THE PRODUCTION OF LOW PROTEIN BREAD

BY

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ABSTRACT

Investigation was conducted to evaluate the possibility to produce low protein bread which is required for protein restricted diets. The results indicated that starch addition to first break flour led to increase total carbohydrates content i.e. from 88.65 % (100% first break flour) to 92 % in mixture I (70 % first break flour + 30% starch) and 94.3 % in mixture II (50 % first break flour + 50 % starch). On the other hand, total protein content was decreased from 6.80 % to 4.80 % and 2.40 %. Meantime, other constituents showed remarkable reduction in their values

Rheological properties illustrated that first break flour-starch mixtures had less desirable rheological characteristics owing to the dilution effect of gluten by starch addition. Dough weaking values (B.U) were improved by the addition of guar gum. Increasing guar gum up to 0.8 and 1.00 % gave the best improvement in weaking values especially with mixture I Extensograph test indicated that addition of guar gum to first break flour -starch mixtures improved dough extensibility and reduced other parameter values of the extensograph.

Organoleptic evaluation of Balady and Toast bread indicated that guar gum additions avoided crust cracks and improved the results of appearance and other properties.

Generally, it could be concluded that first break flour-starch mixtures may be used in low protein bread making. Guar gum can be used as stabilizer and thickner at ratios 0.8 % or 1.0 % to improve rheological and organoleptic characteristics

INTRODUCTION

In Egypt bread is produced in two main types i e baladdy bread and European or Shamy bread. Both types contain about 9% crude protein on dry weight basis (El-Bardiny 1990).

Except short bread for regimen and diabetic patient, which are in fact high fiber bread type, there are no special commercial therapeutic bread as for patients with chronic renal failure of moderate severity or with subaucte hepatic encephalopathy (Davidson et al., 1975). For patients with severe chronic renal failure, bread must be salt and protein free, patient can consume 17 g./day protein of high biological value. Whereas for those of the moderate severity, bread must contain low protein, and patient can consume 40 g/day protein of high biological value.

Low protein bread is required for protein restricted diets as in renal disease and phenylketonuria (Saxelly and Brown, 1980). Also, there is a need for a low protein bread for patients in their treatment management.

Fortunately, the first break flour has high quality with low protein content (7.2%) in the flour mill streams (El-Bardiny et al., 1989) and it was better for the production of low protein bread.

Pomeronz (1971) cited that the gluten function is chiefly as a dough binding agent and is not essential for crumb structure. Therefore, the production of low protein bread is accompanied with the problem of its lower gluten content. Consequently, it is important to utilize a gel forming material to improve dough properties and also to facilitate handling of dough during fermentation.

Guar gum, really a mucilage, is composed of the storage polysaccharide of the endosperm of the guar seeds (Cyamposis tetragonoloba). Sandford and Baird (1983) reported that the total production of guar gum in the year 1970 amounted to 60,000 metric tons and reached 90.000 tons in the year 1980. This increase was chiefly due to the wide range of functional characteristics exhibited by this polysaccharide. Khater (1977) stated that the guar gum has 5-8 times the thickening power of starch. Also, Apling et al (1978) mentioned that the guar polysaccharide is used extensively in the food industry as a stabilizer and thickener in amounts below 1 %.

Guindi et al (1989) studied the chemical structure of guar gum which is produced under the Egyptian conditions. The proposed structure of this polysaccharide consisted of 171 repeating segments, each segment is composed of a main chain of four mannopyranose units joined by B-(1 -- 4) glycosidic linkages. Each segment is also joined with two units of galactopyranose through B (1 -- 6) glycosidic bonds. The same investigators found that guar gum was suitable to form firm gel when compared with standard pectin. In addition, the ability of guar gum to form gel at room temperature was higher than that of pectin. On the other hand, Ibrahim and Salem (1983) stated that the amount of pectin equals fifteen times that of guar gum to obtain the same gel strength in Jam making. This point seems to be important from the economical point of view.

The present investigation aimed to produce low protein bread from first break flour and evaluate its chemical, rheological characteristics and baking quality.

MATERIALS AND METHODS

Materials:

Samples of low protein flour (first break flour) were obtained from Flour Mill, North Cairo Flour Milling Co. Starch was obtained from the market.

Guar-gum was obtained from guar seeds according the method described by Guindi et al (1989).

I: Chemical analysis: Moisture, crude protein (N X 5.7), ash. lipids, falling number and total sugars were determined according to A.O.A.C. (1980). Starch was determined enzymatically according to Kerr et al (1951). Dietary fibers were estimated by using the following equation.
Dietary fibers = 100-(total protein + available carbohydrates + lipids + ash).

