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NUTRITIONAL AND ORGANOLEPTIC EVALUATION OF WHEAT BREAD SUPPLEMENTED WITH PEANUT FLOUR

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In order to prepare a nutritive and acceptable bread, wheat flour was supplemented with 10, 20 and 30% peanut flour. The proximate composition, nutritive value and organoleptic characteristics of the breads prepared from these flours were studied. It was found that the protein content of the breads increased from 12.50 to 25.0% with supplementation. The PER and NPU values were significantly increased over control by all leve of peanut flour supplement. The bread containing 20% peanut flour was best with respect to PER, NPR and organoleptic evaluation.

INTRODUCTION

Protein energy malnutrition is widespread among the people of low income group. Wheat is the staple diet of the people of Pakistan. The protein content of wheat is low and relatively deficient in certain essential amino acids, such as lysine and threonine [1,2]. Since food legumes are rich and economical sources of good quality protein [3,4], they could play an important role to supplement wheat protein and to combat the protein calories malnutrition problem in the country.

Peanut *(Arachis hypogaea* L.) is an important food legume, with high protein and oil contents[5]. The defatted peanut flour contains abundant protein[6] and thus can serve as good protein supplement. It may also counterbalance the lysine and theonine deficiencies of wheat protein. The amino acid composition of peanut have been reported by a number of workers [7,8]. Studies on the supplementation of corn with soybean and other legumes have been reported by various workers[9,10], but no significant work regarding the supplementation of wheat with peanut flour have been reported in Pakistan. The present work, was therefore undertaken to study the protein quality and acceptability of wheat bread supplemented with various levels of peanut flour.

METHODS AND MATERIALS

Ordinary wheat flour was purchased from the local market. Peanut ('Kurram' cultivar) was obtained from Agricultural Officer, Hangu, district Kohat. The raw peanut was roasted in an oven at 110 °c for half an hour. It was then shelled and ground in a micro-grinder. After repeated extraction of oil in Soxhelt apparatus with petroleum ether, the flour was sun dried and used in the preparation of breads.

Preparation of Bread: Wheat and peanut flours were mixed in the following proportion with a small amount of sodium chloride:

i) 100 % wheat flour for control bread
ii) 90 % wheat flour + 10 % peanut flour
iii) 80 % wheat flour + 20 % peanut flour
iv) 70 % wheat flour + 30 % peanut flour

Water was added to each mixture and the dough was kneaded for 15 minutes in each case. The breads were baked by the traditional method in an earthern oven, locally called "Tannour."

Proximate Composition. The moisture, protein, fat, ash and crude fibre of all the breads were determined by the standard methods of A.O.A.C.[11]. Nitrogen free extract was calculated by difference.

Nutritive Value. The protein quality of the control and supplemented bread was assessed by measuring protein efficiency ratio (PER) and net protein utilization (NPU).

Protein Effiency Ratio (PER): The PER was determined by the methods of Osborne *et al*[12]. White albino rats at the age of 28 days were uniformly divided into five groups. Each group consist of 4 rats kept separately in a wire cage. All the groups were weightd at the beginning of the experiment. Three groups of rates received supplemeted bread, one group was given unsupplemented bread and the other received casein diet. The protein level of all the diets were adjusted to 10 %. Weighed diet was given daily and unconsumed diet was collected separately. The experiment lasted for 4 weeks. The rates were weighed and from the gain in weight and protein consumed, PER was calculated.

$$PER = \frac{\text{gain in weight (g)}}{\text{protein consumed (g)}}$$

Net Protein Utilization (NPU): The NPU was estimated by the method of Miller and Bender[13]. Young 28 days old ablino rats were unifrmly divided into six groups (4 rates in each group). They were weighed and kept separately in cages. One group was fed a casein diet. The other group was given protein free diet while remaining four groups received unsupplemented wheat bread and bread supplemented with peanut for a period of 10 days. At the end of the experiment the animals were killed with chloroform. Incisions were made into skull, thoracic and body cavities and dried at constant weight. The carcass were analyzed for nitrogen content by Kjeldahl method. From the body nitrogen content and nitrogen intake, the NPU was calculated.

$$NPU = \frac{B - (BK - 1K)}{I} \times 100$$

Organoleptic Evaluation. The fresh breads were cooled to room temperature and presented to a panel of 100 judges, who were asked to evaluate each bread for colour, odour, texture, chewing quality, tast and overall acceptability. The Hedonic scale method of Peryam and Pilgrim[14] was used for this purpose.

