Incorporation of Barely Flour of Bundelkhand Region in Bread

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Abstract - Blending of barley flour at levels of 5, 10, 15 and 20 percent with white flour was studied for its effect on bread making qualities. The protein, fat, ash, crude fibre, phosphorus and iron contents increased in the blends. The sedimentation value, polenshke value, wet and dry gluten percent decreased marginally at higher levels of blending. The incorporation of barley flour with white flour increased water absorption capacity significantly (P<0.05) . The bread prepared from the blends also varied in their loaf weight, loaf volume and compression force (TPA). The bread volume decreased with increasing amount of barley flour and loaf weight was increased by incorporation of barley flour (5-20 percent). These blends were found organoleptically (crust colour, crumb colour, texture, taste, flavour, over all acceptability) acceptable upto 15 percent level of supplementation. At the higher levels, the acceptability of bread declined. On the basis of sensory score upto 15 percent of barley flour observed non-significant variation after that a significant (P<0.05) decrease in variation was found. During storage the moisture content was decreased . on the basis of storage studies, it was found that the barley flour incorporated bread may stored for 3 days at room temperature (35-37ºC) and 5 days at refrigeration temperature (4 ºC)

Index Terms: Barley flour, Loaf weight, Loaf volume, Barley bread.

1. INTRODUCTION

Bread and other wheat containing baked products are widely accepted and consumed throughout the world. Bread is an important staple food (Edema MO et al., 2005). Barley (*Hordeum vulgare L)* is one of the founder crops of old world agriculture. Barley is grown as a commercial crop in some one hundred countries world-wide and is one of the most important cereal crops in the world (The Agricultural Economics Research Institute 1986). Food produced from barley is a good source of protein, fiber minerals and B-vitamins. The nutritive value of barley is, generally, similar to that of main cereals staple foods. Barley is unique among cereals because of its higher concentration of soluble dietary fibre, particularly mixed linked 1-3, 1-4 β- D glucans, this material has been studied in connection with its hypocholesterolemic effects in animals and humans. (Bhatty,1986; Hecker et al., 1998; Riaz 1999; Kalar & Jood, 2004). Although, bread is traditionally made from wheat flour, other cereals such as rye, barley, sorghum, maize etc have been used, either alone or in combination with wheat flour, for bread making in various parts of the world. Several studies have indicated the possibility of incorporating hull-less barley (Bhatty, 1986) in wheat flour at various levels and the rheological and baking properties have been reported. Bread, on the other hand, is usually considered higher glycemic response foods. Fibre in breads has either no or variable effects on glycemic response by forming a physical barrier to enzymatic hydrolysis of starch. Barley has an important role as a feed grain in most western countries. In finland barley constituent 50 % of all cultivated cereals. Approximately 81 % of annual barley production is used for feed, 9% for seed, 8 % for malt and alcohol production, and only 2% for human consumption (The Agricultural economics Research Institute 1986). The work on the above is very scanty. Therefore, the present investigation to incorporation of barley flour with white flour in bread making undertaken to utilized barley flour.

