Kujurat (Hibiscus sabdariffa L) as a Minearal and Per Fiber Supplement in Chocolate Cakes

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Abstract: Kujurat (Hibiscus sabdariffa L.) powder was used as crude fiber, calcium, and iron supplemented raw materials in chocolate cakes at a levels of 0,1,3,5, and 7%W/W. Cakes made from non-pH controled kujurat supplemented batter had showed a significant reducation (p0.05) in volume specific volume and crumb pH.On the other hand no significant differences in studied parameters showed in cakes made from pH controled batter, except for the treatments wher supplemention level was 7% Crude fiber-, calcium, and iron contents in these cakes increased 5 approximately and 2 fold 4 respectively. The unsatisfactory use of kujurat in chocolate cakes is attributable at least in part to the high organic acid level in kujurat which lower the pH value of cake crumb. Kujurat powder up to 5% level of supplementation can be used in the production of chocolate cakes

Introduction:

The insufficient daily calcium, iron or fiber intake among children in tropical and subtropical regions requires a search for a new natural calcium, iron or fiber source for certain palatable products in the food industry. Especially, in high sugar items such as cakes and other sweet products made of wheat flour. Kujurat is an excellent source of calcium, iron, and crude fiber. Chemical analysis reveals that kujurat have a copious content of fiber (20%). Calcium and iron levels were 1342 and 41 mg / 100 g respectively based on the dry weight (9).

Kujurat powder has a red or purple color and contains a high level of organic acids (12). It is made from the dry calices and flowers of the plant kujurat, Roselle (Hibiscus sabdriffa L.) which is an edible popular food in tropical and subtropical regions. The plant products appear to have a food industry processing potential, which remains, largely unexploited. The calyx and floral bracts of the plant are usually esteemed for the acid flavor and the red or purple color they impart to jams, jellies, sauces syrups, beverages snack foods, cake and pie fillers The properties derived from the plant are traditionally used to replace some medicines or preservatives. It has been considered that some kujurat products might be useful for the treatment of cough, high blood pressure, and wounds (8). Since kujurat products has traditionally been considered by the consumers in tropical and subtropical regions to be a healthful and natural food, the ongoing trend towards a more healthful diet and life style should continue to favor the use of kujurat products in the food industries in the coming decade.

Although the nutritional and Industrial properties of kujurat plant is widely recognized (,1: 3; 9; 4). Little work has actually been performed on kujurat to elucidate its value as a useful nutrient supplement in bakery products where calcium, iron or fiber may be inadequate. To avoid adverse effect on functional properties or baking qualities of wheat flour, one important function is the control of pH by adjustment of the leaving components such as soda or leavening acids pH is an important factor in bakery products formulation and production because of its very pronounced effect on bakery products qualities such as product volume, color, flavor, grain texture, and other product quality scores (6).

The use of organic acids in bakery products had been studied (15). Also, kujurat as an iron supplement already has investigated in bread making (10). Cocoa in the chocolate cake formula is expected to mask to some extent any deteriorative effects of kujurat powder on cake making properties. In addition, natural organic acids in kujurat powder may be effectively neutralized by either cocoa or an additional soda Accordingly, the objective of this study was to evaluate the suitability of kujurat powder as a calcium, iron, and crude fiber supplement in the production of chocolate cakes.

Material and Methods:

Kujurat and wheat flour samples

Commercial kujurat calyx and floral bracts were collected from local markets. They were ground in a mill equipped with α 250μ screen .Wheat flour was commercially unclorinated and unenriched cake flour produced in Iraq by the Iraq Grain silos and flour mills company.

Chemical analysis

Kujurat and wheat flour samples as well as chocolate cake samples were analysed for crude protein, crude fat, crude fiber, ash, and moisture contents according to AACC approved Methods (2). The calcium and iron contents were determined with atomic absorption spectrophotometry according to AOAC method (5). The pH of kujurat and wheat flour and chocolate cake crumb samples were determined by AACC Approved Method(2).

Preparation of chocolate cakes:

The method was based on a variation of(11), chocolate cakes were prepared with flour (200g), shortening (100 g), fresh whole egg (120g), baking powder (16g), non fat dry milk (28g), salt (3.2g), sucrose (280g), coca (30g) and water as determined from the baking absorption estimated from a farinograph absorption at 500 BU (192 g) . Cake making, was performed with 0,1,3,5, and 7% kujurat powder based on wheat flour weight. Sodium bicarbonate was added just before cake making to adjust the pH of cake batter to 7.0. Batter (400g) was weighed into a 20-cm diameter round pan and baked for 30 min. at 175 c in an electric oven Cakes were baked in a randomized sequence. All cake measurements were the average of three cakes.