Phytate phosphorous was determined according to Lopez et al (1983) Total calories were calculated according to Yadkin and Offord (1980) by using the following equation E = 4(% protein + % carbohydrates) + 9 X % fat where E = energy as calories per 100 grams.

II- Rheological properties of the dough:- The rheological properties of the different doughs were determined by using a Farinograph and Extensograph tests according to A.A.C.C. (1962).

III-Preparation of bread: Bread was prepared by using; 100 % first break flour (control), 70 % first break flour + 30 % starch (mixture I) and 50 % first break flour + 50 % starch (mixture II).

Guar gum was added at ratios of 0.0, 0.2, 0.4, 0.6, 0.8 and 1.0 % to the two mixtures. Flour and flour mixtures were mixed with water to form the needed dough according to farinograph test. In addition, 2.0 % yeast and 2.0 % sugar were added to the three doughs to form both Toast and Balady bread.

Toast bread; was fermented for 70 min. and backed at 200 °C. Balady bread; was fermented for 20 min., then the dough was divided into 165 g.-pieces, the individual pieces were placed on a tray sprinkled with a layer of bran, fermented for 10 min. then flattened and backed at 300-350 °C.

IV- Organoleptic Evaluation: Panelists were asked for sensory evaluation of bread appearance, crumb, odour, crust, color and taste according to the method of Kramer and Twigg (1974).

RESULTS AND DISCUSSION

Chemical constituents of flour samples:

The chemical constituents of flour samples i.e. first break flour, mixture I and mixture II are shown in Table (1). The obtained results indicate that starch addition to first break flour led to increase total carbohydrates content i.e from 88.65 to 92.00 and 94.32 %. Also, total calories values were increased i.e from 391.9 to 394.4 and 396.2 in the two mixtures. Meantime, other constituents showed remarkable reduction in their values.

Table (2) shows the effect of guar gum addition on falling number (viscosity) of first break flour and flour mixtures. The results illustrate that addition of starch was accompanied with higher values of falling number. This may be attributed to their higher carbohydrates content which produce higher reducing sugars percentage under the action of alpha amylase on the starch (Pomeronz 1971).

Table (1): Chemical constituents of flour and flour mixtures

Tested sample	Ash %	Total lipids.	Crude protein	available carbohydrates %	Dietary fibres %	phytate phosphorus.	Gluten wet	Gluten dry	Total caloric values.
First break flour *	0.5	1.1	6.8	88.7	3.00	0.12	20.6	7.9	391.9
Mixture I	0.4	0.8	4.8	92.0	2.10	0.08	14.3	5.5	394.4
Mixture II	0.3	0.6	3.4	94.3	1.5	0.06	10.3	4.0	396.2

* 100 % first break flour.

Mixture I = 70 % first break flour + 30 % starch.

Mixture II= 50 % first break flour + 50 % starch.

Table (2): Effect of guar addition on falling number of flour and flour mixtures.

% Guar gum	Falling Number		
	100 % first break flour	Mixture I	Mixture II
0.0	353	300	419
0.2	367	389	446
0.4	378	412	455
0.6	400	426	520
0.8	414	471	543
1.0	470	471	620

Mixture I = 70 % first break flour + 30 % starch.

Mixture II = 50 % first break flour + 50 % starch.

The obtained results demonstrate that addition of guar gum which is composed of galactomannan polysaccharide (Guindi et al., 1989) raised falling numbers especially with mixture II.

Rheological properties:

a) Farinograph test: The results presented in Table (3) show that water absorption was modified by increasing starch ratio. Such trend could be attributed to the higher water absorption of starch as mentioned by Dexter and Matsuo (1979). Dough development and stability were decreased by increasing starch ratio. On the other hand, dough weakening had positive proportional relation with the added starch. However weakening of the dough is a result of the break down of gluten network after elapsing an appropriate mixing time (10 and 20 minutes). Protein in first break flour-starch mixtures is of low quality because of its deficiency in gluten and therefore, the weakening values were increased. The obtained results indicate that first break flour-starch mixture had less desirable rheological properties than the first break flour. This observation may be due to the dilution effect of gluten by the starch addition (Shuey, 1972). Dough weakening values (B.U.) were improved by the addition of guar gum up to 1.0 % as shown in Table (3). A desirable reduction in the degree of softening was observed by adding 0.6 % guar gum to mixture I, where weaking values reached the lowest values i.e. 155 and 170 B.U. after 10 and 20 min., respectively. Increasing guar up to 0.8 and 1.0 % showed the best weaking values improvement specially with mixture I.

b) *Extensograph test:* The results in Table (4) indicate that dough resistance to extension, proportional number and energy of mixture II were higher than those of mixture I which could be attributed to its higher percentage of the added starch. Addition of guar gum, which is used extensively as stabilizer and thickener in food industry Apling et al (1978), improved dough extensability and reduced the other parameter values of the extensograph.