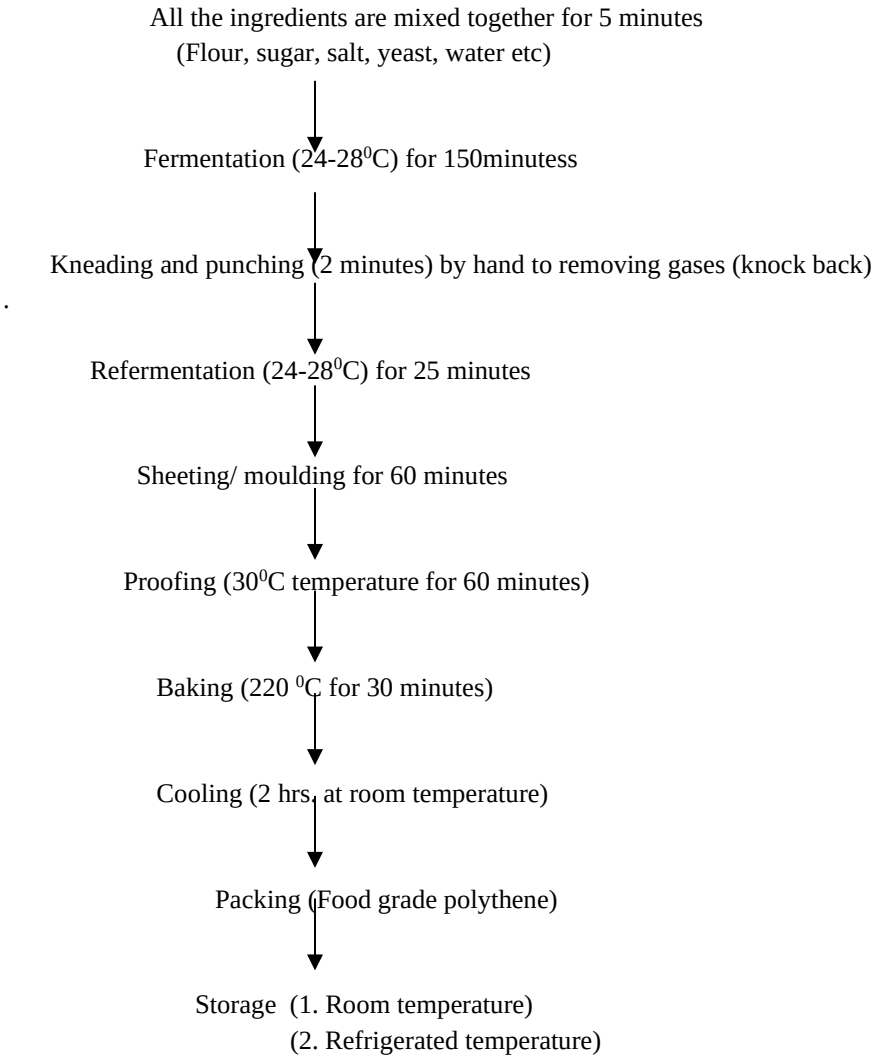
2. MATERIALS AND METHODS

Materials: White flour and barley flour were collected from the local market of Jhansi (U.P) India.

Blend formation: Blends were prepared by mixing barley flour with white flour in the proportions of 100:0, 95:5, 90:10, 85:15 and 80:20, respectively.

Preparation of breads- The breads (control and blends) were prepared using straight dough method of AACC (1984). The flow diagram of bread making is as follows.

Flow chart-



Physico- chemical characteristics of blends and bread: The protein content of flour was determined by Kjeldahl method AOAC (1984), using a nitrogen to protein conversion factor of 5.71 for wheat and 6.25 for soybean flour. Moisture, fat, ash and crude fibre in the sample were estimated according to AACC (1976) methods. Phosphours and iron were determined by colorimetric method as described by Ranganna (1986), while calcium was determined by AACC (1976) method, after precipitating Gluten content of plain and blended flour was determined according to the methods of AACC (1984). Sedimentation value of plain and blended flours was determined according AACC (1969). Water absorption capacity was assessed by following the method of Abbound et al., (1985).

Loaf weight and loaf volume: Breads from control and supplemented flours were baked in three replications.

After removing from the oven, loaves were immediately weighed and then placed on a wire grid for about 2 h. before volumes were determined. Loaf volumes were measured by rapeseed displacement method. Specific loaf volumes were calculated by dividing the loaf volume by loaf weight and the results were expressed as ml/g. A compression plate (P 75, 75 mm diameter) was used in conjunction with a texture analyzer (Bourne 1982).

Sensory characteristics: The Organoleptic characteristics of bread such as crust colour, crumb colour, texture, taste flavour and over all acceptability were evaluated by an untrained panel of ten judges on a nine-point hedonic scale. Hedonic ranges from like extremely (9) to dislike extremely (1) for each organoleptic characteristic as suggested by Ranganna (2003).

Statistical analysis: The data were statistically analyzed for analysis of variance (ANOVA) and to determine the critical difference (CD) according to the method of Snedecor & Cochran (1967).

