

Effect of Oilseed Flour Addition on the Chemical Characteristics of Wheat Chapati

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ABSTRACT

Chapatties prepared with whole-wheat flour and with 10 and 20% substitution with cotton seed, mustard and sunflower seed flours were evaluated for chemical characteristics and protein contents. It was observed that the chemical composition of chapattis prepared from whole wheat and enriched flours did not differ significantly for moisture, crude protein and crude fat contents while differed significantly for ash content of the chapatties for the crop years and wheat flour interactions for the years 2001-02. The composition of chapatties were also found to be non-significantly different for crop years with wheat flours and oilseed flour combinations whereas oilseed flour combinations differed significantly with one another with respect to enriched chapati composition. The mean values of moisture, crude protein, crude fat, ash and total carbohydrate ranged from 32.32 to 36.73%, 7.62 to 15.75%, 0.95 to 1.46% and 1.60 to 2.48% respectively for chapatties prepared from whole wheat and enriched flours.

Key Words: Oilseed flours; Oilseed; Chapatti; Chemical characteristics

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the important cereal grains because of its use for the preparation of many baked products. Chapatti, the major wheat based food product, is one of the important staple foods in the Subcontinent. Unfortunately, lysine is the first limiting amino acid in wheat flour. Tryptophan, threonine and methionine are also low in wheat when compared to the FAO standards (FAO/WHO, 1973). The deficiencies of essential amino acids lead to poor utilization of proteins and thus contribute to the prevalence of malnutrition. Protein deficiency also results in predisposition to parasitic and infectious diseases and general ill-health. The specific maladies such as Kwashiorkor and Marasmus are more prevalent due to protein deficiency. In adults, apart from direct ill-health, protein deficiency results in reduced capacity for physical work. The wheat products deficient in lysine further aggravate the situation due to its losses during baking. The lysine is destroyed more than 10% during baking (Saab *et al.*, 1981).

The scientists have made various attempts to improve protein content and quality of wheat flour through different means. They have carried out studies on the preparation of the composite flours comprising wheat supplemented with protein rich materials of different products of oilseeds e.g. soybean, peanut, sunflower and cottonseed. Oilseed flours significantly improve the quality of wheat flour because of its high contents of protein and essential amino acids especially lysine. This situation demands to explore the possibility of improving the wheat based foods such as chapatties breads, noodles and crackers with protein sources such as fish flour, oilseed flour, soya, yeast or synthetically

produced lysine. This approach seems to be more feasible and exhibits advantages of substantial enhancement in the protein content and at the same time it helps correcting the amino acid balance deficiencies.

Proteins from oilseeds may help in solving protein deficiency problems to combat the malnutrition prevalence in Pakistan. The use of oilseed flours for preparation of indigenous products such as chapati has not been carried out extensively. Thus there was a need to explore the possibility of using oilseed protein enriched wheat flour for the production of nutritious chapati without sacrificing its functional and sensory characteristics. Therefore, the present study was undertaken to find out the suitable proportion of oilseed flours into wheat flour for the production of oilseed protein enriched chapatties and also to find out acceptability of chapatties prepared from oilseed enriched wheat flours.

MATERIALS AND METHODS

The proposed study was carried out on the supplementation of wheat flour with different oilseed flours for producing high protein, nutritious and acceptable chapati. The following raw materials were used.

Wheat varieties (Faisalabad, 85 & Chakwal, 86) were procured from the Wheat Research Institute, Ayub Agricultural Research Institute, Faisalabad. Flours were prepared by grinding the two wheat varieties through Udy cyclone mills and sieving through 20 mesh sieve. Flours (12% moisture) were packed in separate air tight containers and stored at room temperature until utilized. Oilseed flours were prepared from two varieties each of cottonseed, mustard and sunflower seeds (CIM, 240; NIAB, 78; Peela Raya, Raya Anmol, Hysun, 33 & Suncom, 110).

The oilseeds were procured from oilseed section, Ayub Agricultural Research Institute, Faisalabad for the crop years 2001-02 and processed in such a way to get defatted, detoxified and low fibre oilseed flours. The oilseed flours were blended with 10 and 20% levels with whole-wheat flours for chapatti preparation.

