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Development and Optimization of Bread Improver

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ABSTRACT

Three improvers were prepared using different proportions of wheat gluten, ascorbic acid, ammonium chloride, soybean flour, potassium bromate, maize germ and wheat flour. The improvers were used @ 0.50, 0.75 and 1.0% each with straight grade flour to prepare the bread. Commercial improver Eka-300 was used as the control. The proximate analysis of commercial wheat flour revealed protein content 10.54%. Moreover, moisture, crude fat, ash, crude fibre and gluten contents were 11.25, 1.24, 0.2 and 8.89%, respectively. Parameters for rheological (Farinographic and mixographic) studies such as water absorption capacity, dough development time, dough stability, mixing time and peak height percentage increased as compared with control, with the addition of locally made improvers. The physical and sensory evaluation, especially for bread prepared from improver C (wheat gluten 1.50%, ascorbic acid 0.75%, ammonium chloride 1.50%, soybean flour 35.0%, malted barley flour 30.0%, potassium bromate 0.25%, maize germ 1.50% and wheat flour 29.5%) @ 1.0% showed better results for volume, crumb color, grain texture, aroma, taste and character of crust when compared to commercial improver Eka-300 @ 1.0%; with the only exception of crust color, evenness of bake and symmetry of forms which are similar to those of bread prepared from flour containing Eka-300 @ 0.50%. Rheological and sensory characteristics of bread prepared from locally developed improvers and the control (Eka-300) revealed that the local improver C especially @ 1.0% showed superiority in bread quality and economy. Therefore, it can safely be recommended to the commercial bakers to use improver C for the bread production due to its desirable features of both quality and economy.

Key Words: Bread; Improver; Wheat gluten; Soybean

INTRODUCTION

Among the food grains, wheat is unique because it is the only grain that's flour when mixed with water, gives a dough, which can be leavened by yeast fermentation and baked into an attractive and tasty loaf of bread. Wheat flour is the major ingredient for bread production. Others are water, yeast, sugar, shortening, salt and small amount of additives etc.

The rapid growth in population and mechanization of food industry has increased the demand of white pan bread rapidly day by day. Uniformity and quality of raw material is very important factor to produce high standard bakery products. The composition and nutritive value of wheat flour vary widely due to inherent factors such as class, variety of wheat and environmental factor like climate, soil and cultural practices (Kent, 1983).

In western countries, flours of specific quality are available for different products. No such system exists in Pakistan. The baker has to use the flour of unknown quality. Under prevailing conditions, there is little hope of getting flour of uniform quality for the production of white pan bread. Bread prepared from poor quality flour lacks some of the desirable quality characteristics. Its quality is inferior with respect to loaf volume, colour, flavour, elasticity as well as freshness. There is a possibility to improve the performance of flour (fermentation, dough properties, oxidation, pH control and emulsification) by the use of different additives, like fungal alpha-amylase, proteolytic enzyme, L-ascorbic acid, Azodicarbonamide, potassium bromate, monocalcium phosphate, Lecithine, benzoyl peroxide and chlorine dioxide (Anonymous, 1987).

Presently, a number of commercial bread improvers are imported in Pakistan. The import of bread improvers requires substantial amount of foreign exchange. Although we have enough local material but still no proper work has been carried out to use such local material. Therefore, the project has been designed to attain the following objectives.

1. Evaluate commercial flour for its chemical composition.
2. Analyse commercial flour containing improvers for its Rheological properties.
3. Develop bread improvers by the use of different ingredients.
4. Check the multifunctional properties of different composite improvers.
5. Improve the volume and quality of bread as well as reducing its cost.
6. Find out the most suitable improver along with its dose for the industry.

MATERIALS AND METHODS

Preparation of flour. The straight grade flour and wheat gluten were purchased from the local market. Soybean and barley grains were procured from the Ayub Agricultural Research institute, Faisalabad. Maize germ was obtained from the Rafhan Maize

Products, Faisalabad. Soybean was cleaned, then wet heat treatment was applied to inactivate trypsin inhibitor and its husk was removed. Thereafter, soybean was dried at room temperature and milled through Udy-Cyclone Sample Mill. Barley grains were steeped by soaking grains in water till they attain moisture level of 45%. The amount of water required to increase moisture of barley grains was computed according to procedure given in AACC (1983). The germination of barley grains was carried out by allowing the barley grains to germinate for 72 hours. The grains were dried at low temperature until the moisture in grains reduced to 10%. The dried grains were ground through Udy-Cyclone Sample Mill to get malted barley flour.

