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SUPPLEMENTATION OF WHEAT FLOUR WITH DEFATTED GROUNDNUT (Arachis hypogaea L.) FLOUR

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In this study the protein quality of wheat, groundnut and wheat supplemented by groundnut was determined by means of biological methods. In the supplemented diets wheat provided 75, 50 and 25 percent of the protein while the rest was supplied by groundnut protein. The PER, NPU and BV of supplemented diets varied between 2.21 to 2.71, 62.73 to 72.73 and 77.89 to 90.63 percent respectively, compared to 1.88, 42.62 and 55.36 percent of unsupplemented wheat and 1.69, 51.17 and 66.39 percent of groundnut protein respectively. Supplementation of wheat protein with groundnut protein improved the quality of wheat protein and best results in terms of weight gain, PER, NPU and BV were obtained with diet supplying 25 percent protein from defatted groundnut and 75 percent protein from wheat. It was concluded that such vegetable protein mixtures could be suitable for the prevention of protein malnutrition.

INTRODUCTION

Legumes are the cheap and abundantly available source of good quality protein, which if relied upon is capable of compensating the limiting amino acid, lysine in wheat, the staple food of millions in the world. Besides, groundnut is grown over a vast area in Pakistan yielding an abundant crop, which if properly processed and blended with wheat or rice meals is likely to improve their nutritive value. Processing of groundnut however would be necessary in order to remove excessive oil alongwith erucic acid which if left in the product reduces nutritive as well as keeping quality. Nirmala *et al.* (1966) determined net protein utilization and PER of four diets in which groundnut meal supplied 10 or 15 percent protein containing 4 or 8 percent fat and reported that growth was better with 15 percent than with 10 percent protein diet. The present study was, planned to investigate the effect of supplementation of wheat flour with various levels of defatted ground flour.

MATERIALS AND METHODS

Twenty four weanling albino rats were used for the biological evaluation of experimental diets. The rats were fed on stock diet for 7 days and were

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grouped randomly. Each group consisted of four rats housed in a cage, and a sheet of filter paper was placed under each cage for the collection of faeces.

The experimental diets (Table 1) were randomly assigned to these groups and fed *ad-libitum*. In order to measure the metabolic faecal nitrogen a group of rats was fed on protein free diet. Fresh and clean water was provided all the time for a period of ten days. Gains in body weight were recorded daily. Faeces were collected for the determination of true digestibility. At the end of the experiment the rats were killed with chloroform. Incisions were made into the skull, thoracic and abdominal cavities and the carcasses of each group were dried to a constant weight at 105°C. Dried carcasses were weighed and ground. The nitrogen content of diets, faeces and carcasses of each group were deter-

TABLE 1. *Percentage composition of experimental diets.*

Ingredients	A	B	C	D	E	F
Wheat flour	85.0	62.50	41.70	20.85	—	—
Groundnut flour	—	5.10	10.20	15.30	20.50	—
Corn starch	—	16.40	32.10	47.85	63.50	84.0
Corn oil	5	5	5	5	5	5
Glucose	5	5	5	5	5	5
Mineral mixture	4	4	4	4	4	4
Vitamin mixture	2	2	2	2	2	2
Total	100	100	100	100	100	100
			Protein percent distribution			
Wheat flour	100	75	50	25	0	—
Groundnut flour	0	25	50	75	100	—

mined by the Kjeldahl method (A.O.A.C., 1970). PER (g. weight gain/g protein intake) was calculated. Net protein utilization was estimated according to the method of Miller and Bender (1955). The biological values were calculated from true digestibility and NPU values.

The experiment was repeated under similar laboratory conditions and the data, thus collected in both assays were subjected to statistical analysis using analysis of variance technique (Snedecor, 1967).

RESULTS AND DISCUSSION

The data on average weight gain, feed consumption protein efficiency ratio, true digestibility, net protein utilization and biological value of experimental diets are given in Table 2.