Whole wheat and oilseed enriched chapatties were analyzed for moisture, crude protein, crude fat, crude fiber and ash contents by the methods of A.O.A.C. (1984). The data thus collected were subjected to statistical analysis employing completely, randomized design (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

The statistical analysis revealed that moisture content of chapati was not affected significantly by the crop years as well as wheat flours. The interaction of crop years, wheat flours and oilseed flour combinations was also found to be non-significantly different with one another. It is obvious from the results that the moisture content of chapatties among oilseed flour combinations differed significantly. The average moisture content of chapatties prepared from different oilseed enriched wheat flours is shown in Table I. The data showed that the moisture content in chapatties was found to be significantly the highest in wheat flours enriched with 20% of Peela Raya, Hysun, 33 and Suncom, 110. The wheat flours enriched with 10 and 20% CIM 240 and 10 and 20% NIAB 78 were found to be statistically at par with respect to moisture content. The moisture content between chapatties prepared from un-enriched wheat flours and 10% Suncom, 110 did not show significant variation. The lowest moisture was obtained in the chapatties prepared from wheat flour enriched with 10 and 20% CIM 240 and 10 and 20% NIAB 78 followed by chapatties prepared from wheat flour enriched with 10% Peela Raya and then 10% Raya Anmol and 10% Hysun 33. The chapatties from wheat flour enriched with 10% Raya Anmol and 10% Hysun 33 yielded identical moisture content.

The chapatties prepared from wheat flour enriched

with oilseed flours significantly contained higher moisture content than the chapatties prepared from un-enriched wheat flour. The studies conducted by Bhat and Vivian (1980) had indicated that the moisture contents in chapattis were 32.6 to 36.0% when supplemented with soy, peanut and cottonseed flours while moisture contents in whole wheat chapati was 35.5%. The moisture content found in the present study is well correlated to the findings of these workers. However, significant variation among the enriched wheat flours may be ascribed to higher water holding capacity of the oilseed flours. However, the baking conditions also have pronounced effect on the moisture content of chapatties. Since the conditions were kept identical throughout the experimentation. Therefore, the variation may be due to addition of oilseed flour in wheat flours.

The crude protein content of chapatties also did not differ significantly due to interaction of crop years with wheat flours and oilseed flour combinations. The results indicated that the chapatties prepared from different combination of oilseed flour possessed significant differences in protein content. The mean value for crude protein content is presented in Table II. The protein content was found to be the highest in chapatties prepared from wheat flour enriched with 20% Peela Raya and 20% Raya Anmol. The chapatties prepared from wheat flour enriched with 10% Peela Raya and 10% Raya Anmol did not differ significantly for this chemical constituent. The crude protein contents of chapatties prepared from wheat flour enriched with 10% CIM 240 and 20% Hysun 33 were also found to have statistically identical values for crude protein content. The lowest crude protein content was recorded in chapatties prepared from un-enriched wheat flours followed by the chapatties prepared from wheat flour enriched with 10% Hysun 33.

The data on crude protein content of chapatties showed that there was a significant increase in the crude protein content of chapatties when prepared from oilseed enriched wheat flours. It was further observed that crude protein content of chapatties increased progressively with the increase in the level of oilseed flour supplementation.

Table I. Moisture (%) of chapatties prepared from different oil seed enriched flours

Years	Wheat flour	Control T0	Cotton seed flour				Mustard seed flour				Sunflower seed flour			
			CIM 240		NIAB 78		Peela Raya		Raya Anmol		Hysun 33		Suncom 110	
			10+90 T1	20+80 T2	10+90 T3	20+80 T4	10+90 T5	20+80 T6	10+90 T7	20+80 T8	10+90 T9	20+80 T10	10+90 T11	20+80 T12
2000-01	F1	35.50	33.67	33.26	32.92	32.68	35.00	36.21	34.93	36.19	35.92	36.73	35.36	36.47
	F2	35.70	32.90	32.54	33.10	32.60	34.27	36.10	35.12	36.07	34.85	36.15	35.17	36.31
	Mean	35.60	33.28	32.90	33.01	32.64	34.64	36.16	35.02	36.13	35.38	36.44	35.26	36.39
2001-02	F1	34.90	32.87	33.13	32.86	32.37	34.86	36.10	35.27	36.07	35.76	36.43	36.11	36.51
	F2	35.45	32.85	32.34	32.92	32.23	34.39	36.00	35.05	35.86	34.61	36.00	34.85	36.09
	Mean	35.18	32.86	32.74	32.89	32.30	34.62	36.05	35.16	35.96	35.18	36.22	35.48	36.30
Mean	F1	35.20	33.27	33.20	32.89	32.52	34.93	36.16	35.10	36.13	35.84	36.58	35.74	36.49
	F2	35.58	32.88	32.44	33.01	32.42	34.33	36.05	35.08	35.96	34.73	36.08	35.01	36.20
	Mean	35.39bc	33.07e	32.82e	32.95e	32.47e	34.63d	36.10a	35.09cd	36.05ab	35.28cd	36.33a	35.37bc	36.34a

F1 = Wheat flour (Faisalabad-85); F2 = Wheat flour (Chakwal-86)

Means, in a row or a column, sharing the same alphabet are statistically non-significant ($P > 0.05$).