Preparation of improvers. Three improvers A, B and C were prepared using different proportions (Table I) of wheat gluten, ascorbic acid, ammonium chloride, soybean flour, malted barley flour, potassium bromate, maize germ and wheat flour.

Table I. Formulation of different bread improvers

Ingredients	Improvers (%)		
	A	B	C
Wheat gluten	0.50	1	1.5
Ascorbic acid	0.45	0.55	0.75
Ammonium chloride	2.50	2.80	1.50
Soybean flour	23.0	28.0	35.0
Malted barley flour	18.0	25.0	30.0
Potassium bromate	0.35	0.30	0.25
Maize germ	0.50	0.75	1.50
Wheat flour	54.7	41.6	29.5

Proximate analysis. Commercial flour sample was analysed according to the methods described in AACC (1983) for moisture, crude fat, crude protein, crude fibre, ash and dry gluten.

Physical dough testing. Physical dough characteristics of the flour containing bread improvers were studied for their Farinographic and mixographic characteristics following the method described in AACC (1983).

Preparation of bread. The bread was prepared from straight grade flour following the method described in AACC (1983). The improvers A, B and C were added at the rate of 0.5, 0.75 and 1% level each. Eka-300 improver was used as a standard.

Evaluation of bread. External and internal characteristics were analyzed following the methods described by Matz (1972). Loaf volume was measured by using rapeseed displacement method.

Statistical analysis. Data obtained from different parameters was analyzed statistically according to the methods described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The chemical composition of commercial flour was crude protein 10.54%, moisture 11.25%, crude fat 1.24%, ash 0.32%, crude fibre 0.23% and gluten 8.89%. These results supported those of Yaqub (1998). Rheological studies revealed that the addition of improver increased water absorption capacity, dough development time and dough stability that ranged from 60.5 to 61.5%, 6.00 to 6.65 min and 8.85 to 11.50 min, respectively (Table II). Highest value for water absorption capacity, dough development time and dough stability was found in T_9, T_2 and T_3, respectively. Least values for dough development time (5.75 min) and dough stability (8.85 min) were observed in case of control (T_{10}). The mixographic studies revealed that the addition of composite

Table II. Rheological characteristics of commercial wheat flour samples containing improvers

			Farinographic Characteristics			Mixographic Characteristics	
Improvers	Treatments	Dose (%)	W.A. (%)	D.D.T. (min)	D.S. (min)	M.T. (min)	P. H (%)
	T_1	0.50	61.00	6.35	9.25	6.50	57
A	T_2	0.75	61.20	6.65	11.00	6.50	60
	T_3	1.00	61.20	6.50	10.80	6.90	60
	T_4	0.50	60.50	6.50	10.10	6.50	56
B	T_5	0.75	60.90	6.25	11.50	6.70	57
	T_6	1.00	61.00	6.00	10.45	7.50	57
	T_7	0.50	60.90	6.30	9.20	6.90	57
C	T_8	0.75	61.00	6.50	9.25	7.00	58
	T_9	1.00	61.50	6.50	11.50	7.80	58
Eka-300	T_{10}	0.50	60.00	5.75	8.85	6.25	55

W.A. = Water Absorption; D.D.T.= Dough Development Time; D.S.= Dough Stability; M.T.= Mixing Time; P.H.= Peak Height

improvers increased the mixing time and peak height percentage ranged from 6.25 to 7.80 min and 55 to 60%, respectively. Highest value for mixing time was observed in case of T_9. Similar findings were reported by Siddique (1989), Latif (1994), Mumtaz (1997) and Ayaz (1998).

The statistical results observed for external and internal characteristics of bread prepared by using different improver doses during its sensory evaluation are arranged in table III and IV .The results for external characteristics (Table III) revealed that improver C when implied @ 1% laid significant effect on volume, crust colour and evenness of bake while other treatments were found non significantly different with respect to each other. The other parameters like symmetry of form and character of crust gave little or no response to the other treatments of local improvers.

