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Effect of Supplementation of Detoxified Matri Flour with Wheat Flour on the Quality of Pan Bread

Salman Ahmad Lodhi, Salim-ur-Rehman* and Nuzhat Huma

Department of Food and Technology, University of Agriculture, Faisalabad, Pakistan

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Breads were prepared from wheat flour supplemented with 5, 10, 15, 20 and 25% of detoxified matri flour and evaluated for sensory acceptability, i.e. bread taste, aroma, texture, crumb colour, grain, loaf volume, crust colour, symmetry of form, character of crust and evenness of bake. Brabender farinograph, mixograph and viscoamylograph characteristics of flour were also studied. Farinograph water absorption, arrival time and dough development time increased and dough stability decreased and amylograph peak viscosities, mixograph peak height and mixing time decreased as level of supplementation with matri flour increased. The quantities of crude protein, crude fibre, crude fat and ash increased with the increase of matri flour in wheat flour. Increasing levels of legume substitution decreased many sensory parameters of wheat bread. Results indicate that detoxified matri flour can successfully be substituted for wheat flour in breads at levels up to 10% . Legume substitution tended to increase the protein level in the finished product.

Key words: Bread, Detoxified matri flour, Wheat flour.

Introduction

Baked products are consumed worldwide. Therefore, fortification with high protein legume flours provides a good opportunity to improve the nutritional quality of protein consumed by many people (Hoover 1979). Wheat flour supplementation with legumes has been studied by several researchers. Legumes are recognized as a rich source of protein, vitamins and minerals (Khan and Chughtai 1958).

Bread and biscuits have been prepared with wheat flour containing chickpea (*Cicer arietinum*) flour. Rheological properties of dough and sensory characteristics of baked goods have also been investigated. The addition upto 10% chickpea flour allows the preparation of a spongy bread of good quality even with out the use of improving agent. (Figuerola *et al* 1987). Bread was made from a soft wheat flour partially substituted with cassava flour. 10-20% substitution gave better results regarding bread making quality (Eggleston *et al* 1993).

Diwan (1982) incorporated green gram and black gram flours in the preparation of biscuits. He observed good organoleptic qualities and increased protein content by 1.5%.

Matri contains as high as 28.8% protein on dry matter basis. It contains a toxin, neurotoxin *beta-N-oxalyl-L-alpha-beta-diaminopropionic acid (DDAP) also known as bet-N-oxalyl-amino-L-alanine* (BOAA) which causes a disease called lathyrism, a paralysis of the lower limbs in both men and animals (Malik *et al* 1967). Several studies have demonstrated that the amount of legume flour needed to produce the desired level of protein fortification results in difficult handling and manipulation of the dough, decreased loaf volume, and delecterious changes in crumb grain and texture (D' Appolonia 1977; Deshpande *et al* 1983). The purpose of this study was to determine the effects of substituting five different levels (5, 10, 15, 20 and 25%) of detoxified matri flour for wheat flour in order to get the most appropriate level of substitution in pan bread.

*Author for correspondence

Materials and Methods

Wheat line 6500 was procured from the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. Cleaned and tempered wheat milled in the Quadrumate Senior Experimental Mill. Break and reduction flours were mixed to obtain straight grade flour.

Matri *(Lathyrus sativus)* was purchased from the local market. It was cleaned and detoxified by steeping double quantity of water for 8 hrs at 60-70°C. Water was changed for 7 times, drained and matri was sun dried (Shahid 1977). This method decreased the toxin to the extent of 93.05%. The soaked dried matri was milled in the Quadrumate Senior Experimental Mill. Break and reduction flours were mixed to get flour of 70% extraction rate (removal of bran portion further reduced the toxin) for further use. Composite flours were prepared containing 5, 10, 15, 20 and 25% of matri flour with wheat flour.

Farinograph, mixograms and amylograms were obtained according to AACC methods 54-21, 54-40A and 22-10 respectively (AACC, 2000).

Table 1
Proximate composition of composite flours

Samples	Moisture (%)	Crude protein (%)	Crude fibre (%)	Crude fat (%)	Ash (%)	NFE (%)
Wheat flour	12.58	12.54	1.18	1.41	0.52	71.75
5% matri flour	12.30	13.88	1.25	1.42	0.62	70.67
10% matri flour	12.23	14.60	1.31	1.45	0.70	69.91
15% matri flour	12.20	15.31	1.35	1.48	0.76	69.15
20% matri flour	12.11	16.24	1.42	1.50	0.85	68.22
25% matri flour	11.85	16.94	1.49	1.55	0.97	67.62

Table 2
Farinographic characteristics of flour of wheat line 6500 and composite flours

Samples	WA (%)	AT (min)	DD (min)	RD (min)	DS (min)	SD (B.U.)
Wheat flour	62.20	1.80	2.30	16.60	14.70	25
5% matri flour	62.40	1.80	2.80	14.00	12.20	30
10% matri flour	62.60	1.80	3.00	12.30	10.50	35
15% matri flour	62.80	1.90	5.30	11.80	9.90	40
20% matri flour	63.00	5.40	7.60	14.60	9.20	55
25% matri flour	63.20	5.20	8.10	11.50	6.50	75

WA; Water absorption, AT; Arrival time, DD; Dough development, RD; Resistance to dough, DS; Dough stability, SD; Softening of dough, Min; Minutes, B.U.; Brabender units; NFE, Nitrogen free extract.

