CHEMICAL AND BIOCHEMICAL EVALUATION OF SOME LOCAL FOODSTUFFS

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ABSTRACT

The nutrient and protein content of 15 local foodstuffs were chemically and biologically evaluated. Plant proteins were found to be inferior in quantity and quality especially in terms of their protein digestibility and amino acid utilization. These were attributed to such factors as presence of toxins, high fiber content and amino acid deficiency or imbalance. For better utilization, it was suggested that proper cooking be done to counteract the heat-correctable factors. The mixture of different proteins in the diet was also recommended to correct the amino acid deficiency or imbalance.

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INTRODUCTION

The quantitative need for food may be broadly divided into energy and protein sources. Energy foods like grains and tubers are easily and cheaply produced, while protein foods are often expensive.

It is known that people in developed and advanced countries eat more and better protein than those in underdeveloped countries (Orr, 1978). In the Philippines, nutritionists have been advocating for cheap plant proteins as meat substitutes. These can be used either as supplement or replacement to the protein requirements of an individual. This study therefore tried to assess the viability of this idea through chemical and biological analyses of 15 different local foodstuffs.

MATERIALS AND METHODS

Foodstuffs. — These were categorized into the following:

1. Marine sources: *dilis* (anchovy), green mussel.
2. Plant seeds: English pea *(Pisum sativum)*, soybean *(Glycine max)*, peanut *(Arachis hypogaea)*, winged bean *(Psophocarpus tetragonolobus)*, mungbean *(Vigna radia-*

ta), mungbean sprout.

3. Plant pods: Baguio bean or kidney bean *(Phaseolus vulgaris),* string bean *(Vigna sesquipedalis).*
4. Plant leaves: cane cabbage or leaves of sugar cane *(Saccharum officinarum),* cassava *(Manihot esculenta),* ipil-ipil *(Leucaena leucocephala).*

Preparation of Foodstuffs. — English pea, soybean, peanut, Baguio bean and cane cabbage were cooked before these were dried and ground for sampling. The rest were dried and ground raw.

Chemical Analysis. — The ground samples were weighed for proximate analysis (AOAC, 1975) and mineral (calcium and phosphorus) analysis. Calcium analysis was done using the permanganate method and phosphorus analysis using the phosphomolybdate method (Tetx, 1976).

Biological Analysis. — Each foodstuff was fortified with purified nutrients like coconut oil for fat, corn starch and sugar for soluble carbohydrates and cotton for fiber, with the protein in the foodstuff mainly supplying the protein. This produced a standard ration with the following nutrient compositions:

Soluble carbohydrates:	
starch	56
glucose	16
Oil or fat	10
Cellulose or fiber	8
Protein	8
Vitamin-mineral mixture	2
	100

Test Animals. — Weanling albino rats and mice were used for the biological analysis. Three animals were fed with each kind of foodstuff. The rats were given a 10-gram ration daily and water was made available all the time. They were individually placed in metabolism cages where urine and fecal matter were collected. The nitrogen content of the samples were analyzed after the experimental period of 5 days. True digestibility, biological value, net protein utilization and net protein value were then calculated.

True digestibility (TD) - proportion of the consumed protein that is digestible.

$$TD = \frac{\text{nitrogen consumed - fecal nitrogen}}{\text{nitrogen consumed}} \times 100$$

Biological value (BV) - proportion of the absorbed protein (amino acid) that is utilizable.

$$BV = \frac{\text{nitrogen digested - urinary nitrogen}}{\text{nitrogen digested}} \times 100$$

Net protein utilization (NPU) - proportion of the consumed protein that is utilizable.

$$NPU = BV \times TD$$

Net protein value (NPV) - proportion of the foodstuff protein that is utilizable.

NPV = NPU x crude protein

Proper corrections for metabolic fecal nitrogen and endogenous urinary nitrogen were made.

RESULTS AND DISCUSSION

Plant proteins were inferior not only in quantity but also in quality, especially in terms of their digestibility and utilization (Table 1). Two major factors which could have decreased the digestibility of proteins were the crude fiber content in the plant pods and the presence of toxic substances in ipil-ipil, winged bean and cassava. The crude fiber could trap the proteins while many toxic substances could inhibit the enzymatic digestion of these proteins, making them unavailable. For example, trypsin inhibitors in legumes (Liener, 1978; Payumo, 1978) make them doubtful protein sources when raw. However, such effects had been observed to be corrected by cooking.

The utilization of digested proteins could be influenced by the presence of some toxic substances or by the deficiency in the essential amino acid content of protein. Toxic substances could be amino acid analogues, like the mimosine of ipil-ipil which could antagonize the utilization of the real amino acids. Amino acid imbalance had been observed in mungbean which was found to be deficient in methionine (Tsou and Hsu, 1978; Payumo, 1978). Addition of this deficient amino acid was observed to greatly improve the mungbean protein quality (Gloria, 1980).

Based on the results of this study, the quality of plant proteins could not equal that of meat or marine proteins. Most plant proteins could not be made as the only

Table 1. Chemical and biological analyses of the nutrient composition of the dry matter of foodstuffs.

Foodstuff	Crude Fat	Fiber	Digestible Carbo-hydrate	Crude Protein	Protein Quality Evaluation			
					True Diges-tibility	Biological Value	Net Protein Utilization	Net Protein Value
Marine Source:								
1. *Dilis* (Anchovy).	5.84	0	5.09	77.62	87.50	94.18	83.22	64.59(1)
2. Green Mussel	22.55	0	24.81	49.87	92.90	93.15	87.38	43.58(2)
Seeds:								
1. English pea (cooked)	2.64	4.11	64.04	26.75	88.93	84.15	74.85	20.02
2. Soybean (cooked)	24.97	10.19	11.36	47.89	94.81	77.02	72.99	34.96
3. Peanut (cooked)	52.18	13.86	15.26	16.12	78.69	43.99	34.56	5.57
4. Winged bean (raw)	22.27	8.16	30.11	33.62	58.30	47.59	27.23	9.16
5. Mungbean (raw)	2.14	8.70	59.77	24.90	89.01	75.76	68.11	16.96
6. Mungbean sprout (raw)	2.53	16.20	45.18	31.35	83.82	80.18	66.24	20.77
Pods:								
1. Baguio bean (cooked)	2.03	28.76	44.48	20.10	64.44	78.01	50.32	10.11
2. String bean (raw)	3.91	23.60	41.02	25.68	69.73	79.51	55.26	14.19
Leaves:								
1. Cane cabbage (cooked)	1.94	13.58	62.47	12.71	72.94	73.09	53.31	6.78
2. Cane cabbage (raw)	2.12	13.20	61.72	12.98	70.75	72.51	51.31	6.66
3. Cassava leafmeal	5.42	11.69	53.44	21.98	51.29	79.55	40.93	9.00
4. Ipil-ipil leafmeal	5.27	9.56	51.72	24.24	48.17	55.50	26.65	6.46

protein source in the diet. Hence, it is suggested that these should be mixed with other proteins to correct the amino acid deficiency or imbalance. These should also be properly cooked to counteract the effects of their toxic substances. The above results strongly indicate that it is necessary to conduct a detailed study on the proper utilization of plant proteins and other possible protein sources.

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