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THE PRODUCTION OF LOW PROTEIN BREAD BY USING STARCH AND PECTIN BY

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ABSTRACT

Investigation was carried out to evaluate the possibility to produce low protein bread which is required for protein restricted diets. The obtained results illustrated 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 indicated that first break flour starch mixtures had less desirable rheological properties owing to the dilution effect of gluten by starch addition

Dough weakening values (B.U.) were improved by the addition of pectic substances. Increasing of pectin up to 0.8 and 1.0% gave the best improvement in weakening values especially with mixture I Extensograph test revealed that addition of pectic substances to first break flour-starch mixtures improved dough extensibility and decreased other parameter values of the extensogram

Organoleptic evaluation of Balady and toast bread indicated that pectin addition avoided crust crachs and improved the results of appearance and other properties

Generally it could be concluded that first break flour-starch mixtures may be used in the production of low protein bread And also pectin can be utilized at 0.8% or 1.0% to improve rheological and organoleptic characteristics

INTRODUCTION

In Egypt, bread is produced in two main types i.e. balady 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 fibre bread type, there are on special commercial theropeutic bread as for patients with chronic renal failure of moderate severity or with subacute hepatic encephalopsthy (Davidson et. al., 1975). The outhor reported that, 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 contain low protein, and patient consume 40g/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 is accompanied with the problem of its lower gluten content. Consequently, it is important to utilize a gel forming material e.g. pectin to improve daugh properties and also to facilitate handling of dough during fermentation.

Pectin is a group designation for those complex colloidal carbohydrate derivaties which occur in, or are prepared from plants and contain proportion of anhydrogalacturonic acid units which are thought to exist in a chain-like combination. The carboxyl groups of polygalacturonic acid may be partially esterified by methoxyl groups and partially or completely neutralized by one or more bases. pectin is not a single pure substance but it is group of heteropolymers, Saad (1985).

Pilnik and Varagen (1980) and Jackman (1983), reported that pectin is widely applied as gelling, thickening and stablizing agent in the food industry Also, Saad (1985) found that orange peel pectin was suitable to form firm high gel strength

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

MATERIALS AND METHODS

Samples of low protein flour (First break flour) were obtained from Flour Mill, North Cairo Flour Milling Co. Starch was obtained from the Market. Pectin substance was obtained from orange peel according to the method described by Saad (1985).

I: Chemical analysis: Moisture. Crude protein. 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 fibres were estimated by using the following equation:
Dietary fibers=100-(total protein+available (carbohydrate)+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 + % carbohyrates)+9x%fat) where E=energy as calories per 100grams.

II- Rheological properties of the dough: The rheological properties of different doughs were determined by using 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 1) and 50% first break flour+50% starch (mixture 11).

Pectin 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 pan and Balady bread.

Toast bread: was fermented for 70 min and baked 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 baked at 300-350°C.

1V- 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, mixtur 1 and mixture 11 are shown in Table (1). The obtained results indicate that starch additon to first break flour increased total carbohydrates content i.e from 88.67 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 pectic substances on falling numbers (viscosity) of first break flour and flour mixtures. The results illustrates that addition of starch was accompanied with lower values of falling number. This may be attributed to their higher content which produce higher reducing sugar percentage under the action of alpha-amylase on the starch (Pomeronz, 1971).

The obtained results demonstrate that addition of pectin which is mainly composed of polygalacturonic acid polysaccharide (Saad, 1985) raised falling numbers especially with mixture II.

Rheological Properties

a) Fariograph test:

The results illustrated in Table (3) show that water absorption was modified by increasing starch ratio. Such trend could be attrbited to the higher water absorption of starch as mentioned by Dexter and Matsuo (1979). Dough developement and stability were decreased by increasing starch ratio. On the other hand, dough weaking had positive proportianal relation with the added starch. However, weaking of the dough is a result of the break down of gluten network after elapsing on appropriate time (10 and 20 minutes). Protein in First break flour-starch mixture is of low quality because of its deficiency in gluten and therefore, the weaking 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 weaking values (B.U.) were improved by the addition of pectin up to 1.0% as shown in table (3). A desirable reduction in the degree of softening was observed by adding 0.6% pectin to mixture I, where weaking values reached 165 and 170 after 20 and 10 minutes, respectively. Increasing pectin 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

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

Tested sample	*Ash %*	*Total lipids %*	*Crude protein %*	*AvailableCarbohydrate %*	*Dietary fibers %*	*Phytate phosphorous %*	*Gluten*		*Total Caloric Value*
							wet	*dry*	
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	4.5	396.2

* 100% first break flour.

