CHEMICAL, RHEOLOGICAL AND BAKING QUALITY STUDIES ON THE FLOUR PRODUCING FROM MILL-STREAMS.

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ABSTRACT

The chemical composition, rheological properties and baking performance of mill-streams flour under investigation were determined. The 5th break flour, which resembles about 5% from the total milling production was characterized by high protein and gluten contents. Such flour tend to be dark in color accompanied with high yellow pigment. Dough of the 5th break flour developed readily with high stability indicating sufficient gluten quantity and quality. Also, the main rheological properties were satisfactory approved. Meantime, high value of extensibility accompanied with low resistance to extension were noticed as compared with patent flour (72% extraction). However, flour of the 5th break might be used for making toast bread instead of applying it in the composition of 2nd grade flour which mainly used as a protein supplemented for ruminant livestock.

INTRODUCTION

The main development in milling industry recognized impact milling with air classified flours to separate the products with high, moderate and low protein contents. Such development. Can be utilized in the production of flour with high proteins content which used in baking with high gluten bread, Anon (1976).

Nelson and Mc-Donald (1977) stated that slightly differtiation in the nutritional values of flour protein which were produced from mill-streams. Also, Kent (1966) and Staudt and Ziegler (1973) showed that sub-aleurone layers which are found in the outer layers of the endosperm in hard wheat contained highly proteins content i.e. 40% approximately.

Morad et al (1980) stated that the increasing in dough development time, dough stability and valorimeter value are favourable rheological properties for pasta quality. According to Refai (1982) the quanity of gluten is not so very important as the quality. Gluten suitable for pasta products should be strong and may be shorter for bread flour. Cooking quality is related to protein content, since it improves with increasing protein content, Graveland et al., (1982).

The main objective of this research is to investigate the possibility of producing high protein flour content from new roller milling in Egypt, with its capability, in accordance with the ultimate use of milling by-products as a human foodstuffs.

MATERIAL AND METHODS

Flour of different mill-streams and patent flour (72% extraction) were obtained from Fouad Mill, North Cairo Milling Company.

Chemical analysis:

Moisture, crude fiber, lipids and proteins content were carried out according to A.O.A.C. (1980). Yellow pigment and alpha amylase activity was determined according to A.O.A.C. (1980) using falling number values. Wet and dry gluten contents were estimated according to the method of Refai (1965). The grade color figure was determined using Kent-Jones and Martin color grades, according to Anon (1976).

Brownness:

Was determined according to Matsuo and Irvin (1967) by measuring the absorption of an aqueous extract of flour at 400 nm using spectrophotometer. Phytic acid was determined according to the method of Lopez et al., (1983).

Rheological properties:

The rheological properties of the different doughs were carried out using Barbender Farinograph and Extensograph tests according to A.A.C.C. (1962).

Preparation of the toast bread(as the percentage of flours):

The flour samples were mixed with water of form the needed dough. Ascorbic acid (0.01%) as well as 2% sodium chloride and 2% yeast were added. The previous ingredients were mixed and fermented for 1.0 hr at 30°C.

Organoleptic evaluation:

Panelists were ashed for sensory evaluation of crust quality, pulp quality, flavor, porosity, crumb structure and taste according to Grance and Wragg (1980).

RESULTS AND DISCUSSION

Chemical constituents:

Data of chemical constituents of mill-breaks flour and patent flour (72% extraction) are illustrated in Table (1). In general, moisture contents gradually decrease during mill-streams accompanied with increasing in ash contents. Moisture content of the 1st break flours was 14.6%, this value decreased to 12.3% in the 5th break flours. Such reduction in the humidity might be attributed to exposure through hot roller-mill.

Ash contents increased from 0.5% in the 1st break flours and reached to 1.09% at the last break. Such increase might be due to increasing the fiber contents. Gluten of the 5th break flour was higher than that of other breaks flour as it was soft and sticky. Data concerning that, a considerable and gradual increase was reported in the proteins content. Since, flours of the 5th break are characterized by higher protein content i.e. 13.95%. Such value is

Table 1: Chemical constituents of different mill-streams flour and patent flour (72% extraction).

