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UTILIZATION OF SPROUTED WHEAT FOR THE PRODUCTION OF BREAD

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ABSTRACT

Wheat variety LU-26S was subjected to sprouting for 48 hours at 30°C. Sprouted wheat flour (70% extraction) contained moisture 12.93%, protein 12.17%, fibre 0.93%, ash 0.67%, fat 0.74% and nitrogen free extract 85.49%. This was blended with sound wheat flour in various proportions (5, 10, 15, 20 and 25%). Breads were prepared from the composite flours. The volume, weight and weight to volume ratio of bread loaves prepared from composite flours were found higher than the normal flour bread. Sensory evaluation revealed that breads prepared from composite flours scored significantly higher for external and internal characteristics than control. It was concluded that breads of acceptable quality could be prepared with the addition of 15% sprouted wheat with flour from sound wheat.

Key words: Sprouting, Wheat, Bread, Sensory evaluation, Rheology, Blending.

INTRODUCTION

Sprouting is a major economic constraint in wheat producing areas where precipitation occurs frequently at harvest time. The frequency of sprout damaged wheat grains up to 44 % has been recorded in northern areas of Punjab during 1986-88, while similar damage was observed during harvesting and threshing operations in 1981-82 (Anon, 1988). Germination increases reducing sugars, diastatic activity and damaged starch, while it decreases gluten content, falling number and water absorption (Leelavathi and Haridas Rao, 1988; Kruger and Matsuo, 1982) that adversely affect the quality of bread. There is an improvement in the nutritional quality of the flour as a result of germination. This is reflected by rise in the crude protein, crude fat, thiamine and riboflavin (Linda and Barry, 1976) contents of the flour with an improvement in the protein quality owing to increase in lysine (Dalby and Tsai, 1976; Hamad and Fields, 1979). Similarly the amount of soluble starch, amylose and amylopectin increases with germination time (Morad and Rubenthaler, 1983).

Major part of sprouted wheat, whenever conditions become favourable, is either wasted or fed to the farm animals. The millers and bakers are reluctant to use this wheat. It is, therefore, essential to find suitable uses of sprouted wheat so as to prevent economic loss to the farmers. This project was initiated to determine the suitability of using sprouted wheat for the production of bread.

MATERIALS AND METHODS

Wheat variety LU-26S was selected for the purpose of this investigation. It was procured from the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. The cleaned wheat was subjected to sprouting by soaking in tap water for 8 hours and allowing to germinate at 30°C for 48 hours at 80% relative humidity. The sprouted wheat was dried in the sun. The sound and sprouted wheat samples were subjected to proximate analysis according to the methods described in AACC (1983).

The sound and sprouted wheat samples were tempered in batches of 3 kg by placing in air-tight bottles and adding calculated amount of water and allowing to rest for 12 hours. They were milled in Quadrumate Senior Experimental Mill to collect high grade flour, low grade flour, shorts and bran. High grade and low grade flours were pooled up and used for the production of bread.

Composite flours were prepared by blending different proportions of sound and sprouted wheats as given in Table 1.

Table 1: Blending of sound and sprouted wheat flours.

Treatment	Sprouted wheat flour (%)	Sound wheat flour (%)
T1	0	100
T2	5	95
T3	10	90
T4	15	85
T5	20	80
T6	25	75

Rheological studies (farinographic and amylographic) were carried according to the methods given in AACC (1983). Baking tests were performed to determine baking behaviour. Dough was prepared by straight dough method (AACC, 1983). Yeast suspension was prepared by dispersing 12g active dry yeast in water and diluting to 100 mL. Salt sugar solution was made by dissolving 4g salt and 20g sugar in water and raising its volume to 100 mL. Following recipe was used:

Flour	100 g
Yeast suspension	25 mL
Salt sugar solution	25 mL
Water	Desirable to make dough of proper consistency as determined with farinograph.

Pan bread was prepared using the normal procedures. Each bread sample was characterized for its volume, weight and weight to volume ratio. Loaf volume was determined by rape-seed displacement method.

Sensory analysis was performed for external and internal characteristics of bread by a panel of 5 judges (Rehman *et al.*, 1988) for storing up to 36 hours. Data were analysed statistically by using the analysis of variance technique and Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Proximate composition

The data obtained for proximate analyses of grain and flours is given in Table 2. Sound wheat was found to contain moisture 8.29%, crude protein 12.77%, crude fat 2.18%, crude fibre 2.36%, ash 1.97% and nitrogen free extract 80.72%. These results are with in the range as reported earlier by Sajid (1984) and Ahmad (1990).

Protein content of sprouted wheat flour increased appreciably from 11.57% in sound wheat to 12.17% in sprouted wheat. This is attributed to biochemical changes during sprouting (Leelavathi and Haridas Rao, 1988). Increase in crude fibre and ash contents is similar to the results reported by Ranhotra et al. (1977). Crude fat content of sprouted wheat flour decreased slightly which is in close agreement with Lukow et al. (1985). Nitrogen free extract also decreased. These results are similar to the findings of Linda and Barry (1976).