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

Mixture 11= 50% first break flour +50% Starch.

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

% pectin	*Falling Number*		
	100% first break flour	*Mixture I*	*Mixture II*
0.0	353	310	330
0.2	367	370	405
0.4	378	402	430
0.6	400	416	462
0.8	414	438	492
1.0	470	486	560

Mixture I : 70% First break flour

Mixture II: 50% first break flour

Table(3): Farinograph parameters of 30%, 50% starch and different concentrations of pectin added to frist Break flour.

Parameters	Control first break flour	Pectin addition											
		0.00		0.20		0.40		0.60		0.80		1.00	
		MI	MII	MI	MII	MI	MII	Mi	MII	Mi	MII	Mi	MII
Water absorption%	54.0	59.30	60.00	60.00	61.00	60.00	61.00	60.40	61.50	60.40	61.50	60.6	61.7
Arrival time min.	0.70	0.70	0.80	0.65	0.80	0.60	0.80	0.70	0.80	0.60	0.80	0.70	0.90
Dough development time (min.)	1.2	0.80	1.00	0.70	0.70	0.70	0.90	0.80	0.90	0.85	1.00	0.80	1.00
Stability (min)	1.3	0.30	0.50	0.40	0.55	0.40	0.55	0.40	0.55	0.40	0.55	0.40	0.55
Degree after 10 min	95	215	225	190	205	185	200	170	190	160	190	135	170
Weakening after 20 min	115	225	245	195	225	175	225	165	210	165	210	160	200

M I = Mixture: I= 70% I Break flour + 30 % starch.

M II = Mixture II=50% Break flour + 50% Starch.

Table (4): Extensograph parameters of 30% and 50% starch and different concentrations of pectin added to first break flour .

Parameters	Control 100% break flour	Percentage of pectin substance											
		0.00		0.20		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	116	95	118	95	120	95	120	100
Resistance to extensibility (B.U)	370	190	375	170	350	155	325	155	300	130	250	120	210
Proportional number	2.42	1.69	4.68	1.60	4.00	1.40	3.55	1.25	3.20	0.95	2.90	0.90	2.40
Higher peak (B.U)	390	190	615	180	510	170	470	155	420	145	410	130	230
Energy (Cm^2)	48	26	40	26	38	24	36	23	34	22	28	19	24

M I = 70% First break flour + 30% starch.

M II= 50% First break flour + 50% starch.

of pectin. which is used extensively as gelling, stabilizer and thickener in food industry, (Jackman, 1983 and Pilnik and Voragen 1980), improved dough extensability and reduced the other parameter values of extensograph.

Organoleptic qualities:

a) Toast bread:

The results concerning the quality of the produced toast bread are shown in table (5). These 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. On the other hand. first break flour bread had the highest organoleptic properties (total of 46 Vs 26 and 24).

Pectin addition up to 0.4% resulted in a reduction in weight and increment in volume of bread produced from the two mixtures. Increasing pectin percentage from 0.6 to 1.0% reduced gradual the volume of the produced bread from mixture I. while such increment in pectin addition had no effect on bread produced from mixture II.

It is important to mention that addition of pectin improved the organoleptic propertis of the produced bead, especially at the ratio of 0.8 and 1.0%.

b) Balady bread:

Balady bread produced from the first break flour had the higher orgonoleptic properties scores 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.

Addition of pectin facilitated, to large extent, bread flattening, avoided crust Cracks, and improved the results of appearance and other properties (Mixture I + pectin) produced higher quality bread than that produced from (Mixture II + pectin) at different ratios of additions to first break flour. The best results were acquired by adding pectic substances at ratios 0.8 and 1.0%. This may be due its higher gluten content in the first mixture.

Generally. it could be concluded that pectin might be used as a stabilizer and thickener at ratios 0.8% or 1% in the production of low protein bread.

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Table (5) Effect of pectin on organoleptic qualities of 30% and 50% starch toast bread.

