

LEAF PROTEIN CONCENTRATE IN HUMAN DIET : Part II

F. H. SHAH, R. Z. TOOSY AND A. SALAM SHEIKH,

PCSIR Laboratories, Lahore-16

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Abstract. Leaf Protein Concentrate was incorporated into ten common Pakistani dishes including two varieties of the Peanut "maroonda". The dishes were evaluated organoleptically and analyzed for protein, lipid and fibre contents. Protein contents of these dishes increased up to 70.2% on fortification with Leaf Protein Concentrate (LPC). All these dishes were found acceptable.

Introduction

Animal protein foods have been, and are, being pushed to a higher cost plateau and are even now out of the reach of common man. Thus human beings will be forced to make transitions from animal food to the one in which plant proteins attain a greater degree of importance. The change from animal proteins to plant proteins should be gradual, smooth and in an orderly fashion and should be so done as to keep the food habits of the consumers in view.

Leaf Protein Concentrate (LPC) has been produced in bulk in Pakistan and Pakistani dishes were fortified with Leaf Protein Concentrate.¹ Leaf Protein Concentrates obtained from fodder crops, waste leaves and grasses have been incorporated in the normal cuisines in India,^{2, 3} Nigeria⁴ and Jamaica⁵. The amino-acid pattern of leaf proteins from various grasses is similar.⁶ The amino acid pattern of LPC supplies all essential amino-acids in quantities higher than the FAO (1965) provisional recommendation.⁷ In contrast with seed proteins these preparations are rich in lysine, and the average content is more than one and half times that of the FAO reference protein.⁷ LPC contains a considerable amount of lipids which are mostly with two or three double bonds.^{8, 9} These lipids provide energy and the essential fatty acids to the body. Intermediate Technology Services set up by the Government of Pakistan to assess the technico-economic feasibility of mini-plants in Pakistan recommended a large-scale production of LPC as technico-economically most feasible and estimated the price of LPC at Rs. 4-6/kg.¹⁰ Thus LPC would be one of the cheapest sources of good-quality protein, lipids, vitamins and minerals.⁶

The present investigations were undertaken to fortify some more dishes with LPC.

Materials and Methods

Protein was extracted using an IBP pulper and press^{11, 12} from *Cenchrus ciliaris*, *Chloris gayana*, *Cymbopogon jwarancusa*, *Dicanthium annulatum*,

Panicum antidotale and *Sorghum alnum* grown on experimental plots of the P.C.S.I.R. Laboratories, Lahore.

The method of proximate analysis was the same as reported elsewhere.¹ Organoleptic evaluation of the dishes was carried out by a panel of six experienced judges.¹³ Samples were independently graded by scaler scoring (0-10) for their appearance, texture, taste and flavour.

Recipes:

1. Chutney (mint sauce):

Sample A : Mint, 75 g.
Coriander green, 75 g.
Onion, 75 g.
Pomegranate seeds, 75 g.
Red chillies, 1 teaspoonful.
Salt, 1 teaspoonful

Sample B 100 g. of A + 15 g. LPC.

2. Corn "maroonda" (Corn snack) :

Sample A: Jaggery, 180 g.
Pop corn, 120 g.

Sample B 100 g of A + 7 g LPC

3. Doughnuts :

Sample A Wheat flour, 200 g.
Yeast, 7 g.
Milk, $\frac{1}{2}$ cup
Egg, 1
Sugar, 3.8 g.

Sample B: 100 g of A + 10 g LPC.

4. "Kachori" (Stuffed dough) :

Sample A: Wheat flour, 240 g.
Yeast, 7 g.
Milk, $\frac{1}{2}$ cup
Mashed potatoes, 100 g.
Egg, 1
Salt, 1 Tea spoonful
Red chillies, 1 Tea spoonful

Sample B: 100 g. of A + 10 g. LPC.

5. "Missi roti" (Spiced chapati) :
- Sample A; Gram flour, 200 g.
Wheat flour, 200 g.
Salt, 1 teaspoonful
Chillies, 1 teaSpoonful
Cumin seeds, $\frac{1}{2}$ teaSpoonful
- Sample B: 100 g. of A+6 g. LPC.
6. "Murmura":
- Sample A; Jaggery, 100 g.
Peanuts, 25 g.
Roasted gram, 25 g.
Puffed rice, 10 g.
- Sample B: 100 g. of A+7 g. of LPC.
7. Peanut "Maroonda" (Peanut snack):
- Sample A: Jaggery, 100 g.
Peanuts, 100 g.
- Sample B: 100 g. of A+7 g. LPC.
- Sample C: Jaggery, 120 g.
Peanuts, 40 g.
- Sample D: 100 g. of C+7 g. LPC.
8. Rice "Maroonda":
- Sample A: Puffed rice, 140 g.
Jaggery, 210 g.
- Sample B: 100 g. of A+7 g. LPC.
9. Spinach curry:
- Sample A: Spinach, 900 g.
Fenugreek, 100 g.
Salt, $\frac{1}{2}$ Tea Sp.
Chillies, $\frac{1}{2}$ Tea Sp.
Coriander powder, $\frac{1}{2}$ Tea spoonful
Fat, 200 g.
- Sample B: 100 g. of A+10 g. LPC.
10. Wheat "maroonda":
- Sample A: Jaggery, 210 g.
Puffed wheat, 140 g.
- Sample B: 100 g. of A+7 g. LPC.

Results and Discussions

Leaf protein concentrate was incorporated into ten dishes, including two varieties of the peanut "maroonda". Two of these dishes, spinach curry and "missi roti", are consumed as main dishes. The rest are consumed as food adjuncts and snacks.