Chocolate cake evaluation

Cake weight and volume were taken after 1 hr of cooling cakes at room temperature. Cake volume was determined by rape seed displacement method. Cakes were graded the following day according to AACC Approved Method (2). Cake firmness was measured by a baker compressemter (F. Watkins Co. NJ.) with penetration speed 0.5 mm/sec. A section 1.5 cm thick was cut from the centre of the cake.

The piece was placed on the platform below the probe so that the surface of the crumb to be tested was facing upwards. Three positrons were choosed to test the crumb : crumb centre portion, right and left portion The average of three readings was recorded as crumb firmness in g.

Statistical analysis:

Data were analyzed via analysis of variance (ANOVA) and Duncan's multiple range test to identify significant differences at the 0.05 probability level.

Results and Discussion:

Proximate composition of kujurat powder

Chemical analysis of kujurat powder compared to wheat flour is shown in Table (1). Kujurat powder is a useful nutrient supplement in wheat flour and supplementation with kujurat powder may be important in tropical and subtropical regions. The major components of interest are crude fiber, calcium, and iron contents, which were 10, 117, and 3.1 fold respectively more than levels in wheat flour. As expected, pH value of kujurat powder was lower than that of wheat flour because kujurat contain a high level of organic acids(12).

Effect of pH uncontrolled and controlled kujurat supplemented batter on chocolate cake making properties

The effects of non-controlled kujurat on chocolate cake properties were examined. Means of actual cake volume, specific volume, firmness, cake scores and crumb pH of chocolate cakes are shown in Table (2) kujurat adversely affects actual cake volume, cake specific volume and cake crumb pH. Such effects are more pronounced at higher levels of supplementation. At 7% level kujurat caused a significant deterioration to cake firmness, grain, texture, and cake crumb cells. The deteriorative effects of kujurat on cake volume or other quality factors are likely attributed to organic acids in kujurat which lower the pH of cake crumb.

According to (13) cake quality is often significantly affected by its pH (6) also discussed the role of pH in cake baking. Similar problems with kujurat supplementation in bread such as a lower volume have been reported by (10).

No significant differences between 5% kujurat and the control chocolate cakes were found when the pH of cake batter was adjusted to 7.0 for obtaining the optimizing cake properties by the addition of soda just before cake making (Table 3). This indicates that good chocolate cake making properties can be obtained by controlling the pH of cake batter containing up to 5% kujurat. On the contrary adjusting the pH of cake batters containing 7% kujurat did not produce good quality cakes, which suggests that the increase of the amount of kujurat flour more than 5% in chocolate cakes would negatively affect the cake properties even with controlling the pH to the optimum level. Other components beside organic acids such as protein and fiber are likely responsible factors for decreasing cake properties. Similar trends have been reported in bread containing more than 5% kujurat powder(10).

Table (l) pH, proxirnate composition, Ca, and Fe contents of kujurapowder and wheat flour'(dry Weight)

Assay	Kujurat Powder	Wheat Flour
pH(5% solution)	2.8	6.2
Protein (%)b	6.1	10.5 '
Lipid(%)	0.90	1.5 '
Ash(%)	8.76	0.75
Crude fibe(%)	l0	0.4
Carbohydrate(%)'	47	86.8
Ca(mgl100g)	rt7	0.t7
Fe (me/100e)	3.1	$,02'

[a]Data represent means of measurements on three replicates + standard deviations.

[b] Protein content was calculated by multiplying the nitrogen content by the conversion factors 5.7

[c]Calculated by difference.

Table (2) Effect of pH - uncontrolled kujurat on chocolate cake making properties[a]

Percent kujurat Supplement in wheat flour[b]	Cake volume (cm3)	Cake sPeci fic Volume (cm3/g)[c]	Cake firmness (e)
0(controI)	1085 a	3.10 a	22.99b
1	1015 b	290b	23.00 b
3	985 c	2.75 c	22.99b
5	935 e	2.66 d	22.99b
7	956 d	2.47 e	23.97 a

Table (2) cont .

Percentage kujurat Supplement in wheat flour[b]	Cake crumb scores[d]			Cake crumb
	Cells	Grain	Taxture	pH
0(controI)	26a	13a	30a	7.00 a
1	25a	ll a	30a	6.9s b
3	24a	12a	28a	6.74 c
5	27a	ll a	29a	6.60 d
7	15b	9b	17b	5.97 e

[a] Values represent means of measurements on three replicate cakes + standard deviations. Values followed by the same letter same column are not significantly different ($p<0.05$)according to Duncan's multiple range test.

