Egypt. J. Agric. Res., 73 (3), 1995

A NEW REDUCED CALORIE-PAN BREAD, CAKE, COOKIE AND PASTA PRODUCTS

AFAF, A. ATIA[1] , BOTHYNA, M. ABD EL-LATEEF[2] AND S. K. ABD EL-REHEEM[1]

1 Food Technology Research Institute, Agricultural Research Centre, Giza, Egypt.
2 Central Laboratory for Food and Feed, Agricultural Research Centre, Giza, Egypt

(Manuscript received 8 February 1994)

Abstract

Fiber materials were extracted from tocal commercial sugar cane baggas (SCB). SCB were treated with alkaline hydrogen peroxide (AHP).

The SCB - AHP treated fibers were added to wheat flour, 72% extraction at 10, 15 and 20% levels for making pan bread, cake, cookies and pasta products (macaroni).

The best treatment for low calorie pan bread was 15% level. This treatment decreased lipids by 10.5% and carbohydrates by 23.88%. The calorific value was reduced by 21.80%.

This treatment was a suitable mean for retardation of staling of pan bread and a good binding factor in doughs of cake and cokkies products.

This binding effect of AHP fibers was found to be ralatively weak in case of pasta products, but it was compensated by developing considerable increase in volume and weight of cooked macaroni (about 25%).

INTRODUCTION

Miranda and Horowitz (1978), reported that high fiber diets may be beneficial for some people such as diabetics.

Lenennier (1978) studied the reduction of blood cholesterol level by diet enriched with cellulose, oats and bran. In rats, diet with cellulose increased transit, absorption of bile acids and their excretion which reduced blood cholesterol.

Gould 1984, 1987, 1989 and Gould *et al.* (1989), reported that the properties of a wide range of lignicellulose material could be altered substantially by treating them with a dilute alkaline solution of hydrogen peroxide. Alkaline hydrogen peroxide (AHP) treatment solubilizes a portion of the lignin originally present in the cell wall.

Producing a highly water absorbent material with a more open internal structure (Gould *et al.*, 1989) apearently allow particles of AHP-treated lignocellulose to hydrate more extensively causing the particles to swell and soften dramatically. The unusual physical properties of AHP-treated lignocellulose also allow them to be incorporated into dough and batter formulations at very high levels in lieu of flour without loss of baking performance or degradation of sensory qualities (Jasberg *et al.*, 1987 a, b).

The purpose of this study is to produce low calorific value products (pan bread, cake, cookies and pasta) for diabetics. The effect of adding (sugarcane bagges) to produce low calorie products on chemical, energy, physical and sensory properties was also investigated.

MATERIALS AND METHODS

Treated lignocellulosics

Lignocellulosic materials of local commercial sugar cane bagges (SCB) were treated with alkaline hydrogen peroxide (AHP) as described by (Gould 1984, 1987). The (SCB-AHP) treated fibers were added to flour 72% extraction at 10, 15 and 20% levels on flour dry basis weight.

Preparation and organolyptic examination of pan bread

Pan bread containing (SCB-AHP) in ratios of 10%, 15% and 20% were produced according to the method described by Juge and Hoseney (1981). The quality score for pan bread includes general appearance (10) taste (20) color of crust (20) texture of crumb (20) and freshness (20).

Determination of staling rate

Pan bread freshness was determined at zero time and after 24, 48 and 72 hours by alkaline water retention capacity (AWRC) according to the method of Yamazaki (1953) and modified by Kitterman and Rubenthalor (1971).

Preparation of cake and cookies

Layer cakes and cookies (SCB-AHP) were prepared according to the standard method of A.A.C.C. (1980). The quality score for cakes and cookies were determined by the same method.

Preparation of macaroni

The cooking quality of macaroni samples were determined according to the method described by Lorenz *et al.* (1979). Organolypic tests were evaluated as reported by Matez (1959).

Chemical composition

Moisture content, crude protein, crude fiber and ether extract contents were estimated according to the (A.O.A.C. 1980). Total carbohydrates were estimated by difference.

Calculation of calorific value of baked products and pasta

Calorific value was calculated on the basis that one gram of the main food stuffs, protein, carbohydrates and lipids gives 4, 4 and 9 k calorie, when is completely oxidized in human body.

RESULTS AND DISCUSSION

Chemical composition of pan bread containing (SCB-AHP) treated fibers is recorded in Table 1. The most suitable treatment for production of low calorie pan bread was the addition of (AHP) treated (SCB) at 15% level. This treatment decreased lipids by 10.5% and carbohydrates by 23.88%, the calorific value was then

Table 1. The chemical composition and calorific value of panned bread containing cellulosic (SCB-AHP) additive fibers.

