, 26.56 and 41.53 % respectively. In this connection [27], reported that all caked prepared with fat replacers were found to be lower in their caloric value compared to that of control. The results mention that LCFs formula is successfully used to reduce the calorie in cakes with best quality and nutrition value, and could be used as a shortening replacer in the formulation of cakes. Thus, it might be possible to produce cakes with low calorie value.As result of indigestibly of beeswax, the calories yielding of LCC decreased. Using of LCFs formula in the formulation of foods allows processing products with low amount of saturated fats and protecting human health against cardiovascular diseases. Besides, the beeswax used in LCFs formula had not any revers effect on the quality of cake products on the other hand as preparation of LCFs is not difficult, Large amount of it could be easily achieved.

Table (5): chemical and caloric composition of cakes Prepared by LCFs

Cake Samples	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Caloric Value	Decreasing Calorie (%)
Control	24.12 ± 0.64^{a}	0.97 ± 0.02^{b}	24.21 ± 0.98^{a}	7.30 ± 0.00^{c}	43.39 ± 0.46^{a}	420.72 ± 7.38^{a}	-
A	25.47 ± 1.19^{a}	0.99 ± 0.04^{b}	25.40 ± 0.94^{a}	7.16 ± 0.03^{d}	40.95 ± 0.05^{a}	364.12 ± 2.67^{c}	13.42 ± 0.93^{a}
B	24.90 ± 0.49^{a}	1.15 ± 0.00^{a}	25.86 ± 0.62^{a}	7.93 ± 0.03^{b}	40.14 ± 0.99^{ab}	308.70 ± 1.81^{a}	26.56 ± 1.74^{ab}
C	26.56 ± 0.70^{a}	1.18 ± 0.01^{a}	24.59 ± 0.42^{a}	11.16 ± 0.03^{a}	36.48 ± 1.09^{b}	245.84 ± 3.49^{b}	41.53 ± 1.26^{a}

-Means with different letters in the same column differ significantly at ($P \leq 0.05$)

Conclusions

The Low-calorie Fat Formula is prepared by blending of Beeswax with sunflower oil in three different ratios (25:75, 50:50, 75:25) w/w. Then using the Low-calorie fat in making low calorie cakes, the physiochemical properties of Low-calorie fat and nutritional, caloric and sensory properties of prepared cakes were evaluated. Melting point and peroxide value are significantly increased ($P \leq 0.05$) for the three samples. While free fatty acids and acid value, are higher in A25:75 and C 75:25 samples as compared with B 50:50 sample. Inversely, the blending level of 25:75 had a higher smoke point score. The sensory properties prepared cakes all are insignificant ($p>0.05$) for control A, B and C samples. A nutritional and caloric composition are significantly ($P \leq 0.05$) influenced by control, A, B and C samples. The caloric value of all cake samples is significantly ($P \leq 0.05$) decreased by using Beeswax in the LCFs formula.

Recommendations

1. Using low-calorie fat in the making of low-calorie cake instead of commercial shortenings in order to reduce the total calorie and energy taken in bakery products such as cakes.
2. Restriction the use of fatty high calorie foods by producing such processingfats in easiest ways and in large amount.

Conflict of Interests.

There are non-conflicts of interest .

References

1. Patty W Siri-Tarino, Qi Sun, Frank B Hu, and Ronald M Krauss.(2010). Saturated Fat, carbohydrate, and cardiovascular disease. Am J ClinNutr 2010;91:502-9.
2. Anon. Nordic Nutrition Recommendations 2012: Part 1 Summary, principles and use. Copenhagen: Nordic Council of Ministers, 2013.
3. FAO. Fats and fatty acids in human nutrition: Report of an expertconsulatation. Rome: Food and Agriculture Organization of the United Nations, 2010.
4. Berger, K.G. The function of fats in bekery products. Paoer No. 5, presented at first product technology course, Bandar barubangi, Selangor, Malaysia, November, pp.12-26 (1985).
5. Subha v., Arulsha W., Kirubanandan S., Renganathan S. (2018). Sustained drug delivery of capcitabine using natural (bee wax) and synthetic polymer (PLGA). Volume 2 Issue 3- June 21, 2018.
6. Bogdanov S., (2004) Quality and standard of Pollen and Beeswax. Swiss Bee research Centre, Federal Dairy Research Centre, Liebefeld, 3003 Bern, Switzerland. APIACTA 38(2004)334-341.
7. Hargrove JL, Greenspan P, Hartle DK.(2004). Nutritional significance and metabolism of very long chain fatty alcohols and acids from dietary waxes. ExpBiol Med (Maywood). 2004 Mar; 229(3):215-26.
8. Skoric D, Jocic S, Sakac Z, Lecic N. (2008).Genetic possibilities for altering sunflower oil quality to obtain novel oils. Canadian Journal of Physiol Pharmacol. 86 (4): 215-21.
9. Chowdhury K, Banu LA, Khan S, Latif A (2007). Studies on the Fatty Acid Composition of Edible Oil. Bangadesh Journal of Science Industrial Research. 42(3): 311-316.
10. AOAC. (1999). Official Methods and Recommended Practices of American Oil Chemists' Society. Cag a-48, Cd 3d-63.
11. AOAC. (2000). Official Methods of Analysis of the Association of Official Agricultural Chemists, 14th ed. Washington, D.C.
12. *British Pharmacopoeia*, Appendix XF, IA, IB. Peroxide value, 2000.
13. *British Pharmacopoeia*, Appendix XB, IA, IB. Acid value, 2000.
14. AACC. (2000). Approved methods of the American association of cereal chemists (10 th ed.). St. Paul, MN: AACC International.