Organoleptic qualities:

a) *Toast bread:* The results concerning the quality of the produced toast bread are shown in Table (5) These

Table (3): Farinograph parameters of 30 % , 50 % starch and different concentrations of guar gum added to 1 st Break Flour .

Parameters	Control	Guar gum additions											
		0.00		0.20		0.40		0.60		0.80		1.00	
	I Break flour.	MI	MII	MI	MII	MI	MII	MI	MII	MI	MII	MI	MII
Water absorption %	54.00	59.30	60.00	59.50	59.90	59.80	59.80	60.40	59.90	60.00	60.00	60.90	60.10
Arrival time min.	0.70	0.70	0.80	0.60	0.80	0.60	0.80	0.70	0.80	0.60	0.90	0.70	0.90
Dough development time (Min.).	1.20	0.80	1.00	0.70	7.00	0.70	1.00	0.80	1.00	0.80	1.00	0.80	1.00
Stability.	1.3	0.3	0.50	0.40	0.50	0.40	0.50	0.40	0.50	0.40	0.50	0.40	0.50
Degree of weakening after 10 min.	95	215	225	195	210	190	210	155	200	150	200	145	190
Degree of weakening after 20 min.	115	225	245	205	230	200	230	170	220	165	215	165	210

MI = Mixture I = 70 % I Break flour + 30 % starch.

MII= Mixture II= 50 % I Break flour + 50 % starch.

Table (4): Extensograph parameters of blends of 30 % and 50 % starch added to 1st Break flour and different concentration of guar gum.

Parameters	Control 100% first break flour	0.00		0.02		0.40		0.60		0.80		1.00	
		MI	MII	MI	MII	MI	MII	MI	MII	MI	MII	MI	MII
Extensibility (min.)	153	112	80	114	85	115	90	118	90	122	92	120	95
Resistance to extensibility (B.U.).	370	190	375	180	350	160	325	150	300	110	250	110	200
Proportional number.	2.42	1.69	4.68	1.58	4.12	1.39	3.61	1.27	3.33	0.90	2.71	0.91	2.10
Higher peak (B.U.).	3.90	190	6L5	180	500	160	450	150	400	140	406	140	220
Energy (cm^2).	48	28	41	26	36	24	34	23	31	22	30	22	25

MI = 70 % first break flour + 30 % starch.

MII= 50 % first break flour + 50 % starch.

Table (5): Effect of guar gum on organoleptic qualities of 30 % and 50 % starch toust bread

Properties	Control I break flour	Percentage of guar gum. 0.00 MI	0.00 MII	0.20 MI	0.20 MII	0.40 MI	0.40 MII	0.60 MI	0.60 MII	0.80 MI	0.80 MII	1.00 MI	1.00 MII
Weight. (g.).	422	452	454	456	454	448	458	448	437	444	437	440	437
Volume (cc).	1250	1160	1485	1325	1485	1355	1520	1220	1420	1200	1420	1180	1420
Specific volume cc / g	2.96	2.57	3.27	2.90	3.27	3.02	0.32	2.72	3.25	2.70	3.25	2.68	3.25
Quality of crust	9	3	3	5	7	6	8	7	8	6	9	7	9
Crumb.	8	3	3	7	6	7	6	6	6	6	6	6	6
Flavour.	7	6	5	6	5	6	5	6	5	6	5	6	5
Structure.	7	3	4	6	6	7	7	7	7	8	8	8	8
Taste.	7	7	6	7	6	7	6	7	6	7	6	7	6
Grain.	8	4	3	6	5	7	6	6	6	8	7	8	7
Total.	46	26	24	37	35	40	38	39	38	41	41	42	41

MI = 70 % first break flour + 30 % starch.

MII = 50 % first break flour + 50 % starch.

results indicate that bread produced from first break flour (control) is characterized by lower weight than that produced from the other two mixtures. This could be attributed to the higher water absorption of the mixtures. First break flour bread also had the highest organoleptic properties (total of 46 vs. 26 and 24). Guar addition up to 0.4 % resulted in a reduction in weight and increment in volume of bread produced from the two mixtures. Increasing guar gum percentage from 0.6 to 1.0 % reduced gradual the volume and weight of the produced bread from mixture I, while such increment in guar addition had no effect on bread produced from mixture II. Addition of guar gum improved the organoleptic properties of the produced bread especially at the ratios of 0.8 and 1.0 %.

b) *Balady bread:* The organoleptic qualities of tested balady bread are shown in Table (6).