RESULTS AND DISCUSSION

Proximate Composition. The proximate composition of the supplemented and control breads is presented in Table 1. The results indicate that the crude protein, fat, ash and crude fibre contents were increased by supplementing wheat with peanut flour. As compared to control bread the protein content was increased by 29.0, 64.0 and 100% in breads containing 10, 20 and 30% peanut flour, respectively. Grewe[15] also reported an increase in the protein, fat, ash and crude fibre contents of European breads supplemented with 5 to 25% peanut flour. The market increase in the protein content of the supplemented breada was expected as peanut flour contained 56.87% protein[6].

Nutritive Value. The protein efficiency ratio (PER) of control and supplemented breads is given in Table 2. The results revealed that the PER was significantly ($P < .05$) increased over control by all levels of peanut supplement The lowest PER was recorded in control and the highest in bread supplemented with 20% peanut flour. There was no significant difference in the PER values of the breads supplemented with peanut flour.

The results (Table 3) indicate that the net protein utilization (NPU) was increased from 41.0 in control to 52.8 by 30% peanut bread. The NPU value of 51.0 incase of 20% peanut bread is little different from that of

Table 1. Proximate Composition of wheat bread and the breads supplemented with peanut flour

	Breads	Moisture %	Per cent on dry weight basis* Protein (Nx6.25)	Crude fat	Ash	Crude fibre	Nitrogen Free Extract
1.	Wheat bread, (control)	15.20	12.50	1.60	1.20	2.58	82.12
2.	Wheat + 10% Peanut flour	13.90	16.12	2.60	1.48	2.88	76.92
3.	Wheat + 20 % Peanut flour	14.20	20.50	3.40	1.66	3.50	70.94
4.	Wheat + 30 % Peanut flour	15.00	25.00	3.96	2.10	4.40	64.54

*Each value is the average of three determinations.

Table 2. Protein efficiency ratio (PER) of control and supplemented breads

	Diet	Grain in weight (g)	Food consumed (g)	Protein consumed (g)	PER determined	PER adjusted**
1.	Wheat bread (control)	40	249	24.9	1.60±0.10	1.21
2.	Wheat + 10 % Peanut flour	60	308	30.8	1.95±0.14	1.47
3.	Wheat + 20 % Peanut flour	72	337	33.7	2.16±0.26	1.61
4.	Wheat + 30 % Peanut flour	72	348	34.8	2.07±0.12	1.56
5.	Casein	100	303	30.3	3.33±0.30	2.50
	F ratio:	14.04	3.93	–	8.0	–
	L.S.D 5%	3.81	17.8	–	0.27	–

* Mean ± standard deviation

** Adjusted to standard PER of casein taken as 2.5

Table 3. The net protein utilization (NPU) of control and experimental breads

	Diets	Nitrogen content of carcass (g)	Nitrogen intake (g)	NPU determined	NUP as % of casein
1.	Protein free	4.1	0.16	–	–
2.	Wheat bread (control)	5.08	2.78	41	62
3.	Wheat + 10 % Peanut flour	5.53	3.46	46	70
4.	Wheat + 20 % Peanut flour	5.87	3.78	51.	77
5.	Wheat + 30 % Peanut flour	6.00	3.90	53	80
	Casein	6.18	3.39	66	100

Table 4. Organoleptic Evaluation of Wheat bread supplemented with peanut flour*

	Bread characteristics	Supplemental level used				L.S.D.
		Control	10%	20%	30%	(5%)
1.	Colour	6.0	6.2	6.5	7.0	NS
2.	Odour	6.6	7.0	7.6	8.2	0.64
3.	Taste	6.7	6.2	6.8	6.4	NS
4.	Chewing quality	6.7	6.5	6.9	6.5	0.25
5.	Texture	7.8	7.7	7.8	6.6	0.49
6.	Overall acceptability	6.6	6.4	6.6	6.8	NS

Significantly different (P = 0.05) from control

NS = Non significant

* Average score of ten judges.

bead containing 30% peanut flour and suggests that 20% peanut supplement is optimal for improvement the nutritive value of wheat bread in this manner. These observations are in fair agreement to those of Nirmala *et al*[16] and Woddham and Clark[17] who also reported that the nutritive value of wheat can be enhanced by peanut supplementation.

Organoleptic Tests. The various organoleptic tests of control and supplemented breads are given in Table 4. The results revealed that the colour, taste and overall acceptability of wheat bread were not significantly ($P = 0.5$) affected by supplementation with peanut flour. The odour of the bread containing 20 to 30% peanut flour was significantly ($P < .05$) better than control. The texture and chewing quality of 20% peanut bread was comparable to that of control. Further addition of peanut flour adversely affected these qualities. These results suggest that 20% peanut flour can be incorporated into wheat flour without any adverse effect on the acceptability of the bread.

Based on these observations it is recommended that in order to prepare an acceptable bread with higher nutritive value, wheat flour should be supplemented with 20% peanut flour.

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