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NUTRITIONAL AND ORGANOLEPTIC EVALUATION OF WHEAT BREAD SUPPLEMENTED WITH CHICK PEA FLOUR

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Proximate composition, organoleptic characteristics and the nutritive value of wheat bread supplemented with different levels of chick pea flour were studied. Wheat and chick pea flours were mixed in definite ratios and the breads were baked. Protein, fat and ash contents of control bread were improved with supplementation. Organoleptic study revealed that incorporation of chick pea up to 20% had no adverse effect on the acceptability of the bread. Protein efficiency ratio, net protein utilization and biological value of supplemented breads were higher than the control bread. However, the true digestibility of wheat bread could not be improved.

INTRODUCTION

In Pakistan, wheat *(Triticum aestivum)* is widely grown as a major food crop. It contributes to 84% of the total cereals intake and provides 51% and 60% of the total calories and proteins consumed respectively [1]. It contains an average of 13% protein, 2% ash and 2-3% crude fibre [2]. Wheat proteins are deficient in some essential amino acids. Lysine, threonine and valine have been found to be the first, second and third limiting amino acids in wheat [3].

Chick pea *(Cicer arietinum)* cultivated extensively in the rainfed areas of NWFP contains 17.5 to 28.0% protein and is a rich source of wheat deficient amino acids [4]. However, chick pea is deficient in sulphur-containing amino acids [5]. Combination of wheat with various legumes considerably enhanced the quality of its protein by improving the essential amino acid profile [6, 7, 8]. Supplementation of maize with soy residue greatly enhanced the nutritive value of the former [9]. Likewise the fortification of corn with 12% soybean flour [10] or pea nut and chick pea [11] improved its nutritive value significantly. Supplementation of wheat bread either with chick pea or soybean flour resulted in net increase in lysine content and available protein [12]. Similar were the observations of Khalil *et al.* [13] who achieved considerable improvement in the protein quality of wheat bread enriched with pea nut flour.

Supplementation of wheat bread with chick pea flour and subsequent evaluation by rat bioassay have not been systematically carried out so far, particularly in NWFP. It was therefore, considered desirable to undertake such a study with the hope that it would give a positive response in developing a good quality bread balanced in the essential amino acids.

MATERIALS AND METHODS

Certified seeds of wheat variety Pak-81 were collected from Malkandher Farm, NWFP. Agricultural University, Peshawar, while the chick pea variety CM-72 was obtained from Agricultural Research Station, Ahmad Wala, Karak, Bannu.

Preparation of bread: Chick pea flour at 5, 10, 15 and 20% levels was mixed with wheat flour and a homogeneous dough was obtained. The breads were baked by the traditional method in an earten oven and utilized for chemical and biological evaluation.

Organoleptic evaluation: : Wheat bread prepared in combination with different levels of chick pea flour as well as control bread was presented to a taste panel of eight judges for organoleptic evaluation. The breads were graded for colour, odour, texture, chewing quality, taste and overall acceptability according to a 10-point score card. The average scores of eight judges were compared statistically [14].

Proximate analysis: Moisture, protein, fat and ash contents of the samples were determined according to the standard methods of AOAC [15], while crude fibre was estimated by an alternate method as described by Jacobs [16].

Preparation of diet: The test diets were prepared by mixing 5, 10, 15 and 20% chick pea flour with wheat flour. The protein content of the diets was adjusted to 10%. All diets were supplemented with 5% corn oil, 1% cod liver oil, 4% mineral mixture, 1 g vitamin mixture and maize starch to adjust to 100. The casein diet was used as standard diet with the protein level adjusted to 10%.

Protein Efficiency Ratio: PER was determined by the method of Osborne and Mendel [17]. Young rats weaned at 21 days of age were fed on a stock diet for one week. The 28-day old rats were uniformly divided into six groups of 4 each and housed in separate cages. Four groups of rats were fed the test diets, one group was given the control diet, while the 6th group received the standard casein diet. The diet and water were provided ad-libitum for a period of 28 days. From the food consumed and weight gained by each group, the PER was calculated.

Net Protein Utilization (NPU): For the determination of NPU, the method of Miller and Bender [18] was followed. The 28-day old rats were divided into seven groups. Six groups received the diets as mentioned above while the 7th group was fed the basal protein-free-diet for a period of 10 days.

The animals were killed with chloroform, their fresh weights were recorded, and then dried in an oven at 105°. From the loss in weight and nitrogen intake by the group, the NPU was calculated.

The feces collected at the end of the experiment were dried and fecal nitrogen was determined. True digestibility and biological value were calculated according to the formulae of Miller and Bender [18].

RESULTS AND DISCUSSION

The proximate composition of wheat flour, chick pea flour and the supplemented breads is presented in Table 1. The results for moisture, protein and ash contents in wheat flour were in the range reported by Leonard and Martin [19]. However, fat and crude fibre contents differed in the two determinations. The results are in confirmity with the data of Khalil, *et al.* [20], though the crude fibre content in the latter investigation was higher. Considerable variations in the protein contents of wheat have also been observed by Ahmad, *et al* [21] which may be attributed to varietal and ecological differences.

The data for chick pea (Table 1) is in fair agreement with that of Ahsen, *et al* [22]. The protein content of control bread improved significantly ($P < 0.05$) as the level of supplementation increased from 5 to 20%. Addition of 10 to 20% chick pea flour increased the fat content of the bread sgnificantly.