Cellulosic fibers	Protein		Total carbohydrates		Ether extract		Ash	Total calorific value
	Percent %	Calories	Percent %	Calories	Percent %	Calories		
Control	10.61	42.04	83.75	335.00	2.10	18.90	1.08	395.94
SCB 10%	9.74	38.96	66.25	265.00	1.91	17.19	3.04	321.15
SCB 15%	9.43	37.72	63.75	255.00	1.88	16.92	3.13	309.64
SCB 20%	8.75	35.00	75.50	230.00	1.82	16.38	3.22	281.38

- (SCB-AHP) = Sugarcane baggas fibers treated with alkaline H_2O_2.
- Fibers were added on flour dry weight basis.

Table 2. Evaluation of staling properties of pan bread containing cellulosic additives by AWRC method.

Cellulosic Fibers	Fresh	1st day	Change %	2nd day	Change %	3rd day	Change %
Control	270.16	236.80	12.33	214.89	20.45	196.77	27.54
SCB 10%	320.37	295.34	9.78	268.78	17.81	241.08	26.11
SCB 15%	350.53	318.54	9.13	293.12	16.38	275.55	21.39
SCB 20%	379.89	323.77	14.79	298.41	21.45	268.08	29.43

* AWRC = Alkaline water retention capacity.

Table3. Evaluation of organolyptic qualities of pan bread containing SCB-AHP cellulosic additives.

Cellulosic fibers	General Appear. (20)	Taste (20)	Color of crust (20)	Texture of crumb (20)	Freshness (20)	Overall score
Control	20	19	19	19	18	95
SCB 10%	20	16	17	18	18	89
SCB 15%	18	13	14	16	19	80
SCB 20%	15	13	11	12	19	70

Excellent over 100, V. good 90-100, Good 80-89 and satisfactory 70-79.

Table 4. The chemical composition and calorific value of cakes containing cellulosic SCB-AHP additive fibers.

Cellulosic fibers	Protein		Total carbohydrates		Ether extract		Ash	Total calorific value
	Percent %	Calories	Percent %	Calories	Percent %	Calories	%	
Control	10.13	40.52	86.50	346.00	0.02	18.18	1.86	404.70
SCB 10%	10.35	41.40	76.75	307.00	2.50	22.50	2.37	370.90
SCB 15%	10.34	41.36	64.50	278.00	4.30	38.70	2.95	358.06
SCB 20%	10.11	40.44	58.50	234.00	4.50	40.50	2.97	314.94

- SCB-AHP = Sugarcane baggas fibers treated with alkaline H_2O_2.
- Fibers were added on flour dry weight basis.

Table 5. Evaluation of organolyptic qualities of cakes containing SCB-AHP cellulosic additives.

Cellulosic fiber	Cells			Grain	Texture		Crumb		Overall acceptance (100)
	Uniformity (10)	Size of cells (10)	Thickness of walls (10)	(20)	Tenderness (10)	Softness (10)	Color (15)	Flavor (15)	
Control	8.9	9.1	9.3	19.5	9.4	9.2	15.0	15.0	95.2
SCB 10%	8.6	8.8	8.9	19.0	9.2	8.8	14.6	14.8	92.7
SCB 15%	8.5	8.5	8.5	18.5	9.1	8.6	14.2	14.6	90.3
SCB 20%	8.5	8.4	8.5	18.5	8.9	8.5	14.2	14.6	90.1

Excellent over 100, V. good 90-100, Good 80-89 and satisfactory 70-79.

Table 6. The chemical composition and calorific value of cookies for containing cellulosic SCB-AHP additive fibers.

Cellulosic fibers	Protein		Total carbohydrates		Ether extract		Ash	Total calorific value
	Percent %	Calories	Percent %	Calories	Percent %	Calories	%	
Control	10.07	40.28	88.50	342.00	2.00	18.00	0.90	400.28
SCB 10%	10.15	40.60	75.00	300.00	2.20	19.80	1.11	360.40
SCB 15%	9.59	38.36	68.50	274.00	4.50	40.50	1.19	352.86
SCB 20%	8.81	35.20	56.25	225.00	4.80	43.20	1.78	303.40

- SCB-AHP = Sugarcane baggas fibers treated with alkaline H_2O_2.
- Fibers were added on flour dry weight basis.