TABLE 2. *Average weight gain, feed consumption, protein efficiency ratio, true digestibility, net protein utilization and biological value of experimental diets.*

Description	DIETS				
	A	B	C	D	E
Number of rats in each group	4	4	4	4	4
Days on experiment	10	10	10	10	10
Initial weight per group (gms)	252.0	253.0	251.0	254.0	253.0
Final weight per group (gms)	305.0	343.5	324.5	319.0	296.5
Gain weight per group	53.5	90.5	73.5	65.5	43.5
Feed consumption (gms)	283	332	289	294	229
Protein Efficiency Ration	1.88	2.71	2.53	2.21	1.69
Net protein utilization (%)	42.62	63.73	62.73	72.63	51.17
True digestibility (%)	76.91	81.61	80.84	80.30	77.91
Biological value (%)	55.36	83.68	77.89	90.63	66.36

Body weight

The body weight increased by 53.5, 90.5, 73.5, 65.5 and 43.5 gm respectively. The groups of rats fed on diet B, C, D and A gained 47.0, 30.0, 22.0 and 10.0 gms more weight than the group fed on diet E (100 percent protein from groundnut). The rats on diet B had significantly higher gain in weight than those fed on other diets and rats fed on diets C and D produced significantly ($P<0.01$) better growth than on diets A and E. Similarly, diet A was

significantly ($P<0.05$) better than diet E based on groundnut flour in promoting growth of rats. Supplementation of wheat flour with groundnut flour improved the growth rate of the rats but it decreased with the increasing level of groundnut flour in the diet. Nirmala *et al.* 1966, Roy 1970, Narayanaswamy (1973) had also observed better growth in rats fed on different levels of fortified groundnut flour.

Protein efficiency ratio

The average values of diets having wheat protein alone was 1.88 and it improved to 2.71, 2.53, 2.21 when supplemented with 25, 50 and 75 percent levels of protein from groundnut flour. Supplemented diets had significantly better PER than diets containing wheat protein or groundnut protein only. The rats fed on diets B and C had significantly better PER than those fed on diets, D, A and E. The difference between diets B and C was, however, non-significant. Diet A had significantly higher PER than diet E. The results indicated that PER of wheat protein was improved when 25, 50 and 75 percent of wheat protein was replaced by groundnut protein but the diet having 25 percent protein from groundnut flour had the best PER presumably because of having better assortment of essential amino acids compared to other diets under test.

True digestibility

The highest digestibility (81.61 percent) was found in case of diet B containing 25 percent protein was obtained in rats fed diet A based on wheat flour. Supplementation of wheat flour with groundnut flour did not improve the true digestibility as there was no significant difference between the experimental diets. This could obviously might be due to the fact that all the groups utilized, to their best the protein contained in the test diets irrespective of the protein source.

Net protein utilization

The supplemented diets B, C, D and E retained 26.11, 20.11, 30.07 and 8.55 percent more nitrogen than that of wheat based diet A. Supplemented diets had significantly higher NPU than diets A and E, however the difference

between mean values of diets B, C and D were non significant. Diet C differed significantly ($P<0.05$) from diets E and A and the difference of NPU of diets E and A was non-significant. It is clear from the results that the NPU of wheat flour was enhanced when it was supplemented with different levels of groundnut flour which may be due to correction of lysine deficiency in wheat protein.

Biological values

The percentage of absorbed nitrogen retained in the bodies of rats fed experimental diets showed trend similar to NPU values. As evident from results the biological value was highest for diet D though it was not significantly higher than BV of diets B and C. The differences between the biological values of diets D, E, B and C were statistically non significant. The supplementation of wheat flour with 25, 50 and 75 percent protein from groundnut showed 28.32, 22 53 and 35.25 percent higher values than the wheat protein. The diets A and E showed non significant difference from each other. The results of our study are in line with the findings of Rajalakshmi and Subbulakshmi 1964, Oke (1973) who had reported higher biological values of groundnut flour supplemented diet. Vegetable mixture of statisfactory nutritive value can be prepared by mutual supplementation of wheat flour with groundnut protein.

From the data of the present study, it may be concluded that supplementation of wheat flour with groundnut flour, improved the quality of wheat protein and best results in terms of weight gain, protein efficiency ration, net protein utilization and biological values were obtained with a diet supplying 25 percent protein from defatted groundnut flour and 75 percent from wheat flour

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