[b]Wheat flour weight basis.

[C] It was determined by dividing the cake volume by its weight.

[d] They were determined according to AACC Approved Method (2).

Table (3). Effect of pH - controlled kujurat on chocolate cake making proprties[a]

Percent kujurat Supplement in wheat flourb	Cake volume (cm3)	Cake sPeci fic Volume (cm3/g)[c]	Cake firmness (e)
0(controI)	1085 a	3.25a	l8-99 a
1	1015 b	3.25a	19.2 a
3	985 c	3.25a	18.8 a
5	935 e	3.25a	18.9 a
7	956 d	2.56b	19.7 b

Table (3) cont .

Percentage kujurat Supplement in wheat flour[b]	Cake crumb scores[d]			Cake crumb
	Cells	Grain	Taxture	pH
0(controI)	26a	13a	30a	7.02
1	25a	ll a	28a	7.0
3	24a	12a	25a	6.69
5	27a	13 a	27a	6.98
7	16b	7b	18b	7.04

[a]values represent means of measurements on three replicate cakes + standard deviations values followed by the same letter in same column are not significantly different (P < P0.05) according to Duncan's multiple range test.

[b]Wheat flour weight basis.

[C] It was determined by dividing the cake volume by its weight.

[d] They were determined according to AACC Approved Method (2) Minerals and crude fiber in chocolate cakes Changes in calcium, iron and crude fiber in chocolate cakes supplemented with 5% pH controlled kujurat based on wheat flour weight are shown in Table (4). As expected, calcium, iron, and fiber contents in cakes approximately increase 4, 2 and 5 fold respectively , than the components content in the control cakes containing wheat flour alone. More iron content in the baked products can be obtained by using a kujurat variety that has a higher amount of iron such as 188 mg/100g. Hayashi and seguchi (1998) found that the iron content in bread containing 5% kujurat in wheat flour, approximately increases (7) fold. Table(4) Changes in Ca, Fe, and crude fiber contents in chocolate cakes supplemented with 5% pH kujurat powder based on wheat flour weight controlled

Component	Content of component before Supplementation Mg / 1009" drY weight basis	Content of component after Supplementation mg /10g u dry weight basis
Ca	0.17	117.1s
Fe	0.02	3.11
Crude fiber	0.4	10.03

[a] Data represent means of measurements on three replicates ±standard deviations

Conclusions:

The unsatisfactory use of kujurat in chocolate cakes is attributable at least in part to organic acids in the kujurat which lower the pH value of cake crumb. With the pH value of cake batter controlled to the optimum level by the addition of soda just before making cakes, kujurat powder can be used in the production of chocolate cakes at levels up to 5% based on wheat flour weight. The crude fiber, calcium and iron contents in the resulting cakes approximately increase 5, 4, and 2 - fold, respectively.

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الكجرات .Hibiscus sabdariffa L كمدعم للمعادن و الألياف

في كعك الشيكولاتة

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الخلاصة : استعمل مسحوق الكركدية كمدعم للالياف و الكالسيوم و الحديد في كعك (كيك) الشيكولاتة بنسب اضافة قدرها صفر ، ٣ ، ٥ ، ٧ % من وزن دقيق القمح ، وتم تقويم الكعك باختبارات الخبيز . وقد وجد ان مسحوق الكجرات الذي لم يتم ضبط الاس الهيدروجيني له قد تسبب في نقص حقيقي لحجم الكعك و حجمه النوعي و الاس الهيدروجيني للبابته ، وكان هذا النقص متمشياً مع زيادة الكجرات . ومع هذا ، فان الكعك المحتوي على ٥% مسحوق الكجرات و الذي تم ضبط الاس الهيدروجيني له عند ٧ باضافة الصودا قبل اعداد الكعك كان مشابهاً للكعك المعد من دقيق القمح وحـده (العينة القياسية) في كل الصفات ، وفضلا على ذلك تضاعفت محتويات هذا الكعك (المحتوي على الكجرات) من الالياف و الكالسيوم و الحديد الى ٥ ، ٤ ، ٢ مرة على التوالي و لقد اعزي التاثير غير المرضي للكجرات على الكعك جزئياً الى محتويات الكجرات من الاحماض العضوية و التي خفضت الاس الهيدروجيني للبابة الكعك ، وعند التحكم في الاس الهيدروجيني للكجرات فانه يمكن ان يستعمل كمدعم غذائي حتى مستوى ٥% من الاضافة ، وذلك عند انتاج كعك الشيكولاته .