Properties	Control 100% break flour	Percentage of pectin											
		0.00		0.20		0.40		0.60		0.80		1.00	
		MI	MII	MI	MII	MI	MII	MI	MII	MI	MII	MI	MII
Weight (g).	422	452	454	450	454	445	450	445	440	445	440	445	440
Volume (cc).	1250	1160	1485	1300	1485	1325	1540	1220	1425	1210	1425	1200	1425
Specific Volume (cc/g)	2.96	2.57	3.27	2.90	3.3	2.9	3.3	2.7	3.3	2.65	3.3	2.6	3.3
Quality of crust	9	3	3	5	7	6	8	7	8	6	9	7	8
Crumb	8	3	3	7	6	7	6	6	6	6	6	7	7
Flavour	7	6	5	7	6	7	6	7	7	7	7	7	6
Structure	7	3	4	6	6	7	7	7	7	8	8	6	8
Taste	7	7	6	7	7	6	7	7	7	7	7	8	7
Grain	8	4	3	7	6	7	6	6	6	8	8	7	7
Total	46	26	24	39	38	40	40	40	41	43	45	42	43

M I = 70% First break flour + 30% starch.

M II = 50% First break flour + 50% starch.

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

Properties	Control	Percentage of pectin											
		0.00		0.20		0.40		0.60		0.80		1.00	
		MI	MII	MI	MII	MI	MII	MI	MII	MI	MII	MI	MII
Crust	8	5	4	6	6	5	6	6	6	8	7	7	8
Colour	7	4	4	6	5	7	5	6	6	7	7	7	8
Taste	7	4	5	5	5	5	5	6	5	6	5	6	5
Odour	7	5	3	5	6	7	5	6	5	6	5	7	5
General appearance	7	5	5	7	6	6	7	5	6	7	6	8	6
Crumb	8	7	6	7	6	7	7	8	6	8	8	8	6
Total	44	30	27	36	34	37	35	37	34	42	38	43	38

M I = 70% First break flour + 30% starch.

M II = 50% First break flour + 50% starch.

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انتاج خبز ذو محتوى بروتينى منخفض باستخدام النشا ومواد بكتينية

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يهدف البحث الى دراسة امكانية انتاج خبز ذو محتوى منخفض من البروتين لكى يستخدمه الأشخاص الذين يعانون من قصور فى نشاط الكلى وذلك باستخدام الدقيق المنخفض فى المحتوى البروتينى باضافة النشا وبعض المواد البكتينية لخفض نسبة البروتين فى الخبز الناتج.

أوضحت النتائج أن اضافة النشا الى الدقيق بنسبة ٣٠ ٪ (المخلوط الأول) أو ٥٠٪ (المخلوط الثانى) أدى الى زيادة المحتوى الكربوهيدراتى من ٧ر٨٨٪ الى ٩٢٪ ، ٣ر٩٤٪ على التوالى كمما أدى الى انخفاض نسبة البروتين من ٨ر٦٪ فى الكنترول الى ٨ر٤٪ ، ٤ر٣٪ فى المخلوط الأول والثانى على التوالى.

كما أدى اضافة النشا الى الدقيق المستخدم الى انخفاض واضح فى مستوى المخلوط من الدهون الكلية والنسبة المئوية للرماد والألياف.

وقد أوضحت الخواص الريبولوجية ان صفات العجين الناتجة من اضافة النشا الى الدقيق أقل فى جودة صفاته عن العجين الناتج من الدقيق فقط وذلك يرجع الى التأثير التخفيفى لشبكة الجلوتين نتيجة اضافة النشا.

وأوضحت النتائج ان اضافة البكتين أدى الى تحسين صفات ضعف العجين وقد أدت زيادة نسبة البكتين من صفر الى ٨ر٠٪ و ١٪ الى أحسن قيم كذلك فى المخلوط الأول (٣٠٪ نشا).

وقد أظهرت اختبار الاكستنوجراف ان اضافة البكتين يمنع تشقق الخبز . وكذلك الى تحسين مظهر الخبز وبقية الصفات الأخرى.

أوضحت نتائج التقييم الحسى للخبز البلدى والتوست ان اضافة البكتين تؤدى الى منع تشقق الخبز وتحسين المظهر المنتج.

مما سبق يتضح انه من الممكن انتاج خبز منخفض فى محتواه من البروتين وذلك باضافه النشا الى الدقيق مع اضافة البكتين بنسبة تتراوح بين ٨ر٠٪ الى ١٪ لتحسين الخواص الريبولوجية للعجين وتحسين مظهر الخبز الناتج.