IDENTIFICATION OF FLATULENCE FACTORS IN SOME PULSES

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PULSES constitute an important part in the Indian dietary but they are known to cause flatulence—uneasiness due to formation of gas in the intestines or stomach. Taeufeul *et al.*[1] suspected sugar playing a part in flatus (gas) formation. But, later on Steggerda *et al.*[2] identified galacto-oligosaccharides—raffinose, stachyose and verbascose, etc., with the gas producing factors present in soybean. These sugars reach the intestines undigested since alpha-galactosidase is not present in the human digestive system. Their assimulation by intestinal flora is accompanied with gas[3–5]. Kawamura and Minora[6] reported variation in gas production due to alteration in oligosaccharide content of the foods.

Keeping in view the flatulent nature of the pulses, the galacto-oligosaccharide content of the three pulses —green gram (*Phaseolus aureus*), black gram (*Phaseolus mungo*) and lentil (*Lens culinoris*)—has been determined.

Experimental

One gram of the powdered pulse was extracted five times with 15 ml each of 50% ethanol on a rotary shaker. The combined extract was deproteinized with lead acetate and centrifuged at 10000 rpm for 10 min. The total carbohydrate content of this acid was determined by the method of Dubois[7].

The concentrated sugar extracts along with standards —sucrose, raffinose and stachyose solutions separately —were loaded on Whatman No. 1 filter paper size 25 × 30 cm. The spots were separated by descending chromatography conducted for 22 hr using solvent system containing propanol, ethyl acetate and water in 7:1:2 v/v ratio. The finished chromatogram was treated with Bailey's Reagent[8] for identification of spots. For quantitative estimation of each oligosaccharide, the untreated spots were eluted with 10 ml distilled water and analysed by Dubois method[7].

Results and Discussion

In all the three pulses four oligosaccharides were detected. Three of these were identified as sucrose, raffinose and stachyose, respectively. The fourth one was identified as verbascose on the basis of its R_f value and its proximity with stachyose spot on the chromatogram. As verbascose lies next to stachyose in the homologous series of galacto-oligosaccharides the inference is justified. The concentrations of oligosaccharides in each of the pulses are shown in Table I.

TABLE I

Oligosaccharide content of different pulses

Sugar	Name of pulse		
	Green gram (*Phaseolus aureus*)	Black gram (*Phaseolus mungo*)	Lentil (*Lens culinoris*)
Sucrose	1·16	1·24	0·78
Raffinose	2·31	1·29	1·03
Stachyose (S)	1·26	3·03	2·02
Verbascose (V)	++	++	++
S + V	3·57	4·32	3·05

As sucrose does not affect the flatulent nature of the pulses the flatus producing capacity can be related with the sum of concentrations of raffinose and stachyose. Therefore, these pulses should cause discomfort due to gas production in the following order:

black gram > green gram > lentil.

This result is borne by the common observation that black gram is the most flatulent pulse and green gram and lentil are easily digestible.

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1. Taeufeul, K., Krause, W., Ruttloff, H. and Maurie, R., *Z. Gasanato. Expt. Med. Einschl. Exp. Chir.*, 1967, **144**, 54.
2. Steggerda, F. R., Shimizu, T. and Anderson, J., *J. Food. Sci.*, 1970, **35**, 634.
3. Theodor and Rosebury, *Microorganisms Indigenous to Man*, McGraw-Hill Book Co., New York, 1962.
4. Eggerth, H. A. and Gagnon, H. B., *J. Bacteriol*, 1933, **25**, 384.
5. Richard, E. A. and Steggerda, F. R., *Proc. Soc. Exp. Biol. Med.*, 1966, **122**, 573.
6. Kawamura, S. and Minora, T., *Evivo To Sho Kuryo*, 1956, **18**, 268.
7. Dubois, M., *Anal. Chem.*, 1956, **28**, 350.
8. Bailey, R. W. and Bourne, E. J., *J. Chromatogr.*, 1960, **4**, 206.