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NUTRITIVE VALUE OF MAXI-PAK WHEAT FLOUR SUPPLEMENTED WITH DEFATTED SOYFLOUR.

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An experiment was conducted on weanling rats to assess the nutritive value of Maxi-Pak wheat flour when supplemented with defatted soyflour at 3, 6, 9 and 12 per cent levels. The percentage protein contribution by wheat and defatted soyflour in experimental diets was 100, 85, 70, 55 and 40 and 0, 15, 30, 45 and 60, respectively. The results indicated that supplementation improved the weight gain, protein efficiency ratio, net protein utilization and biological value. The nutritive value of the wheat flour supplemented with 12 per cent defatted soyflour was maximum and was comparable to casein based diet. The PER of the diet supplemented with 12 per cent soyflour was 2.65 and that of diet containing wheat alone was 1.5. Similarly, NPU and BV of the diet supplemented with 12 per cent soyflour were 70 and 86 per cent, whereas, the corresponding values for the diet containing wheat alone were 48 and 56 per cent. The resultant improvement in the nutritive value of Mexi-Pak wheat flour appeared to be due to the correction of lysine deficiency in wheat protein.

INTRODUCTION

The poor nutritional status of population of this country is due largely to the inadequate production of food, low availability and high prices of foods of high biological value, lack of purchasing power, ignorance of nutritive value of certain foods and consumption of diets based mainly on cereals or starchy foods, supplying inadequate calories and poor quality protein. Under these circumstances the nutritional status of the people in general and weaned infants, pre-school children, pregnant and lactating women in particular can be improved by using vegetable sources of proteins in their diets.

Soybeans are nutritionally important among the vegetable foods because of high protein containing a significant amount of lysine (Hafner, 1942) and could be used to a limited extent to replacement in baby food (Gugusevic *et al.*, 1970).

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Cereal proteins on the other hand are low in lysine and the combination of the two may have nutritive value as good as animal protein. Wheat flour fortified with full fat soyflour raised the protein content, essential amino acids and caloric value of the mixture (Tsen and Hoover, 1973). The protein efficiency ratio of chapatis improved significantly when 10 per cent of whole wheat flour in chapati was replaced by soybean flour (Shyamala and Kenedy, 1962). Similarly, Mizrahi *et al.* (1967) showed that PER of wheat bread increased with the increasing levels of soybean protein and it was concluded that isolated soybean protein may be admixed with wheat flour upto a level of 6 per cent as a means of successful nutritional supplementation.

The present study was thus undertaken to study the nutritive value of wheat flour supplemented with different levels of defatted soybean flour and to compare the results with that obtained using casein.

MATERIALS AND METHODS

Fifty-six weanling Albino rats, 23 days old were used for the biological evaluation of the experimental diets. In the first assay, twenty-eight rats were fed on stock diet (20 per cent protein) for seven days and then divided randomly into seven groups of four rats each. Each group was weighed and housed in a wire screen mesh bottomed cage. The experimental diets (Table 1) containing 10 per cent protein were randomly assigned to these groups and were fed *ad libitum* for a period of ten days.

Table 1. *Percentage composition of experimental diets.*

Ingredients	A	B	C	D	E	F	G
Wheat flour	89.0	75.2	62.0	48.7	35.4	—	—
Soyflour (defatted)	—	3.0	6.0	9.0	12.0	—	—
Casein	—	—	—	—	—	12.0	—
Corn starch	—	10.8	21.0	31.3	41.6	77.0	89.0
Corn oil	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vitamin mixture	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Mineral mixture	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Protein Distribution %							
Wheat flour	100	85	70	55	40		
Soyflour	0	15	30	45	60		