Fortification with 10% chick pea flour was found optimum for obtaining maximum increase in the ash

Table 1. Proximate composition of control, supplemented breads

Sample	Mositure %	Crude fat %	Crude protein %	Ash %	Crude faiber %
Wheat bread control	12.69 a	2.05 a	12.79 a	1.57 a	2.58
Wheat bread + 5 chick pea flour	11.24 b	2.69 ab	13.73 b	2.05 b	2.59
Wheat bread + 10% chick pea flour	11.29 b	2.95 bc	14.37 c	2.27 bc	2.69
Wheat bread + 15% chick pea flour	12.67 a	3.53 cd	14.81 c	2.41 cd	2.70
W Wheat bread + 20% chick pea flour	13.23 c	3.83 d	15.64 d	2.61 d	2.76
L.S.D. (5%)	.52	.73	.61	.23	N.S
Wheat flour	10.57	2.55 b	13.68 b	1.58	1.93
Chick pea flour	9.68	4.41 a	22.48 a	2.65	2.94
L.S.D. (5%)	N.S.	1.84	4.45	N.S	N.S
Casein	–	–	82.00	–	–

Average of three determinations:
Similar letters represent that there is no significant difference at 5% level of probability.

Table 2. The effect of chick pea supplementation on organoleptic properties of wheat breads

Supplementation level (%)	Colour	Taste	Texture	Odour	Chewing quality	overall acceptability
0	7.2	6.9 a	7.5	8.0 a	7.5	7.0
5	7.4	7.0 ab	7.3	8.2 a	7.8	6.8
10	7.5	7.1 ab	7.1	8.5 bc	7.4	7.1
15	7.6	7.2 ab	7.0	8.6 cb	7.6	7.3
20	7.8	7.4 b	6.8	8.8 c	7.6	6.9
L.S.D. %	N.S.	0.47	N.S.	0.34	N.S.	N.S.

Average score of eight judges:
Similar letters represent that there is no significant difference at 5% level of probability.

content. Crude fibre content was not affected appreciably by supplementation.

Improvement in the chemical composition after supplementation could be expected since chick pea has higher quantities of these constitutents and less starch as compared to wheat. These results support the earlier finding of like nature [12, 13, 23].

Organoleptic Properties: The results of the organoleptic investigation of wheat bread are shown in Table 2. It indicated that colour of wheat bread could not be significantly improved by supplementation. However, the taste of the bread fortified with 15-20% chick pea flour improved appreciably. Chick pea failed to improve the texture of wheat bread. Similarly the chewing quality of the supplemented bread was neither consistently increased nor decreased and the score was statistically not significant. It is interesting to observe that the overall acceptability as could be apprehended did not decrease significantly with supplementation.

It may be concluded that the colour, taste, and odour of wheat bread improved while no consistent change was observed as regards the texture, chewing quality and overall acceptability of wheat bread enriched with chick pea flour. These observations endorse the results of other workers [12, 13, 24].

Biological Evaluation: The PER, NPU, True digestibility and biological values of the isoproteic diets are given in Table 3. Rats receiving casein as a source of protein gained weight faster than those of other groups fed on wheat bread alone or the supplements. The PER values ranged from 1.45 of control bread to 2.88 of casein. Casein was followed in growth promoting value by wheat flour, supplemented with 20% chick pea.

The PER values consistently rose by 21, 28, 32, and 35% respectively with the corresponding increase in the proportion of chick pea flour. The difference in the PER values was however, not appreciable. These findings incidate that 15% supplementation with chick pea flour would probably be the optimum to obtained maximum PER. These results are comparable to those of Khalil, *et al.* [13] and Hallab *et al.* [12].

The net protein utilization (Table 3) showed gradual improvement as fortification with chick pea flour was increased. The maximum amount of increase in the NPU value was however, observed with the supplement containing 5% chick pea and 95% wheat flour. Following casein diet, the next higher NPU value of 54, obtained with 20% supplementation showed a significant increase of 22.72% over that of the control bread. When the NPU values were expressed as percent of casein, the control bread had a value of 68 which consistently increased up to 83 with different levels of chick pea flour. The marked improvement in the nutritive value of supplemented bread may be attributed to a complimentary effect of chick pea on wheat as the latter is deficient in lysine.

In agreement with these results, other workers [12, 13, 25] also reported considerable improvement in the NPU values of wheat bread supplemented with different legumes.

The slight depression observed in the true digestibility of wheat bread (Table 3) with supplementation was not significant and it can be conveniently inferred that supplementation had not effect on the digestibility of wheat protein. However, biological value enhanced with increasing levels of supplementation. Combination of chick pea flour at 20% level caused an improvement of the biological value by 13 units, which represents 20% increase in the protein retention

Table 3. PER, NPU, TD and BV of control and supplemented breads*

Diet wheat and chick pea	PER	% PER to casein	NPU	% NPU to casein	T.D.	B.V.
Wheat bread control	1.45	50	44 a	68	90 c	49 a
Wheat bread + 5% chick pea flour.	1.76	61	48 b	74	88 a	54 b
Wheat bread + 10% chick pea flour.	1.86	64	50 c	77	87 ab	57 c
Wheat bread + 15% chick pea flour.	1.92	66	52 d	80	86 b	60 d
Wheat bread + 20% chick pea flour	1.96	68	54 e	83	86 b	62 d
Casein	2.88	100	65	100	95	68
L.S.D. 5% level	N.S.		1.48	–	1.33	2.21

Average of four determinations:
Similar letters represent that there is no significant difference at 5% level of probability.

over control bread. The most significant difference in the biological value was observed at 5% level of supplementation. However, supplementation of wheat bread with 15% chick pea flour may be regarded as optimum for obtaining maximum biological value.

In conclusion, it may be mentioned that supplementation with chick pea flour significantly increased the nutritive value of wheat bread. It is therefore, recommended that the usefulness of such practices may be disseminated in rural and urban areas with the purpose of alleviating the problem of protein malnutrition.

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