Table 7. Evaluation of organolyptic qualities of cookies containing SCB-AHP cellulosic additives.

Cellulosic fibers	Unifor-mity (10)	Thickness of walls (10)	Grain (20)	Softness (20)	Color (20)	Flavor (20)	Overall acceptance (100)
Control .	9.2	9.5	19.5	19.4	19.5	19.0	96.1
SCB 10%	9.2	9.4	19.0	19.4	19.5	18.5	95.0
SCB 15%	9.0	9.2	18.5	18.7	19.0	18.0	92.4
SCB 20%	8.9	9.0	18.5	18.5	19.0	17.5	91.4

Table 8. The chemical composition and calorific value of pasta containing cellulosic SCB-AHP additive fibers.

Cellulosic fibers	Protein		Total carbohydrates		Ether extract		Ash	Total calorific value
	Percent %	Calories	Percent %	Calories	Percent %	Calories	%	
Control	9.52	38.08	77.75	311.00	0.65	5.85	0.64	354.93
SCB 10%	9.41	37.63	65.50	262.00	0.61	5.44	1.19	305.07
SCB 15%	9.13	36.52	53.50	214.00	0.55	4.95	1.70	255.47
SCB 20%	8.94	35.76	41.50	166.00	0.54	4.86	2.52	206.62

- SCB-AHP = Sugarcane baggas fibers treated with alkaline H_2O_2.
- Fibers were added on flour dry weight basis.

Table 9. Cooking properties of pasta products contaning cellulosic SCB-AHP additive fibers.

Cellulosic Fibers	Increase in volume %	Increase in weight %	Total solids %
Control	300	259.5	1.40
SCB 10%	345	298.8	2.00
SCB 15%	375	337.0	2.48
SCB 20%	400	348.1	2.72

- SCB-AHP = Sugarcane baggas fibers treated with alkaline H_2O_2.
- Fibers were added on flour dry weight basis.

Table10. Evaluation of organolyptic qualities of macaroni containing SCB-AHP cellulosic additives.

Cellulosic fiber	Appear-ance (10)	Taste (10)	Shape (10)	Odor (10)	Soft-ness (10)	Tender-ness (10)	Color (10)	Overall score (70)
Control	9.4	9.2	9.4	9.4	9.2	9.0	9.6	65.2
SCB 10%	8.4	8.4	8.4	8.4	8.4	8.2	8.0	58.2
SCB 15%	7.8	7.4	7.4	7.2	7.4	6.0	6.6	49.8
SCB 20%	7.2	6.6	6.4	6.6	6.6	6.4	6.4	46.2

reduced by 21.80%.

Since staling property negatively affects the acceptance of the consumer for bread due to the undesired alterations in taste, odor and appearance that occur during staling development, data in Table 2 revealed that staling developed in the untreated pan bread more rapidly than pan bread containing 15% treated fibers. The untreated loaves were less in alkaline water retention capacity (AWRC). As it decreased from 12.33% after the first day of baking to 27.54% after the third day simultaneously, the pan bread produced from flour containing 15% of (SCB) treated with (AHP) gave a corresponding change of 9.13% after the first day to 21.39% after the third day, indicating considerable improvement towards staling ability of pan bread which may be due to the high ability of hydration capacity of SCB-AHP fibers. These results are in agreement with Mongeau and Braddord (1982).

The organolyptic test of pan bread recorded in Table 3, show that the low calorie pan bread produced from adding 15% SCB-AHP fiber was of good score grade.

From the data demonstrated in Table 4, it is clear that the available carbohydrates decreased considerably by increasing the level of SCB-AHP fiber added (15%). The decrease in carbohydrates level was up to 19.65%, while the decrease in calorie value was only 11.52%. This because of the necessity of increasing fats added to overcome the lack in uniformity of cells cake due to the spreading fibers which interrupt the structure of gluten network (Zabik *et al.,* 1977).

It is clear from Table 5 that cake which contains 15% SCB-AHP fibers had consumer acceprance of 90.3% which was nearly good as compared to untreated cake (95.2%).

Chemical analysis of cookies (Table 6) show that both protein and total carbohydrate contents were affected by the addition of SCB-AHP fibers. The carbohydrate contents were affected to a greater extent compared with protein. The addition of 15% fibers decreased carbohydrate content from 88.5% in the untreated samples to 68.5% in the treated ones. From Table 6 it could be shown that the decrease in calorie value of treated cookies containing 15% SCB-AHP fibers was 11.85%. The organolyptic evaluation of cookies reported in Table 7 indicated that the consumer acceptability of treated cookies scored 92.4% compared to the control sample (96.1 score). This indicated just a little change in cookies acceptance from normal.