Balady bread produced from first break flour had higher organoleptic properties score than those of bread produced from the two mixtures. Crumb was sticky and the prepared bread had broken top. This observation may be due to that the fermentation time was very short. Guar addition facilitated bread flattening, avoided crust cracks, and improved the results of appearance and other properties. (Mixture I + guar) produced higher quality bread than that produced from (Mixture II + guar gum) and the best results were obtained by adding guar at ratios of 0.8 and 1 %. This may be due to its higher gluten content in the first mixture.

Generally, it could be concluded that guar gum might be used as a stabilizer and thickener at ratios of 0.8 or 1.0 % in low protein bread making.

Table (6): Effect of guar gum additions on organoleptic of 30 % and 50 % starch balady bread

Properties	Control	Percentage of guar gum											
		0.00		0.2		0.40		0.60		0.80		1.00	
		MI	MII	MI	MII	MI	MII	MI	MII	MI	MII	MI	MII
Crust	8	4	4	7	6	6	6	7	7	7	7	7	7
Colour	7	4	4	6	7	8	8	7	6	7	6	7	6
Taste	7	5	4	5	4	5	4	5	4	5	4	5	4
Odour	7	6	5	6	5	6	5	6	5	6	5	6	5
General appearance	7	4	4	6	6	6	6	6	6	6	6	6	6
Crumb	8	7	6	8	7	8	7	9	7	9	7	9	7
Total /60	44	30	26	38	35	39	36	40	35	40	35	40	35

MI = 70 % first break flour + 30 % starch.

MII = 50 % first break flour + 50 % starch.

Control = 100 % First break flour

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انتاج الخبز ذو المحتوى البروتينى المنخفض

صلاح مصطفى سعد نادية يحيى عطيه أحمد السيد البردينى سوسن أحمد عبد الحليم

* يهدف البحث الى دراسة أمكانية انتاج خبز ذو محتوى بروتينى منخفض لاستخدامه للاشخاص الذين يحتاجون الى كمية بروتين منخفضة كمرض القصور الكلوى وذلك بأستخدام دقيق الدشة الاولى المنخفض فى نسبة البروتين (٨ر٦٪) وباضافة النشا لتقليل نسبة البروتين فى الخبز الناتج.

أوضحت النتائج أن أضافة النشا الى دقيق الدشة الاولى أدت الى زيادة المحتوى الكربوهيدراتى من ٨٨ر٦٥٪ (دقيق دشة أولى) الى ٩٢٪ فى المخلوط الاولى (٧٠٪ دقيق دشة أولى + ٣٠٪ نشا) والى ٩٤ر٣ ٪ فى المخلوط الثانى (٥٠٪ دقيق دشة أولى + ٥٠٪ نشا). وقد أدى ذلك أيضا الى أنخفاض المحتوى البوتينى من ٨ر٦٪ الى ٨٠ر٤٪ ، ٤ر٣٪ وقد حدث أنخفاض واضح فى بقية المكونات نتيجة أضافة النشا الى الدقيق المستخدم فى التجربة.

وقد أوضحت الخواص الريولوجية أن صفات العجن الخاصة بمخاليط دقيق الدشة الاولى والنشا أقل فى جودة صفاته من دقيق الدشة الاولى منفردا وذلك يرجع الى التأثير التخفيفى لشبكة الجلوتين نتيجة أضافة النشا. وأوضحت النتائج أن أضافة صمغ الجوار أدى الى تحسين صفات ضعف العجين وقد أدى زيادة نسبة الجوار الى ٨ر٠ ، ١٪ الى أحسن قيم للتحسين وخاصة مع المخلوط الاول. وقد أظهر أختبار الاكستنوجراف أن أضافة صمغ الجوار أدى الى تحسين مطاطية العجين وأنخفاض بقية القيم الاخرى الخاصة بالاكستوجراف.

أوضحت نتائج التقييم الحسى للخبز البلدى والتوست أن أضافات صمغ الجوار منعت تشقق الخبز. وكذلك أدت الى تحسين مظهر الخبز وبقية الصفات الاخرى.

* مما سبق يتضح أنه من الممكن أستخدام مخاليط دقيق الدشة الاولى والنشا فى أنتاج الخبز المنخفض فى نسبة البروتين وأنه من الممكن أيضا أستخدام صمغ الجوار بنسب ٨ر٠٪ أو ١٪ لتحسين الخصائص الريولوجية للعجن والحسية للخبز الناتج.