The per cent protein contributed by defatted soyflour and wheat flour was 15, 30, 45 and 60, and 85, 70, 55, and 40 respectively. A casein based diet served as control and in order to measure metabolic fecal nitrogen a protein free diet was introduced. The temperature of the room was maintained between 75-80 °F. A sheet of filter paper was used in each cage for the collection of faeces. The body weight of each group was recorded at the start of experiment and then daily at the same time. The feed intake of each group was also maintained. At the end of experiment, the rats were killed with chloroform and NPU was determined according to the method of Miller and Bender (1955). Biological value was calculated as follows :

$$BV = \frac{\text{Net protein utilization}}{\text{True digestibility}} \times 100$$

The experiment was repeated by using the same number and strain of rats, under similar laboratory conditions to verify the results obtained in the first experiment. The data thus collected in both assays were subjected to statistical analysis, using analysis of variance technique based on completely randomized design (Snedecor, 1962).

RESULTS AND DISCUSSION

The data on average weight gain, protein efficiency ratio, true digestibility, net protein utilization and biological value of the experimental diets are given in Table 2, and are also partly presented in Figure 1.

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

Description	Diets						
	A	B	C	D	E	F	G
Number of rats on each diet	8	8	8	8	8	8	8
Days on experiment	10	10	10	10	10	10	10
Initial weight/group (gm)	209	209	207	208	209	209	208
Final weight/group (gm)	264	275	290	315	333	317	177
Gain in weight/group (gm)	55	66	83	107	124	108	—
Protein efficiency ratio	1.5	1.69	1.94	2.46	2.65	2.86	—
True digestibility (%)	85.8	86.4	84.6	82.2	81.7	95.8	—
Net protein utilization (%)	48	53	54	68	70	71.5	—
Biological value (%)	56	62	64	83	86	75	—