3. RESULT AND DISSCUSSION

The present investigation was carried out to study the effect of incorporation of barley flour in bread. White flour was incorporated with different proportions (95:5, 90:10, 85:15 and 80:20) of barley flour to produce bread are presented. Incorporation of barley flour in white flour to prepare bread was optimized. The effects of blending of barley flour with white flour on functional, physical, chemical and sensory characteristics of bread were studied. The sample of white flour and barley flour were analyzed for chemical composition i.e. for the estimation of protein, fat, ash, crude fiber, carbohydrate, calcium, phosphorus and iron content. The storage studies of barley flour incorporated bread were at room temperature and refrigerated temperature.

Chemical composition of raw material- The chemical composition of white flour and barley flour is presented in Table 1. The white flour and barley contained 10.27 and 10.89 percent moisture, 10.14 and 10.40% protein , 0.68 and 1.42 % fat and 0.58 , 1.12 percent ash ,respectively. The white flour and barley flour showed 0.29 and 3.65% crude fiber, 78.04 and 72.52 percent carbohydrate, respectively. The white flour and barely contained 2.16 and 2.27 ppm pigment, 30.0 and 26.30 mg/100g calcium, 138.9 and 290 mh/100g phosphorus and 2.48and 2.40 mg/100g iron, respectively. The white flour contained30.20 and 9.36 percent wet gluten and dry gluten, respectively.

TABLE 1. PHYSICO-CHEMICAL COMPOSITION OF RAW MATERIALS-

Constituent	White flour	Barley flour
Moisture (%)	10.27	10.89
Protein (%)	10.14	10.40
Fat (%)	0.68	1.42
Ash (%)	0.58	1.12
Crude Fiber (%)	0.29	3.65
Carbohydrate (by difference)	78.04	72.52
Pigments (ppm)	2.16	2.27
Gluten (%) wet	30.20	-
Gluten (%) dry	9.36	-
Calcium (mg/100g)	30.0	26.30
Phosphorus (mg/100g)	138.0	290.0
Iron (mg/100g)	2.48	2.40

*values are average of three determinations

EFFECTS OF BLENDING ON FUNCTIONAL CHARACTERISTISCS OF FLOUR AND BLENDS

The functional characteristics like sedimentation value, pelensh ke value, water absorption, wet gluten, dry gluten and wet/dry gluten ratio of barley flour blends are presented in Table2. The sedimentation value, pelensh ke value and water absorption capacity of white flour were 30.25 ml, 126 minutes and 62.20 percent, respectively. The incorporation of barley flour in white flour decrease sedimentation value and peleshen ke value and the decrease was significant ($P \leq 0.05$). The incorporation of barley flour also increased water absorption capacity significantly ($P \leq 0.05$). Dhingra and jood (2006) reported similar

trend in increase in the value of water absorption capacity for control white flour (70.0 percent) and (71.80) The inclusion of barley flour (5-20 %) in white flour decreased the wet gluten and dry gluten significantly (P≤0.05). the incorporation of barley flour with white flour increased the wet/ dry ratio of gluten but the increase was significant (P≤0.05) after 15 percent incorporation of barley flour. Jood et al (2004) reported similar trend of decrease in wet gluten from 28.33 to 22.57 percent by inclusion of barley flour (5 to 20 percent) in white flour.

TABLE 2. EFFECTS OF BLENDING ON FUNCTIONAL CHARACTERISTISCS OF FLOUR AND BLENDS

WF:BF	Sedimentation value (ml)	Polensh ke value(minuts)	Water absorption (%)	Wet gluten (gm/100g)	Dry gluten (gm/100g)	Wet/Dry ratio
100:00	30.25	126.00	60.20	30.20	9.36	3.226
95:05	29.90	122.00	62.45	29.00	8.93	3.247
90:10	29.50	117.00	64.73	27.78	8.48	3.275
85:15	28.80	112.00	67.02	26.59	7.97	3.336
80:20	28.11	107.00	69.30	25.40	7.46	3.404
00:100	26.78	102.00	71.08	-	-	-
Mean	28.89	114.30	65.79	27.79	8.44	3.297
CD at 5% Level	0.270	1.99	1.35	0.33	0.19	0.112

*values are average of three determinations

EFFECT OF INCORPORATION OF BARLEY FLOUR ON THE PHYSICAL CHARACTERISTICS OF BREAD

The results of the effect of barley flour incorporated n physical characteristics of breads are presented in Table 3. The incorporation of barley flour (5 to 20 percent) in white flour showed a significant (P≤0.05) increase in loaf weight and compression force (Texture Profile Analysis) and a significant (P≤0.05) decrease in loaf volume, specific loaf volume, slice height and loaf height.