Jan *et al.* (2000) have reported an increase in the crude protein content of chapatties enriched with oilseed flours. Rawat *et al.* (1994) also reported an increase in protein level of soy flour fortified chapatties. Ghandi *et al.* (2000) observed increase in protein contents from 11.9 to 19.8% at 20% blending level of defatted soy enriched chapatties. The protein content of chapatties prepared from wheat flour enriched with soy, peanut and cottonseed flour was higher in chapatties prepared from whole-wheat flour (Bhat & Vivian, 1980). The increase in protein content of chapatties prepared from oilseed enriched wheat flours in the present study are in line with the findings reported by Jan *et al.* (2000) and Bhat and Vivian (1980) who found that chapatties prepared from oilseed blended flours contained higher protein content. Since the results reported previously indicated that wheat flours enriched with oilseed flours possessed higher protein content than the un-enriched wheat flours. Higher protein in the present wheat flour enriched with oilseed flours has resulted corresponding increase in the protein content of resultant chapatties.

Crude fat content was not affected significantly by the crop years, wheat flours and the interaction of crop year with wheat flours and oilseed flour combinations. It also showed that the oilseed flour combinations differed significantly with one another with respect to crude fat

content of chapatties. The crude fat content of chapatties prepared from oilseed enriched wheat flours is shown in Table III. The results regarding chapatties prepared from enriched wheat flours showed same trend for fat content, which was observed in case of the respective enriched flours. It was observed that the crude fat content was found to be the highest in chapatties prepared from un-enriched wheat flour. The chapatties prepared from wheat flour enriched with 20% CIM 240 and 10% Suncom 110 gave statistically identical values for fat. The crude fat content did not differ significantly between chapatties prepared from wheat flours enriched with 20% NIAB 78 and 10% Hysun 33. Significantly minimum crude fat content was found in the chapatties prepared from wheat flour enriched with 20% Raya Anmol followed by the chapatties enriched with 20% Suncom 110 varieties. The crude fat content between chapatties enriched with 20% Peela Raya and 20% Raya Anmol did not differ significantly.

Ash content of chapati differed significantly due to the crop years and wheat flours. The interaction of crop years with wheat flours and oilseed flour combinations was found to be non-significant for this constituent. The results further showed that oilseed flour combinations differed significantly with one another with respect to ash content of chapati. The mean ash content of chapatties prepared from

Table II. Crude protein (%) of chapatties prepared from different oil seed enriched flours

Years	Wheat flour	Control T0	Cotton seed flour				Mustard seed flour				Sunflower seed flour			
			CIM 240		NIAB 78		Peela Raya		Raya Anmol		Hysun 33		Suncom 110	
			10+90 T1	20+80 T2	10+90 T3	20+80 T4	10+90 T5	20+80 T6	10+90 T7	20+80 T8	10+90 T9	20+80 T10	10+90 T11	20+80 T12
2000-01	F1	8.10	11.83	13.20	10.34	12.48	11.45	14.82	11.97	14.97	9.12	10.72	10.27	11.67
	F2	8.47	11.17	13.38	11.09	12.01	12.05	13.25	11.87	12.68	10.42	11.35	10.07	11.21
	Mean	8.28	11.50	13.29	10.72	12.24	11.75	14.03	11.92	13.82	9.77	11.04	10.17	11.44
2001-02	F1	7.62	11.21	14.00	11.12	13.48	12.27	15.30	12.35	15.75	9.82	11.11	10.55	11.55
	F2	7.73	11.69	13.86	11.53	12.59	12.65	13.85	12.29	13.30	10.82	12.15	10.21	11.81
	Mean	7.68	11.45	13.93	11.32	13.04	12.46	14.58	12.32	14.52	10.32	11.63	10.38	11.68
Mean	F1	7.86	11.52	13.60	10.73	12.98	11.86	15.06	12.16	15.36	9.47	10.92	10.41	11.61
	F2	8.10	11.43	13.62	11.31	12.30	12.35	13.55	12.08	12.99	10.62	11.75	10.14	11.51
	Mean	7.98g	11.48c-f	13.61ab	11.02def	12.64bc	12.10cd	14.30a	12.12cd	14.18a	10.04f	11.33c-f	10.28ef	11.56cde

F1 = Wheat flour (Faisalabad-85); F2 = Wheat flour (Chakwal-86)

Means, in a row or a column, sharing the same alphabet are statistically non-significant (P>0.05).