15. A.A. C.C. (1983). Approved Methods of the American Association of Cereal Chemists. Published by American Association of cereal Chemists, st. Paul, MNY, USA.
16. Horwitz, W., 2000. Official methods of analysis of AOAC international. 17th ed. AOAC International (Printed in the United States of America), 1: 1-34. J. Food and Dairy Sci., Mansoura Univ., Vol. 2 (11): 617 - 628, 2011.
17. FRARY, C. D.; JOHNSON, R. K. Energia. In: MAHAN, L. K.; ESCOTT-STUMP, S. Krause: alimentos, nutrição e dietoterapia. 11. ed. São Paulo: Rocca, 2005. p. 20-34.
18. Codex standard for vegetable oils (CODEX-STAN210-1999).
19. Osman A., and Nor Aini I.,1999. physical and chemical properties of shortening from Palm oil: Tallow and Palm olein: Tallow blends with and without interesterification. Journal of oil palm research Vol. 11 No. 1, June 1999, P. 1-10.
20. Codex General Standard for Fats and Oils not covered by individual standards (CODEX STAN 19-1981-Rev. 2-1999).
21. EFSA, The European Food Safety Authority. Beeswax (E901) as a glazing agent and carrier for flavours. Scintific opinion of the panel on food additives, flavourings, processing aids and materials in contact with food (AFC). The EFSA journal (2007) 615, 1-28.
22. Pehlivanoglu H., Ozulku G., Metin R., Demirci M., Yoker O., Sagdi O., Investigating the usage of unsaturated fatty acid-rich and low-calorie oleogels as a shortening mimetics in cake.(2018)Journal of Food Processing and Preservation 42(3):e13621 DOI: 10.1111/jfpp.13621.
23. Hussein, E., Gaafar, A., and El-Beltagy, A.,(2011). Production and Quality Evaluation of Low Calorie Cake. American Journal of Food Technology., 6(9): 827- 834, 2011.
24. Hafez A., A. (2012). Physico-Chemical and Sensory Properties of Cakes Supplemented withdifferent Concentration of Marjoram. Australian Journal of Basic and Applied Sciences, 6(13): 463-470, 2012.
25. Shehata, E. M. ;Badea A. Bessar ; Sahar R. Abd El-Hady and S. A. El kady (2011). UTILIZATION OF SOME FOOD PROCESSING WASTES AS A FAT REPLACERS IN CAKES .
26. El-Refai, A. A.; M.B. Domah and M. A. Askar.(2012). UTILIZATION OF FAT REPLACERS IN BAKERY PRODUCT. Food industries Dept., Fac. Agric., Mans. Univ., Egypt
27. Abd-EI-Khalek, M.H.(2007). Effect of Fat Replacers on the Physical, Sensory and Nutritional Quality Characteristics of Some High Fat Bakery Products. Ph.D. Thesis Food Sci., Fac, of Agric., Ain Shams Univ.

الخلاصة

اجريت هذه الدراسة لانتاج دهن منخفض السعرات الحرارية يتميز بالمواصفات الطبيعية للدهون التجارية وبخصائص مقبولة الجودة و استخدامها في اعداد كيك منخفض السعرات كبديل لدهون التقصير. تم تحضير نماذج دهون منخفضة السعرة عن طريق خلط شمع النحل المحلي مع زيت عباد الشمس بثلاث نسب مختلفة (25:75 ، 50:50 ، 75:25) على اساس الوزن .تم تقييم الخواص الفيزيائية و الكيميائية للعينات الثلاث اضافة الى الخصائص التغذوية والسعرية والحسية للكيك المحضر ومقارنتها بعينة السيطرة. هناك ارتفاع ملحوظ في خصائص نقطة الانصهار و قيمة البيروكسيد ($P\leq0.05$) للعينات الثلاث اما بالنسبة لنتائج الاحماض الدهنية الحرة و قيمة الحامض فكانت اعلى في25:75A و 75:25 C مقارنة بالعينة .50:50 Bعلى عكس ذلك فانمستوى المزج 25:75Aكان لديه اعلى نقطة دخان. لا توجد اي فروقات معنوية ($p>0.05$)بالنسبة للخصائص الحسية فيما يتعلق بالطعم ، النكهة، اللون،النعومة، النسجة والاحساس بالفم اضافة الى المجموع الاجمالي. المحتويات الغذائية: الرماد ، البروتين ، الكربوهيدرات، وقيمة السعرات الحرارية جميعها تأثرت معنويا($P\leq0.05$). اما القيم المئوية لخفض السعرات الحرارية تأثرت معنويا و بشكل ملحوظ ($P\leq 0.05$) بالنسبة لجميع العينات.

الكلمات الدالة : كيك منخفض السعرة، دهن منخفض السعرة، شمع النحل، زيت عباد الشمس