Table 2: Proximate composition of wheat and flours

Component	Wheat %	Sound wheat flour %	Sprouted wheat flour %
Moisture	8.29	12.45	12.93
Crude protein (db)	12.77	11.57	12.17
Crude fat (db)	2.18	0.78	0.74
Crude fibre (db)	2.36	0.57	0.93
Total ash (db)	1.97	0.50	0,67
Nitrogen free (db) extract (NFE)	80.72	86.58	85.49

db: dry basis

Rheological Characteristics

The data revealed that water absorption, dough development time, dough stability, resistance of the dough and peak viscosity decreased, while softening increased with an increase in the levels of sprouted wheat flour in the composite flour (Table 3). The gradual decrease in peak viscosity at varying levels of sprouted wheat flours was proportionate to the level of blending. This is indicative of improvement in amylase activity in the composite flours. Leelavathi and Haridas Rao (1988) observed that the diastatic activity increases during germination. The resistance of the dough decreases due to damage in gluten quality (Kulp *et al.*, 1983). Pyler (1973) noted that too high a curve which corresponds to high viscosity of the gelatinized flour suspension gives a crumb in the finished loaf that will dry and stale rapidly. Too low a curve, which results from an excessive α-amylase activity, is normally indicative of most soggy crumb. The best type of crumb is obtained when the curve is of medium height. Breads prepared under these studies showed optimum curve height (360 to 300 BU) with 10 and 15% sprouted wheat flours.

Baking behaviour

In this study fermentation, proofing and baking conditions were kept constant. In general, it was observed that rate of fermentation was rapid in doughs

blended with sprouted wheat flour than control (T1). Doughs with uniform and smooth surface were observed in case of composite flours. It was noted that the loaf volume was maximum for breads prepared from composite flours (Table 4). Volume and weight to volume ratio of the breads increased with increase in levels of sprouted wheat flour from 455 mL (T1) to 550 mL (T6). Similar observations have been reported by Ranhotra *et al.* (1977).

Sensory Evaluation

Sensory evaluation of the bread samples prepared from sound wheat and composite flours (Table 5) revealed that T4 containing 15% sprouted wheat flour scored highest (84.63%) followed by T3 (77.67%). Bread prepared from sound wheat scored lowest (46.16%). Similar results were recorded by Leelavathi and Haridas Rao (1988).

The results of analyses of variance revealed that there are significant differences ($P<0.05$) among storage means and also among treatment means (Table 5). For all the bread characteristics, bread prepared with 15% sprouted wheat flour (T4) scored highest.

Conclusion

From the results it may be concluded that bread containing 15% sprouted wheat flour has larger volume, good crumb, better texture, better taste, aroma and golden brown appearance.

Table 3: Effect of blending sprouted wheat flour on rheological characteristics of flour.

Characteristics	T1	T2	T3	T4	T5	T6
Water absorption (%)	59.0	58.8	58.4	58.2	58.0	57.8
Dough development time (min)	3.5	3.0	3.0	3.0	3.0	2.5
Dough stability (min)	18.5	16.0	11.0	10.5	9.5	6.0
Resistance of the dough (min)	20.0	18.0	13.0	11.5	11.0	7.5
Softening of the dough (BU)	30.0	35.0	60.0	70.0	80.0	100.0
Peak Viscosity (BU)	760.0	540.0	360.0	300.0	120.0	60.0

BU: Brabender Unit min: Minutes

Table 4: Effect of blending on the volume, weight and weight to volume ratio of bread.

Treatment	Volume (mL)	Weight (g)	Weight to volume ratio
T1	455	140.4	1 : 3.24
T2	460	141.4	1 : 3.25
T3	475	139.8	1 : 3.39
T4	500	138.6	1 : 3.60
T5	520	136.8	1 : 3.80
T6	550	139.0	1 : 3.95

Table 5: Analyses of variance showing effect of blending on sensory characteristics of bread.

Characteristics	T1	T2	T3	T4	T5	T6
Volume	4.57f	4.99e	8.36b	9.10a	5.80c	5.40d
Crust colour	3.57e	6.43a	6.34a	5.98b	5.11c	4.12d
Symmetry of form	2.43f	3.26e	3.91b	4.13a	3.71c	3.43d
Evenness of bake	1.12f	1.37e	2.19b	2.43a	1.98c	1.61d
Characteristics of crust	1.50e	1.62e	3.10a	2.54b	2.17c	1.88d
Grain of bread	11.87f	12.18e	13.20b	13.44a	13.00c	12.50d
Crumb colour	4.60f	4.97e	8.52b	9.11a	5.80c	5.45d
Aroma	4.60f	5.00e	8.35b	9.10a	5.80c	5.40d
Taste	6.30f	7.10e	14.00b	17.90a	10.50c	8.00d
Texture	5.60e	5.86e	9.70b	10.90a	7.2c	6.25d

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