Straight grade wheat flour, matri flour and composite flours were chemically analysed for moisture, ash, crude protein, crude fat and crude fibre in accordance with standard methods of AACC (2000). Wheat flour was also analysed for wet and dry gluten content according to the method described in AACC (2000). The sensory properties of breads were measured using 9 points hedonic rating scale (Land and Shapherd 1988) by a panel of judges.

The data collected was subjected to statistical analysis by using the Analysis of Variance Technique and means were compared for their significance according to the methods of Duncun's Multiple Range Test (Steel and Torrie 1980).

Results and Discussion

Analytical data. Table 1 shows the proximate composition of straight grade of wheat flour and composite flours.

The crude protein, crude fibre, crude fat and ash increased ranging from 13.88 to 16.94, 1.25 to 1.49, 1.42 to 1.55 and 0.62 to 0.97%, respectively and the moisture and nitrogen free extract decreased ranging from 11.85 to 12.30 and 67.62 to 70.67% respectively, as the level of substitution of matri flour in wheat flour increased.

Table 3
Amylographic characteristics of flour of wheat line 6500 and composite flours

Flour samples		Peak viscosities (B.U.)
Control	(TO)	2940
5%	(T1)	2850
10%	(T2)	2700
15%	(T3)	2575
20%	(T4)	2540
25%	(T5)	2520

Table 4
Mixographic characteristics of flour of wheat line 6500 and composite flours

Flour samples		Dough development time (min) (mixing time)	Peak hight (%)
Control	(TO)	6.40	60
5%	(T1)	6.20	55
10%	(T2)	5.80	50
15%	(T3)	5.60	50
20%	(T4)	5.40	49
25%	(T5)	5.10	47

Table 5
Comparison of means of sensory characteristics of bread prepared from composite flours

Characteristics and score	TO	T1	T2	T3	T4	T5
Volume (10)	9.16a	8.38b	8.33b	7.33c	6.50d	6.16e
Crust colour (8)	6.77a	6.38b	6.66ab	5.60c	5.22d	4.94d
Symmetry of form (5)	4.33a	4.00b	4.16ab	3.15c	2.48d	2.50d
Evenness of bake (3)	2.83a	2.71ab	2.66ab	2.50c	2.16c	2.16c
Character of crust (4)	3.05a	2.71ab	2.88bc	2.44bc	2.21de	2.10e
Grain (15)	13.0a	11.77a	12.99b	11.33c	9.60d	8.72e
Colour of crumb (10)	8.66a	8.21ab	8.44b	7.55c	6.38d	5.94c
Taste (20)	17.38	15.10a	17.49b	14.33c	12.33d	11.16e
Texture (15)	12.83a	11.00a	12.16ab	9.83b	8.82c	7.60d
Aroma (10)	8.05a	7.66ab	8.44b	7.44b	6.33c	5.83c

Measns sharing the same letters are not significantly different. TO; 0% matri flour; T1, 5% matri flour; T2, 10% matri flour; T3, 15% matri flour; T4, 20% matri flour; T5, 25% matri flour.

Wheat sample contained 32.73% wet gluten and 12.06% dry gluten.

Physical dough testing. Table 2 shows the farinograph data of the control wheat flour and composite flours.

The water absorption, arrival time and dough development time increased 62.20 to 63.20%, 1.80 to 5.40 min and 2.30 to 8.10 min.respectively whereas resistance to dough stability decreased from 16.60 to 11.50 min as the level of matri flour increased in composite flours.

Table 3 shows the amylograph data of the control and composite flours. The peak viscosities decreased as the level of matri flour increased in composite flours.

The mixographic characteristics are shown in Table 4. The mixing time and peak height decreased as the level of matri flour increased in composite flours.

Bread characteristics. The data regrading sensory characteristics of bread is presented in Table 5.

The volume of bread baked from matri flour-wheat flour blends decreased as the level of matri flour increased (9.16 to 6.16) and the bread became more dense and soggy. The crust became duller and lost its appealing brown colour as the matri flour level reached up to 15%. Similarly, the crispness of the crust was also affected at matri flour levels above 10%. The quality of evenness of bake and grain decreased as the level of matri flour increased. The colour crumb decreased as the level of matri flour reached up to 15% or above in composite flours. Beany flavour observed with the increasing level of legume flour in bread but 10% composite flour bread showed highest score. Among the composite flour breads 10% of matri flour got the highest score regarding texture of bread. The bread prepared from composite flours containing more than 10% of matri flour did not get higher score for sensory characteristics. The results of this study indicate that detoxified matri (*Lathyrus sativus*) flour could be successfully substituted for wheat flour in pan breads at levels upto 10%. Flour combinations above this level result in bread with poor properties. Wheat-matri flour breads may become an acceptable product to help alleviate deficiency in developing nations.

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