Proximate analysis of ten dishes fortified with LPC is given in Table I. The maximum increase in protein content (70.2%) was observed in the case of chutney and the minimum (19.1%) in "missi roti". Chutney is a popular food adjunct and is relished by labourers, woman and children. Increase in protein contents of this foodstuff would help in increasing the supply of protein to those who need it the most.

"Missi roti" and spinach curry are consumed as main dishes in Pakistani homes. Fortification of these dishes with LPC increased their protein contents by 19.1 and 41.3% respectively.

Fortification of corn, rice and wheat "maroondas" resulted in an increase in the protein content by 53.0, 43.2 and 28.6% respectively. Two varieties of peanut "Maroonda" showed 26.3 and 47.4% increase in their protein contents. This variation was expected due to the difference in the recipes of these two varieties. Doughnuts, "kachori" and "murmura" showed variable increase (22.2-45.0%) in their protein contents on fortification with LPC.

TABLE I. PROXIMATE ANALYSIS OF LPC CONTAINING DISHES

| Sr. No. | Product | Protein (%) | Protein increase (%) | Fat (%) | Fibre (%) |
|---------|--------------------|-------------|----------------------|---------|-----------|
| 1. | Chutney A | 11.4 | — | 1.2 | 16.6 |
| | B | 19.4 | 70.2 | 1.1 | 15.9 |
| 2. | Corn "maroonda" A | 6.6 | — | 12.5 | 1.8 |
| | B | 10.1 | 53.0 | 12.1 | 1.6 |
| 3. | Doughnuts A | 9.0 | — | 17.0 | 3.0 |
| | B | 11.0 | 22.2 | 17.5 | 2.6 |
| 4. | Kachori A | 10.0 | — | 18.3 | 4.4 |
| | B | 14.5 | 45.0 | 16.5 | 4.0 |
| 5. | "Missi roti" A | 16.2 | — | 5.1 | 2.1 |
| | B | 19.3 | 19.1 | 5.2 | 2.2 |
| 6. | "Murmura" A | 10.0 | — | 9.9 | 7.3 |
| | B | 13.9 | 39.0 | 9.7 | 7.5 |
| 7. | Peanut (i) A | 11.4 | — | 26.6 | 7.7 |
| | "maroonda" B | 14.4 | 26.3 | 25.6 | 6.5 |
| | (ii) C | 7.8 | — | 24.5 | 3.4 |
| | D | 11.5 | 47.4 | 21.5 | 3.3 |
| 8. | Rice "maroonda" A | 4.4 | — | 0.9 | 8.1 |
| | B | 6.3 | 43.2 | 0.8 | 7.5 |
| 9. | Spinach curry A | 12.1 | — | 21.0 | 10.3 |
| | B | 17.1 | 41.3 | 20.0 | 9.9 |
| 10. | Wheat "maroonda" A | 7.7 | — | 3.0 | 7.7 |
| | B | 9.9 | 28.6 | 3.2 | 7.3 |

Rice, corn and peanut "maroondas" are very much liked by the children. The increase in protein contents of these foodstuffs varied between 26.3 and 53.0%. Thus the fortification of "maroondas" with LPC would partially be meeting the protein requirements of children. Singh¹⁴ showed that alfalfa protein was a good supplement for low lysine and low protein diets in children.

The fibre contents of most of these dishes were slightly reduced on fortification with LPC. The fibre content of the chutney was 16.6% (15.9% on fortification with LPC), which was more than the admissible limit in foodstuffs, but the amount of the produce consumed is so small that it would not affect the digestive system.

On fortification with LPC, a decrease in the retention of oil was observed in most of these dishes. A decrease in the retention of fat in textured protein extended beef patties have also been observed by Anderson and Lind.¹⁵

Byers *et. al.*¹⁶ and Morrison and Pirie¹⁷ have incorporated LPC in human food. Piris¹⁸ has shown an increase from 24.9 to 389.3% in LPC contents of various dishes on fortification with LPC.

Organoleptic Evaluation. Table 2 shows that foodstuffs fortified with LPC were acceptable. It is evident from these results that LPC can be incor-

TABLE 2. ORGANOLEPTIC EVALUATION OF LPC CONTAINING DISHES AND SNACKS

| Products | Appearance | Texture | Taste | Flavour | Increase in protein contents (%) |
|----------------------|------------|---------|-------|---------|----------------------------------|
| 1. Chutney | 6.8 | 8.0 | 8.3 | 8.3 | 70.2 |
| 2. Corn "maroonda" | 6.3 | 6.0 | 6.0 | 6.0 | 53.0 |
| 3. Doughnuts | 7.3 | 6.0 | 7.0 | 6.5 | 22.2 |
| 4. "Kachori" | 7.0 | 6.8 | 7.3 | 7.3 | 45.0 |
| 5. "Missi roti" | 6.0 | 6.5 | 7.8 | 6.5 | 19.1 |
| 6. "Murmura" | 8.8 | 8.8 | 8.3 | 8.0 | 39.0 |
| 7. Peanut "maroonda" | (i) 7.5 | 7.0 | 7.3 | 7.2 | 26.3 |
| | (ii) 8.3 | 8.3 | 7.8 | 7.0 | 47.4 |
| 8. Rice "maroonda" | 8.3 | 6.5 | 7.3 | 6.5 | 43.2 |
| 9. Spinach curry | 6.8 | 6.5 | 6.0 | 6.5 | 41.3 |
| 10. Wheat "maroonda" | 6.3 | 5.8 | 6.3 | 6.0 | 28.6 |

*Average of evaluation by six judges.

porated into Pakistani dishes without affecting their taste, texture, flavour or appearance. Texture and taste of most of the dishes improved and the fried dishes generally contained less fat and were crisp.

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