No. of breaks flour	Parameters										
	Moisture %	Ash %	Lipids %	Gluten % Wt	Gluten % dry	Crude protein %	Falling* No.	Yellow** pigment ppm	Color grade value	Browning at 400nm	Phytic acid %
1st	14.6	0.50	1.10	20.64	7.91	7.27	301	2.32	2.4	0.355	0.12
2nd	14.0	0.37	1.3	26.88	10.29	9.34	314	2.74	2.5	0.265	0.19
3rd	13.2	0.45	1.07	25.08	9.44	10.17	304	2.77	2.9	0.218	0.23
4th (fine)	13.5	0.68	1.70	28.48	10.90	10.80	310	2.83	5.0	0.245	0.19
(coarse)	13.1	0.84	2.10	31.08	11.44	11.30	345	2.89	6.8	0.385	0.24
5th (fine)	12.32	0.69	1.60	34.88	13.54	12.90	311	3.61	6.5	0.279	0.25
(coarse)	12.40	1.09	2.70	38.32	16.80	13.95	425	4.12	9.5	0.445	0.39
Patent flour (72% extraction)	12.50	0.66	1.67	26.20	10.76	9.00	335	3.07	3.5	0.311	0.15

* 15% moisture. ** 12% moisture.

Table 2: Farinograph parameters for different mill-streams flour and patent flour (72% extraction).

No. of breaks flour	Parameters						
	Water absorption	anival time (miy)	Dough development time (min)	Dough stability (min)	Tolerance index (B.U.)	Degree of softening (B.U.) after 10 min	Degree of softening (B.U.) after 20 min	Valorimeter value
1st	51.7	0.7	1.2	1.3	110	125	150	30
2nd	52.0	0.9	1.5	1.9	75	100	135	34
3rd	55.8	0.9	1.3	1.3	90	120	160	29
4th (fine)	54.8	0.9	1.4	1.5	80	110	160	30
(coarse)	56.2	1.0	1.7	4.9	60	90	135	35
5th (fine)	60.0	1.2	1.9	6.0	40	65	120	41
(coarse)	67.1	2.5	4.2	6.0	40	45	90	45
Patent flour (72% extraction)	56.0	1.1	1.8	4.8	60	85	125	39

considered twofold comparing with the value obtained from the 1st break flour i.e. 7.27%. The variations in protein and gluten contents in different break flours might be attributed to that the last break flour is produced from sub-aleurone layers which resembles 20% of the endosperm with highly proteins content, approximately 40% (Staudt and Ziegler, 1973).

Lipid and phytic acid contents were noticed in high values in the flours of the 4th and 5th breaks. Such high values of lipid due to the presence of wheat germ molecules or pre-pressing of these molecules through milling.

Color is an important indicator to pasta quality. Data in Table (1) revealed that the flour with high protein content resulted from the last break tend to be dark in color comparing with other flours and had a highest grade color value (9.5) accomplished with high yellow pigment i.e. 4.12 ppm.

Rheological properties:

Farinograph test:

Data in Table (2) illustrated the farinogram of flours under investigation. Generally, farinogram of the 5th break flour was relatively differences compared with other break flours. However, arrival time, dough development time, dough stability and valorimeter value were increased in the dough of the 5th break flour. On the other hand, degree of softening was decreased. The obtained data indicated that good quality and quantity of the resulted protein and gluten contents of the 5th break flour, Since, such components led to dough strength accompanied with increasing the ability of water absorption.

Dough of the 5th break flour was characterized by high water absorption than other flours. This is due to high content of gluten which is considered the major water holding constituent of the flour. These data in accordance with the results obtained by Refai (1982).

Moreover, weaking of the dough, which is a result of the break down of gluten net work after elapsing an appropriate mixing time, was measured after 10 and 20 min. Because of high content of gluten in flours of 5th break, the weakening values were lower than those of other flours. However, , weakening of the dough was noticed at higher values in the flour of 1st break.

On the other hand, arrival time, dough development time, dough stability and strength of dough were noticed in a relatively high values for the patent flour (72% extraction) than those of other flours of mill stream except only the flour of 4th break.

Extensograph test:

The results are shown in Table (3) revealed that dough of different breaks flour were characterized by higher extensibility,

especially the 5th break flour, compared with patent flour (72% extraction) which resulted from the same variety of wheat. Meantime, resistance to extensibility was notably higher in patent flour (72% extraction) than that other different breaks flour. The obtained data indicated that a noticeable variations in characteristics of breaks flour than those of milling flour, since patent flour (72% extraction) is consist of mill flour mixed with break flours.

Table 3: Extensograph parameters for different mill-streams flour and patent flour (72% extraction).