TABLE 3. EFFECT OF INCORPORATION OF BARLEY FLOUR ON THE PHYSICAL CHARACTERISTICS OF BREAD

Proportion of BF (%)	loaf weight (gm)	Loaf volume (ml)	Specific loaf volume (mlg^{-1})	Slice height (cm)	loaf height (cm)	Compression force (TPA) in kg
0	160.20	515.00	3.21	6.93	7.23	2.455
5	161.70	510.20	3.15	6.69	6.83	3.265
10	163.78	504.23	3.07	6.42	6.46	3.983
15	165.88	498.00	3.00	6.18	6.20	4.478
20	167.40	494.55	2.95	5.80	5.91	6.212
Mean	163.79	504.39	3.08	6.40	6.53	4.078
CD(P≤0.05)	1.25	3.47	0.03	0.14	0.21	0.650

*values are average of three determinations

CHEMICAL COMPOSITION OF WHITE FLOUR AND BARLEY FLOUR INCORPORATED BREAD

The results of chemical composition (moisture, protein, fat ash crude fiber, carbohydrate, calcium, phosphorus and iron) of white bread and barley flour incorporated bread presented in Table 4. The barley flour incorporated bread (0 to 20 percent) showed a significant (P≤0.05) increase in moisture, protein, fat, crude fiber and phosphorus content and a significant (P≤0.05) decrease in calcium and carbohydrate content in bread. The barley incorporated bread (5to 20%) showed a significant (P≤0.05) increase in ash content after 5 percent level and a significant (P≤0.05) decrease in iron content after 5 percent level. Dhingra and Jood (2006) also reported similar increasing trend in protein, fat, crude fiber, calcium, phosphorus content of bread included with 5 to 20 percent barley flour.

TABLE 4. CHEMICAL COMPOSITION OF WHITE FLOUR AND BARLEY FLOUR INCORPORATED BREAD

Proportion of BF (%)	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Crude Fiber (%)	Carbohydrate	Calcium mg/100g	Phosphorus mg/100g	Iron (mg/ 100g)
100:00	30.6	9.64	0.69	0.58	0.28	58.21	30.10	137	2.48
95:05	31.82	9.56	0.74	0.61	0.33	56.94	29.79	143	2.47
90:10	33.02	9.30	0.79	0.64	0.37	55.88	28.39	149	2.46
85:15	34.11	9.04	0.85	0.67	0.42	54.91	26.95	156	2.45

80:20	35.2	8.80	0.92	0.70	0.47	53.91	25.35	163	2.44
Mean	32.95	9.27	0.79	0.64	0.37	55.97	28.11	149	2.46
CD(P≤0.05)	0.43	0.06	0.03	0.03	0.04	0.73	0.30	2.22	0.01

*values are average of three determinations

EFFECT OF BLENDING OF BARLEY FLOUR ON THE SENSORY CHARACTERISTICS OF BREAD

The barley flour incorporated breads were evaluated for their sensory characteristics using a taste panel consisting of ten untrained members of institute of Food Technology. A-9 point hedonic scale was used for the sensory evaluation of bread and results were analyzed, using analysis of variance (ANOVA). The mean sensory scores for crust colour crumb colour, texture, taste, flavour and over all acceptability of bread made from blending of barley flour in white flour are presented in Table 4. On the basis of sensory evaluation, the bread upto 15 percent level of barley flour was in acceptable range and the variation upto 15 percent was significant, thereafter the decrease in all parameters (crust colour crumb colour, texture, taste, flavour and over all acceptability).

