

## The Contents of Phytic Acid in Protein Concentrates Prepared from Nigerseed, Sunflower Seed, Rapeseed and Poppy Seed

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### ABSTRACT

The contents of phytic acid were determined for protein-rich flours and protein concentrates prepared from nigerseed, sunflower seed, rapeseed and poppy seed. The values ranged from 6.89 to 8.80 mg phytate-P per g of fat free weight. This means that the phytate content of the analysed oilseed flours was at least about 4 times higher than the phytate content of common grain cereals. The precipitation of extracted phytic acid with trivalent Fe was an important step in the analytical procedure. The Fe : P mole ratios of the precipitates from the different oilseeds were lower than the corresponding ratios previously reported for cereal materials.

### INTRODUCTION

It is well known that a relatively large part of the phosphorus in many vegetable food products is present as phytin, the Ca-Mg salt of phytic acid. Evidence that phytic acid interferes with the calcium absorption in dogs and humans was published several years ago (1, 2). This compound has also been reported to reduce the availability of dietary zinc (3). On the whole, however, the nutritional significance of phytate remains unresolved and the relevance to man is uncertain.

Nevertheless, it is important to determine the levels of phytic acid present in food-stuffs in order that it might be possible to adjust the dietary mineral supplies in relation to the phytate contents.

In the present investigation the amounts of phytic acid in protein-rich flours and protein concentrates prepared from nigerseed, sunflower seed, rapeseed and poppy seed were established.

### MATERIALS AND METHODS

Niger seeds (*Guizotia abyssinica* Cass.) were sent by air from the Ethiopian Nutrition Institute, Addis Ababa. Winter rapeseeds (*Brassica napus* L., Sinus variety) were

purchased from Mälardalens Lantmannaförbund, Uppsala. Sunflower seeds (*Helianthus annuus* L.) and poppy seeds (*Papaver somniferum* L., blue variety) were obtained from Weibull, Inc., Landskrona.

The protein concentrates and press-cake flour, respectively, were prepared as described previously (4, 5, 6, 7).

Phytic acid was analysed by the method proposed by Wheeler & Ferrel (8), by extracting the samples with 3% TCA and determining quantitatively the amount of Fe<sup>+++</sup> which precipitated the extracted phytic acid. The iron content was measured by the method given in the same paper (8). The phosphorus content of the precipitate was determined after dissolving the precipitate in alkaline water. Phosphorus was analysed according to Fiske & Subbarow (9) after perchloric acid digestion as described by McCance & Widdowson (10).

Sodium phytate (inositol hexaphosphoric acid, sodium salt; C<sub>6</sub>H<sub>6</sub>(OPO<sub>3</sub>Na<sub>2</sub>)<sub>6</sub>+H<sub>2</sub>O) was purchased from BDH Biochemicals and used as a control in the phytic acid assay method.

### RESULTS AND DISCUSSION

As shown in Table I, the values obtained for phytate-phosphorus were 6.89 mg/g in the rapeseed protein concentrate (calculated on fat-free weight), 8.80 mg/g in the sunflower seed lipid-protein concentrate, 8.35 mg/g in nigerseed lipid-protein concentrate and 8.08 mg/g in poppy seed press-cake flour. The variation in phytate content between the different oil-seed products was remarkably small. The amount of phytate in these materials are very high in comparison with various whole grain cereals such as wheat, corn and barley which contain about 1-2.5 mg/g of phytate (8). The phytate-phosphorus accounted for 30.4, 45.6, 51.1 and 52.7% of the total phosphorus content in nigerseed, rapeseed, poppy seed and sunflower seed protein concentrates, respectively.

Previous studies on cereal products have indicated that the most probable phytate salt formed

Table I. Contents of phytate-P in protein concentrates prepared from some oilseeds. Analysis of pure sodium phytate is included as a methodological control

Material	Preparation method in ref. no.	Fe ( $\mu\text{M/g}$ ) <sup>a</sup>	P ( $\mu\text{M/g}$ ) <sup>a</sup>	Fe : P mole ratio	Total content of P (mg/g) <sup>a</sup>	Phytate-P	
						mg/g <sup>a</sup>	% of total P
Rapeseed, protein concentrate	6	94.1	222.5	2.54 : 6	15.1	6.89	45.6
Sunflower seed, lipid-protein concentrate	5	115.3	284.1	2.44 : 6	16.7	8.80	52.7
Nigerseed, lipid-protein concentrate	4	114.4	269.5	2.55 : 6	27.5	8.35	30.4
Poppy seed, press-cake flour	7	110.8	260.8	2.55 : 6	15.8	8.08	51.1
Sodium phytate	—	3 825.4	6 295.4	3.65 : 6	195.0	195.0	100.0

<sup>a</sup> Calculated on fat-free weight.

during precipitation with trivalent Fe is  $\text{Fe}_4$ -phytate (8). This is in accordance with a Fe : P mole ratio for whole grain cereals close to 4 : 6 which has been reported by Wheeler & Ferrel (8). The Fe : P mole ratio obtained with pure sodium phytate was only slightly less than 4 : 6 (3.65 : 6). In contrast, the Fe : P mole ratios obtained in the analyses of the oilseed products were considerably lower, ranging from 2.44 : 6 to 2.55 : 6. The reason for this difference in relation to cereal materials, is not clear. Of course it is important to be aware of this variation in the Fe : P mole ratio when calculations of the phytate content of different seed materials are made using the  $\text{Fe}^{+++}$ -precipitation method proposed by Wheeler & Ferrel (8).

It is also important to investigate further the nutritional significance of the high levels of phytate present in the oilseed protein concentrates.

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