Parameters	No. of breaks flour							
				4th		5th		Patent flour (72% extraction)
	1st	2nd	3rd	Fine	Coarse	Fine	Coarse	
Extensibility (m.m)	165	165	198	191	163	218	258	154
Resistance to extension(B.U)	280	290	200	180	210	195	200	300
Proportional number (R/E)	1.70	1.76	1.01	0.94	1.90	0.76	0.92	1.95

It seems that, flour of different breaks were characterized by higher extensibility accompanied with lower resistance to extension compared with patent flour (72% extraction).

Baking and organoleptic qualities of produced toast bread:

The results of making toast bread are shown in Table (4) concerning that volume of the making bread was gradually decreased. Since, large volume was noticed in the bread making from 1st break flours. Such volume has a pronounced and gradually decreasing and reached to minimum volume in the bread of the 5th break flours. Also, weight and volume per weight were gradually decreasing.

Table 4: Quality of bread produced from different mill-streams flour and patent flour (72% extraction).

Bread	Maximum number	1st	2nd	3rd	4th		5th		Patent flour (72% extraction)
					Fine	Coarse	Fine	Coarse	
Weight (g)	-	426	418	413	412	431	415	419	431.5
Volume (cm^3)	-	1780	1730	1720	1495	1700	1400	1435	1675
V/Wt. (cm^3/g)	-	4.17	4.14	4.16	3.63	3.94	3.37	3.42	3.88
Crust quality	11	7.5	7.0	6.5	6.5	7.5	7.5	7.5	7.5
Pulp quality	10	7	6.5	6.5	5.5	6.0	4.0	5.0	7.0
Flavor	10	7	7	7	7	7	7	7	7
Porosity	10	7	7	6.5	5	6.5	4	5	7
Crumb structure	15	9	9	8	8	9	9	7	7
Taste	15	10	10	11	11	11	12	12	11

It seems from the organoleptic evaluation that making bread from the flour of the 1st break gave baking with good qualities. Such qualities were gradually decreased and reached to minimum in the bread resulted from the last break flour.

As a general conclusion, it can be said that the flour of the 5th break produced from new roller-mill which resembles about 5% from the total milling production can be used for human feeding instead of applying it in the composition of the 2nd grade flour, which mainly used as a protein supplemented for animal foodstuffs.

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دراسات كيميائيه وحسيه عن صفات الخبز الناتج من دقيق مراحل الطحن

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اجرى هذا البحث كمحاولة للاستفادة من دقيق الدشه الاخيرة الناتج من مطاحن السلندرات الحديثه والذى يمثل حوالى ٥٪ من القدرة الانتاجية للمطحن بدلا من اضافته الى الدقيق نمرة ٢ والذى يستخدم فى العلف الحيوانى .

تم دراسة الخواص الكيميائيه وصفات العجين الناتج من دقيق مراحل الدشر المختلفة ومقارنته مع الدقيق الفاخر (٧٢٪) الناتج من الطحن .

اوضحت النتائج ارتفاع نسبة البروتين تدريجيا من دقيق الدشه الاولى الى الاخيرة حيث بلغت نسبة البروتين فى دقيق الدشه الخامسه (الاخيرة) ١٣٫٩٥٪ اى حوالى ضعف نسبة البروتين فى دقيق الدشه الاولى (٧٫٢٧٪) . صاحب ذلك ارتفاع نسبه الجلوتين الطرى والجاف فى دقيق الدشه الاخيرة وكانت (٣٢٫٣٨٪ ، ١٦٫٨٪ على الترتيب) .

بالنسبة لصفات العجين: تميز دقيق الدشه الخامسة بارتفاع نسبة امتصاص الماء وسرعة تكوين العجن مع الثبات مما يدل على ارتفاع وزيادة كفاءة جلوتين الدقيق لتكوين العجين .

اختيار الاكستنسوجراف : تميز العجين الناتج من دقيق الدشر وارتفاع المطاطية خاصة دقيق الدشه الخامسة وفى نفس الوقت كان اقل مرونة بالمقارنة بالدقيق الفاخر .

وتبين النتائج المتحصل عليها عند عمل خبز توست ان حجم خبز دقيق الدشه الاولى كبير ثم يتناقص تدريجيا حتى يصل الى اقل حجم فى خبز دقيق الدشه الخامسة ويصاحب ذلك تدرج فى باقى خواص الخبز .

وبصفة عامة يتبين انه يمكن الاستفادة من دقيق الدشه الخامسة المحتوى على نسب مرتفعة من البروتين والجلوتين لاغراض الخبز حيث ان هذا النوع من الدقيق لا يدخل فى الدقيق الفاخر ولكنه يدخل فى مكونات دقيق نمره ٢ والذى يستخدم اساسا فى العلف الحيوانى .