Chemical analysis of pasta products (macaroni) as well as its calorific value is recorded in Table 8. Fiber additives slightly affected protein and ether extract. Available carbohydrate contents were highly affected by addition of treated fiber, where it decreased from 77.75% in the untreated sample to 53.5% in the treated sample containing 15% fiber additives. The calorie value of the treated pasta decreased by 28% with the level of 15% addition.

Cooking characteristics of pasta absorption, volume, growth weight and total solids were examined in the water used to cook pasta. The data recorded in Table 9 indicated that the growth in volume and weight of cooked macaroni was gradually increased as the percent of fibers in pasta progressed so that cellulose material became hygroscopic and absorbed more water. The absorption capacity of the SCB fibers was (1500%). Total solids were also positively correlated with the increase in fiber additives. From data in Table 10, the addition of 15% SCB-AHP fibers was the most suitable treatment from the consumer ponit of view because of the considerable increase in volume and weight of cooked macaroni. The volume increased from 300% to 37%, while the increase in weight was (29.87%). Moreover, total solids in the cooking water incread from 1.4% to 2.48 in the treated sample containing 15% fibers. The increase in total solids may be due to the fact that addition of fiber had weakened the gluten net work and allowed more soluble components of macaroni to desennlerglate in the water during cooking. The overall acceptability of the panelists for the treated sample of 15% level was 7.1 as compared with 9.3 to the untreated one, which could be considered as not bad from the consumer view.

It is clear that AHP treatment of cellulosic fibers of SCB is useful for producing baked bread and pasta products as a low calorie foods still accepted by consumers. The addition of SCB-AHP fibers at the level of 15% to wheat doughs was a suitable means for retradation of staling of pan bread and had a good effect on doughs of cake and cookies. Also it improve pasta cooked volume and weight.

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إنتاج مخبوزات جديدة منخفضة السعرات الحرارية "خبز القوالب والكيك والبتيفور وعجينة المكرونة"

عفاف عبد الحميد أحمد عطية[١] ، بثينة محمد عبد اللطيف[١] ، سيد كريم عبد الرحيم[٢]

١ معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية - الجيزة.

٢ المعمل المركزى للأغذية والأعلاف .

تم الحصول على مخلفات مصاصة القصب (SCB) ثم أجريت لها عمليات غسيل جيد وتجفيف وطحن ثم عوملت بواسطة فوق أكسيد الأيدروجين وإضافة القلوى حتى PH ١١,٥ وتركت لمدة ١٢ ساعة ثم غسلت جيداً بالماء العادى عدة مرات ثم جففت وطحنت ومررت من منخل سعة ثقوبة 10XX وبذلك أمكن الحصول على ألياف سيليلوز نقية . بعد ذلك أستخدمت ألياف مصاصة القصب بنسب ١٠ ، ١٥ ، ٢٠ ٪ مع الدقيق لإنتاج قوالب خبز الفينو ، مكرونة ، بيتى فور ، كيك مع إجراء الإختبارات الخاصة بكل منتج .

بالنسبة لقوالب الخبز الفينو فلقد تم عملة بإضافات ١٠ ، ١٥ ، ٢٠ ٪ من ألياف مصاصة القصب وتم تقييم الخبز ودراسة الخواص الحسية له وتقدير مدى الطزاجة لمدة ٣ أيام وحساب السعرات الحرارية ووجد أن إضافة نسبة ١٥٪ من ألياف مصاصة القصب هى أفضل النسب المضافة.

وبالنسبة للكيك والبيتى فور ، فقد تم عملهما بإضافة ١٠ ، ١٥ ، ٢٠٪ من ألياف مصاصة القصب وتم عمل تقييم للكيك والبيتى فور ودراسة الخواص الحسية لهما وحساب السعرات الحرارية وقد وجد أن إضافة الألياف حتى ٢٠٪ كانت هى أفضل النسب .

ولقد عملت المكرونة بإضافات ١٠ ، ١٥ ، ٢٠ ٪ من ألياف مصاصة القصب وتم تقييم المكرونة بعد الطبخ ودراسة الخواص الحسية لها وكذلك حساب السعرات الحرارية المنخفضة وقد وجد أن إضافة نسبة ١٥٪ من ألياف مصاصة القصب هى أفضل النسب المضافة .