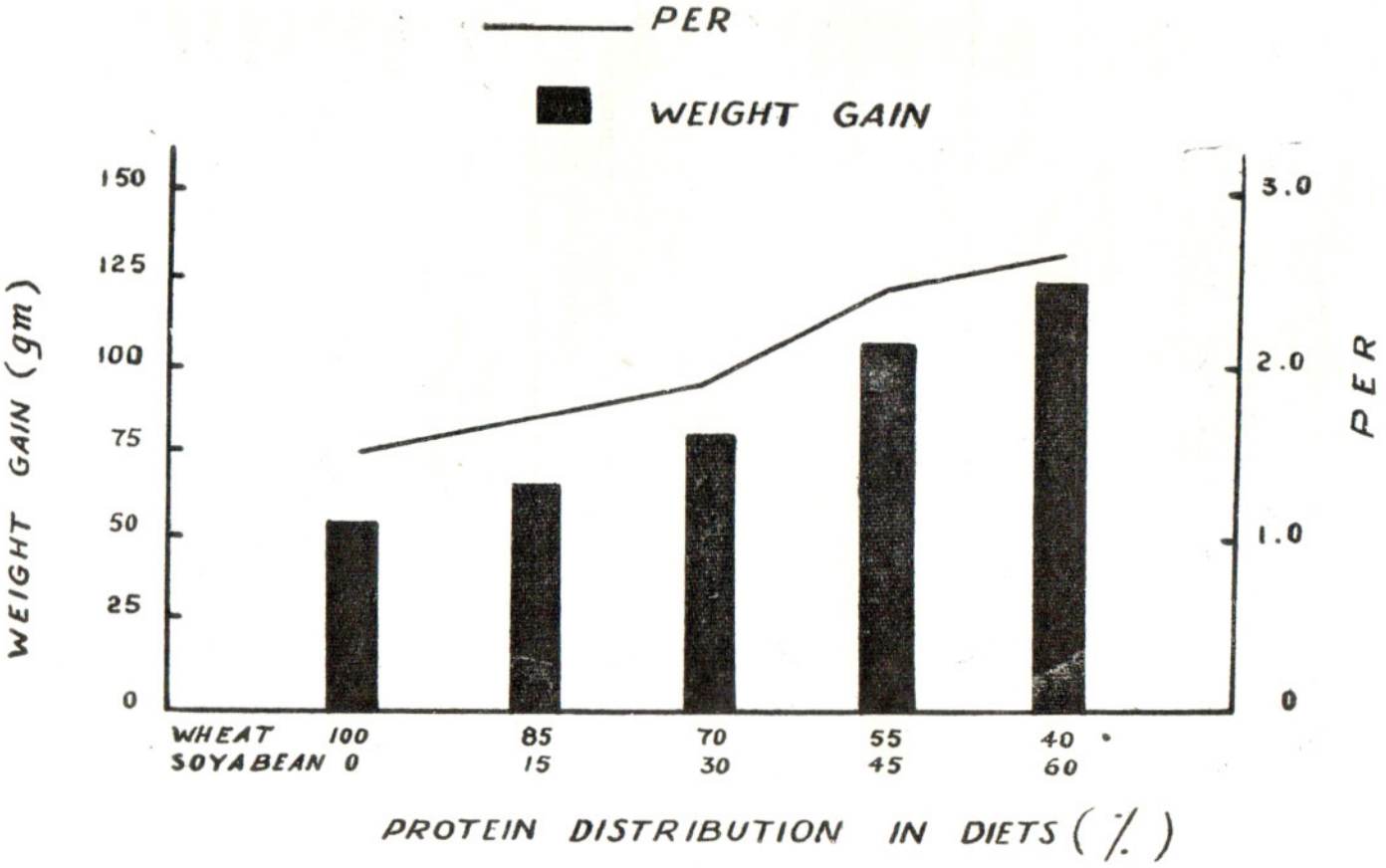

FIG. 1 NUTRITIVE VALUE OF VARIOUS COMBINATIONS OF WHEAT AND SOYABEAN

Weight Gain

The maximum gain in weight of 124 gm was observed in rats fed diet E that contributed 40 and 60 per cent wheat and soyflour protein respectively, whereas minimum gain in weight of 55 gm was noticed in case of rats fed diet A, based on wheat flour. The rats fed on supplemented diets D and E gained significantly ($P<0.05$) more weight than rats fed on diet A. There was no significant difference between the weight gains of rats fed diets A, B and C. The difference among gain in weight of groups fed diets D, E and F was found to be non-significant. It is evident from the results that the addition of soybean flour as a lysine source to the wheat flour improved the growth rates as compared to wheat flour alone and diets D (55 per cent wheat protein+45 per cent soybean protein) and E (40 per cent wheat protein +60 per cent soybean protein) were as good as casein for the growth of rats. The results are in line with the findings of Elias and Bressani (1974) who reported that 40 per cent wheat shorts and 80 per cent soy protein probably offered the best combination for improved growth in rats.

Protein Efficiency Ratio

The PER of diet A, based on wheat flour was 1.5 and it increased to 1.69, 1.94, 2.48 and 2.65 when supplemented with 3, 6, 9, and 12 per cent defatted soyflour, respectively. These values were significantly ($P<0.01$) higher than that of PER of basal diet A. Rats fed on diet F based on casein showed significantly ($P<0.01$) better protein efficiency ratio than all the diets whether supplemented with defatted soyflour or not. The protein efficiency ratio of wheat flour impoved significantly when 15, 30, 45, or 60 per cent of protein in wheat flour was replaced by soy protein and it increased with the increasing levels of soyflour in the diet.

True Disgestibility

The average digestibilities of diets A, B, C, D, E and F were found to be 85.8, 86.4, 84.6, 82.2, 81.7, and 95.8 per cent, respectively. Diet F based on casein had significantly ($P<0.01$) higher digestibility than all other diets. The digestibility of wheat flour did not change significantly when supplemented with 3 or 6 per cent defatted soyflour but it decreased significantly ($P<0.01$) when the level of soyflour in the diet was enhanced to 9 or 12 per cent. These results indicated that the digestibility was lowered as the percentage of soyflour increased in the diet.