Table III. Crude fat (%) of chapatties prepared from different oilseed enriched wheat flours

Years	Wheat flour	Control T0	Cotton seed flour				Mustard seed flour				Sunflower seed flour			
			CIM 240		NIAB 78		Peela Raya		Raya Anmol		Hysun 33		Suncom 110	
			10+90 T1	20+80 T2	10+90 T3	20+80 T4	10+90 T5	20+80 T6	10+90 T7	20+80 T8	10+90 T9	20+80 T10	10+90 T11	20+80 T12
2000-01	F1	1.46	1.36	1.26	1.39	1.31	1.25	1.02	1.21	1.04	1.33	1.20	1.22	1.24
	F2	1.27	1.19	1.10	1.12	1.15	1.07	0.98	1.08	0.93	1.16	1.04	1.14	1.00
	Mean	1.36	1.28	1.18	1.26	1.23	1.16	1.00	1.14	0.98	1.24	1.12	1.18	1.12
2001-02	F1	1.35	1.27	1.20	1.26	1.19	1.14	1.04	1.13	1.00	1.21	0.98	1.20	1.07
	F2	1.19	1.21	1.07	1.14	1.07	1.00	0.93	1.00	0.91	1.07	0.95	1.06	0.96
	Mean	1.27	1.24	1.14	1.20	1.13	1.07	0.98	1.06	0.96	1.14	0.96	1.13	1.02
Mean	F1	1.40	1.32	1.23	1.32	1.25	1.20	1.03	1.17	1.02	1.27	1.09	1.21	1.16
	F2	1.23	1.20	1.08	1.13	1.11	1.04	0.96	1.04	0.92	1.12	1.00	1.10	0.98
	Mean	1.32a	1.26b	1.16def	1.23bc	1.18cde	1.12efg	0.99ij	1.11fgh	0.97j	1.19cd	1.04hi	1.16def	1.07gh

F1 = Wheat flour (Faisalabad-85); F2 = Wheat flour (Chakwal-86)

Means, in a row or a column, sharing the same alphabet are statistically non-significant (P>0.05).

Table IV. Ash (%) of chapatties prepared from different oil seed enriched wheat flours

Years	Wheat flour	Control T0	Cotton seed flour				Mustard seed flour				Sunflower seed flour			
			CIM 240		NIAB 78		Peela Raya		Raya Anmol		Hysun 33		Suncom 110	
			10+90 T1	20+80 T2	10+90 T3	20+80 T4	10+90 T5	20+80 T6	10+90 T7	20+80 T8	10+90 T9	20+80 T10	10+90 T11	20+80 T12
2000-01	F1	1.60	1.72	1.84	1.77	2.04	1.96	2.46	1.91	2.35	1.81	2.20	1.74	2.01
	F2	1.68	1.79	2.10	1.84	2.21	2.03	2.57	1.98	3.04	1.88	2.27	1.82	2.06
	Mean	1.64	1.76	1.97	1.80	2.12	1.99	2.52	1.94	2.69	1.84	2.24	1.78	2.04
2001-02	F1	1.74	1.82	2.01	1.90	2.16	2.07	2.58	2.01	2.46	1.87	2.18	1.89	2.23
	F2	1.62	1.72	2.02	1.79	2.25	1.96	2.48	1.90	2.41	1.83	1.89	1.79	2.03
	Mean	1.68	1.77	2.02	1.84	2.20	2.02	2.53	1.96	2.44	1.85	2.04	1.84	2.13
Mean	F1	1.67	1.77	1.92	1.84	2.10	2.02	2.52	1.96	2.40	1.84	2.19	1.82	2.12
	F2	1.65	1.76	2.06	1.82	2.23	2.00	2.52	1.94	2.72	1.86	2.08	1.81	2.04
	Mean	1.66h	1.76gh	1.99cde	1.82fg	2.16b	2.00cd	2.52a	1.95def	2.56a	1.85efg	2.14bc	1.81fg	2.08bcd

F1 = Wheat flour (Faisalabad-85); F2 = Wheat flour (Chakwal-86)

Means, in a row or a column, sharing the same alphabet are statistically non-significant ($P>0.05$)

different oilseed enriched wheat flours is shown in Table IV. The data revealed that the ash content was found to be significantly higher in chapatties prepared from wheat flour enriched with 20% Peela Raya and 20% Raya Anmol. The chapatties prepared from wheat flour enriched with 20% NIAB 78; Hysun 33 and Suncom 110 were found to be statistically at par with respect to ash content. The ash content of chapatties prepared from wheat flour enriched with 10% NIAB 78 and 10% Suncom 110 also did not differ significantly for this chemical constituent. The lowest ash content was found in the chapatties prepared from un-enriched wheat flour followed by enriched with 10% CIM 240. The variation in ash content between chapatties prepared from wheat flour enriched with 10% Raya Anmol and 10% Hysun 33 were found to be non-significant.

The results of the present study indicated that there was a significant increase in moisture, crude protein and ash contents in chapatties prepared from wheat flour enriched with oilseed flours. It is evident from this study that enrichment of wheat flour with oilseed flours not only increased the protein content and ash content of the enriched flours but also increased the level of these constituents in the chapatties as well. This further showed that wheat flours enrichment with oilseed flours may help to improve the nutritional status of masses whose staple diet is chapati.

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