EFFECT OF DIFFERENT TREATMENTS ON THE REMOVAL OF HYDROCYANIC ACID FROM THE BURMA BEAN (*PHASEOLUS LUNATUS* LINN.)

THE existence of a cyanogenetic glucoside in the Burma bean (also known as the Rangoon bean or the Java bean) has long been known and different methods for the removal of the hydrocyanic acid have also been suggested.[1-10] These methods are generally based on the water-solubility of the glucoside and its removal on prolonged soaking in water. Such a procedure also involves loss of dry matter (15-25 per cent.), discolouration, and cracking of the skin on drying. The bean absorbs its own weight of water and the evaporation of that quantity also becomes expensive. Other methods of treatment are also possible by (i) changing the composition of the steep water, (ii) facilitating conditions for interaction between the glucoside and the enzyme present in the bean followed by drying, (iii) prolonged cooking for not less than two hours which removes most of the hydrocyanic acid, (iv) strong heating to destroy the enzyme and (v) still stronger heating (at about 250°C.) to decompose the glucoside. Recently, steeping in presence of sulphur dioxide (as in starch manufacture) or dilute ammonia has been recommended. Interaction between the enzyme and the glucoside takes place in presence of water and, in fact, that procedure forms the basis for the quantitative release of HCN for the estimation. Heating of the dry bean at 120°-150° C. for about ten minutes destroys most of the enzyme, while frying in oil or fat (as for any food preparation) decomposes the glucoside. The human consumer invariably cooks the food, while the animal is fed with the bean or bean-meal, generally, in the raw state. Minute quantities of hydrocyanic acid are harmless and in fact, 2·4-6 mg. is the medicinal dose for certain disorders. 50-80 mg. is stated to be the lethal dose for human subjects. As cases of poisoning have been recently reported, all these factors have to be taken into account when determining the cheapest and the most efficient procedure for treatment.

The Burma bean is now marketed as four distinct varieties: (i) the Double White (Butter bean) variety which we have found to contain 90-160 parts per million (p.p.m.) as HCN; (ii) the single white variety containing 100-300 p.p.m.; (iii) the chocolate brown (Sultani) variety containing 90-140 p.p.m.; and (iv) the speckled variety, 150-350 p.p.m. Some samples of the 'single' white variety are reported to contain over 500 p.p.m. The cases of poisoning recently reported have been mostly traced to the consumption of the single white and the speckled varieties. In actual practice, the two white and the two coloured varieties are likely to get mixed, so that any method proposed should be applicable to even the variety with the maximum hydrocyanic acid content.

Our observations have shown that moistening of the whole bean with 15-50 per cent. water, standing overnight and then sun-drying causes a drop of about 20 per cent. HCN though occasionally higher figures have been obtained. The dry bean when heated for 10-15 minutes at 120° loses about 25 per cent. of the glucoside HCN and practically no free HCN is formed on steeping or cooking in water as the enzyme is destroyed by the previous heating. We have yet no evidence to show that the residual glucoside will not react with the body secretions to form any free HCN.

On making the bean into a flour and then moistening it, the reaction between the enzyme and the glucoside proceeds fairly rapidly. The following were some of the results obtained after moistening the flour, drying it in the open and then cooking the flour with water for 20 minutes.

TABLE I

Variety of bean	Percentage of water added to flour	Hydrocyanic acid content (in p.p.m.)		
		Fresh bean	Wetted and dried flour	Wetted and dried flour after cooking
Single white ..	25	300	69·7	23·8
	50		23·7	22·0
Double white (butter bean)	50	160	48·1	12·0
Chocolate bean (Sultani)	25	140	..	10·3
	50		29·2	2·2

The results show that the moistening of the flour followed by drying offers a potent method of removing most of the free and combined HCN. As cooking will remove further quantity and as flour has got to be cooked for human consumption, this procedure offers definite practical possibilities. The actual working details for large-scale application have, however, got to be worked out.

As moistening and cooking are important factors in the removal of HCN, and as these are invariably employed in the preparation of food, some experiments were carried out with the raw (untreated) flour (passing 20-mesh sieve) prepared out of the Double White (Butter bean) variety containing 160 p.p.m. of HCN, using it in the same way as any other flour for a number of food preparations. The latter were analysed for their HCN contents. Calculations of the quantities of food preparations required for consuming the tonic (medicinal) and the toxic dose were also made. Consumer tests were also carrid out on the preparations made out of Bengal gram, black gram or wheat as the case may be.

It may be noted that the oil-fried preparations contained absolutely no HCN while the others contained only very small quantities. In all the cases, it would be physically impossible to eat such large quantities to reach the toxic dose. The consumer tests also showed that the