TABLE 5. EFFECT OF BLENDING OF BARLEY FLOUR ON THE ORGANOLEPTICS OF BREAD

Proportion of BF (%)	Crust colour	Crumb colour	Texture	Taste	Flavour	OAA
0	8.19	8.09	8.14	8.11	8.12	8.18
5	8.10	8	8.05	8.06	8.15	8.06
10	8	7.92	7.87	7.95	8	7.89
15	7.91	7.79	7.7	7.53	7.75	7.77
20	6.2	5.59	5.7	5.95	5.84	5.9
Mean	7.68	7.47	7.49	7.52	7.57	7.56
CD(P≤0.05)	0.32	0.31	0.46	0.62	0.48	0.42

*values are average of ten determinations

Storage Studies:

At Ambient temperature: the result of the effect of storage time at room temperature (35-37^{o}C) on sensory parameters like curst colour, crumb colour, texture, taste, flavour and over all acceptability were evaluated at an interval o 1 day for one week of barley incorporated bread is presented in Table 6. The results indicated that the variation in all parameter was non-significant upto 3 days. Thereafter a significant (P≤0.05) variation was observed. The mean sensory score for all parameters was acceptable range upto 7 days of storage. Sharme et al (1999) also reported similar decrease in organoleptical parameters when storage at 37^{o}C temperature.

TABLE 6. SENSORY SCORE OF BARLEY FLOUR OPTIMIZED BREAD AT AMBIENT TEMPERATURE (35-37^{O}C)

Storage Period	Crust colour	Crumb colour	Texture	Taste	Flavour	OAA
0	8.18	7.82	7.60	8.11	7.94	8.01
1	8.13	7.82	7.50	8.1	7.88	7.96
2	8.11	7.77	7.45	8.03	7.84	7.9
3	8.07	7.69	7.24	7.99	7.78	7.87
4	7.9	7.61	7.15	7.86	7.74	7.82
5	7.63	7.5	7	7.75	7.6	7.63
6	7.34	7.43	6.9	7.62	7.5	7.42
7	6	7.11	6.5	6.8	7.2	7.16
Mean	7.67	7.59	7.16	7.78	7.68	7.72
CD(P≤0.05)	0.12	0.13	0.15	0.12	0.17	0.14

*values are average of ten determinations

At refrigeration temperature- the result of the effect of storage time at refrigeration temperature (4^{o}C) on sensory parameters such as curst colour, crumb colour, texture, taste, flavour and over all acceptability were evaluated at an interval of 1 day for one week of barley included bread are presented in Table 7. From the results presented in Table 7 showed a decrease in mean sensory score for all parameters of bread on increasing

the storage periods at refrigerated temperature. The decrease upto 5 days was non –significant, thereafter a significant decrease was observed. The all sensory parameters were in acceptable range upto 7 days of storage. Sharma et al (1999) also reported similar decreasing trend for organoleptically acceptability with increase in storage period at refrigeration temperature.

TABLE 7. SENSORY SCORE OF BARLEY FLOUR OPTIMIZED BREAD AT REFRIGERATION TEMPERATURE ($4^{O}C$)

Storage Period	Crust colour	Crumb colour	Texture	Taste	Flavour	OAA
0	8.2	7.85	7.8	8.03	7.9	7.96
1	8.17	7.83	7.65	8.01	7.9	7.9
2	8.12	7.78	7.6	8	7.86	7.88
3	8.1	7.75	7.35	7.96	7.84	7.8
4	8.1	7.72	7.12	7.9	7.81	7.86
5	8.07	7.69	7.0	7.88	7.74	7.82
6	7.61	7.19	6.89	7.6	7.6	7.76
7	7.1	7	6.71	7.2	7.4	7.46
Mean	7.9	7.6	7.26	7.8	7.75	7.8
CD(P≤0.05)	0.13	0.16	0.18	0.15	0.16	0.14

*values are average of ten determinations

4. CONCLUSION

From the results of present investigation it may concluded that barley flour may be incorporate with white flour upto 15 percent to prepare nutritionally rich bread at it enhanced the level of protein, fat, ash, crude fiber, phosphorus content and decrease the level of carbohydrate, calcium and iron in the bread. The crust colours, crumb colour, texture, taste, flavour and over all acceptability of barley flour incorporated bread upto 15 percent were in acceptable range. On the basis of the storage studies, it was found that the barley flour incorporated bread may store for 3 days at room temperature (35-37^{o}C) and 5 days at refrigeration temperature (4^{o}C).

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