The over all volume (measured by Rape seed Displacement Method) ranged from 687 to 697 cc. The mean values for external characteristics varied from 8.30 to 8.83, 7.50 to 7.66, 2.30 to 2.60, 4.35 to 4.45 and 2.90 to 3.40 for volume, crust colour, evenness of bake, symmetry of forms and character of crust, respectively (Table III), while in case of internal characteristics that varied from 8.00 to 8.50, 7.90 to 8.50, 13.00 to 13.30, 13.40 to 13.55 and 16.90 to 17.90 for crumb colour, aroma, grain, texture and taste, respectively (Table IV). The bread containing improver C @ 1.0% showed better results for volume (8.83), crumb colour (8.50), grain (13.30), texture (13.55), aroma (8.50), taste (17.90) and character of crust (3.40) as compared to the control especially @ 1.0%. However, improver C @ 1.0% showed crust colour (7.66), evenness of bake (2.60) and symmetry of forms (4.42) are in close agreement to the bread prepared from flour containing control @ 0.5%. Similar findings were reported by Mumtaz (1997), Rafique (1997), Ayaz (1998) and Yaqub (1998).

Table III. Mean values for sensory evaluation of bread prepared from commercial flour containing different improvers

			External Characteristics of Bread					Rapeseed Displacement Method
Improver	**Treatment**	**Dose (%)**	**Volume**	**Crust colour**	**Evenness of bake**	**Symmetry of forms**	**Character of crust**	**Loaf volume (cc)**
	T_1	0.50	8.30c	7.59bcd	2.45bc	4.45a	3.20bc	688
	T_2	0.75	8.37b	7.59bcd	2.45bc	4.40a	3.20bc	689
A	T_3	1.00	8.30c	7.58cd	2.45bc	4.45a	3.20bc	690
	T_4	0.50	8.30c	7.50e	2.30d	4.40a	3.10c	687
	T_5	0.75	8.34bc	7.55de	2.40cd	4.35a	2.90d	690
B	T_6	1.00	8.32c	7.56de	2.45bc	4.40a	3.10c	690
	T_7	0.50	8.30c	7.65ab	2.49abc	4.40a	3.40a	689
	T_8	0.75	8.33bc	7.65ab	2.60a	4.45a	3.30ab	690
C	T_9	1.00	8.83a	7.66a	2.60a	4.42a	3.40a	697
Eka-300	T_{10}	0.50	8.30c	7.64abc	2.55ab	4.42a	3.25b	695

Mean values carrying the same latters in a column are not significantly different.

Table IV. Mean values for sensory evaluation of bread prepared from commercial flour containing different improvers

			Internal Characteristics of Bread				
Improver	**Treatment**	**Dose (%)**	**Colour of crumb**	**Aroma**	**Grain**	**Texture**	**Taste**
	T_1	0.50	8.25cd	8.30c	13.20ab	13.50b	17.00b
A	T_2	0.75	8.20d	7.90d	13.20ab	13.46b	16.90c
	T_3	1.00	8.25cd	8.25c	13.20ab	13.46b	17.00bc
	T_4	0.50	8.00e	8.25c	13.00b	13.40c	16.90c
B	T_5	0.75	8.20d	8.35b	13.20ab	13.50b	16.90c
	T_6	1.00	8.30bcd	8.30bc	13.00b	13.40c	16.90c
	T_7	0.50	8.40ab	8.35b	13.20ab	13.50b	17.00bc
C	T_8	0.75	8.40ab	8.45a	13.30a	13.50b	17.00bc
	T_9	1.00	8.50a	8.50a	13.30a	13.55a	17.90a
Eka-300	T_{10}	0.50	8.35bc	8.35b	13.20ab	13.46b	17.08ab

Mean values carrying the same latters in a column are not significantly different.

Comparing loaf volume of bread (measured by rape seed displacement method), which ranged from 687 to 697cc, it was concluded that T_9 (697cc) was the best one as described in table IV. These results are in line with the results reported by Hafeez (1974) and Rafique (1997).

Rheological and sensory characteristics of bread prepared from locally developed improvers and control (Eka-300), revealed that local improver C showed superiority in bread quality characteristics especially @ 1.0%. The relative cost of improver C was found to be less than the control (Eka-300). Therefore, it is recommended that improver C may be used commercially by the baking industry that would be helpful to improve the quality of the bread as well as reduce the cost of production.

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