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The Phytic Acid Content of Wheat Flour and Major Types of Bread Consumed in Kuwait

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ABSTRACT

*The content of phytate in wheat flour (*Triticum aestivam*) used in the preparation of Pita and other types of bread in the State of Kuwait was determined by an ion-exchange procedure. The phytate content in the wheat flour samples varied according to the extraction rates. A significant decrease of phytate content was noticed in all types of bread when compared to its corresponding wheat flour.*

INTRODUCTION

Phytic acid (inositolhexaphosphoric acid) is a naturally-occurring organic substance known to have chelating properties and to form strong complexes with some nutrient mineral cations, reducing their bioavailability (O'Dell & Savage, 1960; Oberleas *et al.*, 1979; Nolan & Duffin, 1987). The first major effort to measure the phytate content in food was by Averill and King (1926). Since then, various efforts were made to measure the phytate content in

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different agricultural commodities (McCance & Widdowson, 1935; Oke, 1965; Lolas *et al.*, 1976). Measurement of the phytate content of plant foods is important since, in the human organism, deficiency in calcium, zinc and iron are associated with the consumption of diets known to be high in phytate (Davies, 1979).

The present study was carried out to determine phytate content of various types of wheat flour and the major types of pita and other types of bread, considered as among the most staple food items in the State of Kuwait.

MATERIALS AND METHODS

Samples

Six samples of each type of flour; namely, grade (F20) flour, extraction rate (ER) 95%, grade (F30) flour, ER 91% and grade (F40) flour ER 78% were purchased from six different local shops. Similarly, six samples of each pita bread; namely, White Pita Bread (WPB), Brown Pita Bread (BPB) and Extra Bran Pita Bread (EBPB), produced by the Kuwait Bakeries Co. were purchased from local shops in a 1 month period. Due to the high variation in mixing (1:1 & 1:2 F20:F40, respectively) the flours used for Tanouri Bread (TB), Tanouri Flour (TF) and TB samples were collected from six different Tanouri bakeries representing different areas of the State of Kuwait. After drying, the samples were wrapped in polyethylene bags and kept at 5°C.

Bread samples were dried in a vacuum oven (Laboratory Thermal Equipment Co. Model L3801-1) to a constant weight at 70°C. Bread samples after drying were ground using a coffee mill (Model 105, SEB Co.).

All chemicals were of Analar grade. Ferric chloride (anhydrous >98% RT) and sulfosalicylic acid were purchased from the Fluka Co. Phytic acid (inositolhexaphosphoric acid from rice) dodeca-sodium salt was purchased from the Sigma Chemical Co. Dowex-1 (Chloride form anion-exchange resin) was purchased from QC Lab. Inc. Glass double-distilled water was used and all the glassware was washed with chromic acid and thoroughly rinsed with distilled water before use.

Method of analysis

Five grammes of the dried samples was extracted for 1 h at room temperature using a magnetic stirrer in 100 ml 0·667N HCl. The extract was filtered under vacuum and kept at 5°C. Phytate content in the extract was determined by the ion-exchange method of Hartland and Oberleas (1977). The sample acid filtrate was diluted (1:4 v/v) with water and 10 ml were

passed through a column (0·7 × 15 cm) packed with 0·5 g of 100–200 mesh Dowex-1 resin at a flow rate of 0·4 ml/min, followed by washing the column with 15 ml of water. The inorganic phosphates were removed by passing 10 ml 0·1M NaCl solution. Finally, phytic acid was eluted with 10 ml of 0·7M NaCl solution.

Phytic acid in the eluates was determined by the method of Latta and Erskin (1980). One millilitre of Wade's reagent (0·03 g $FeCl_3$ and 0·3 g sulfosalicylic acid in water) was added to 3 ml of the sample and mixed on a vortex mixer for 10 sec. The absorption at 500 nm was measured against water in a double beam spectrophotometer (Perkin-Elmer, Model 552).

The concentration of phytic acid in the sample was obtained from the standard curve obtained from serial dilutions (in triplicate) of phytic acid.

RESULTS AND DISCUSSION

Phytate contents in wheat flour used in preparation of different types of bread consumed in Kuwait are shown in Table 1. In wheat flour, the highest concentration of phytic acid was found in type F20 flour (ER 95%), while type F40 (ER 78%) had the lowest levels. The results indicated that the concentration of phytic acid decreased as the rate of extraction decreased. This is in agreement with reports that phytates are located in the outer layer

TABLE 1
Phytic Acid Content in Wheat Flour and Major Bread Types Consumed in Kuwait

Item Arabic name		*Flour extraction rate (ER) %*	*Phytate content (mg/100 g)*[a]	
			Dry basis ± SE	*Fresh basis ± SE*
Wheat flour				
Tahin Sefrain	(20)	95	1 063 ± 9	930 ± 10
Tahin Talata Sefer	(30)	91	798 ± 3	695 ± 4
Tahin Arba'a Sefer	(40)	78	238 ± 8	208 ± 10
Tahin Tanouri	(TF)	86–89	738 ± 5	646 ± 6
Bread				
Khoboz Abyed Arabi	(WPB)	78	33 ± 5	23 ± 1
Khoboz Asmer Arabi	(BPB)	95	696 ± 2	487 ± 3
Khoboz Asmer Belnokhalla	(EBPB)	95[b]	1 045 ± 5	732 ± 7
Khoboz Tanouri	(TB)	86–89	625 ± 2	431 ± 2

[a] Mean of six determinations.
[b] Made by addition of 7% (w/w) wheat bran to ER 95 flour.

of the grain in high concentration (4–5 fold compared to the endosperm) (O'Dell *et al.*, 1972).

A significant decrease ($P < 0{\cdot}05$) in phytic acid content was noticed in all types of bread when compared to the corresponding wheat flour. EBPB, BPB and TB which are made from extra bran, whole and semi-bran wheat, exhibited a higher phytic acid level than WPB. Lolas *et al.* (1976) reported similar results in food, which contained wheat bran or whole wheat. In TB (made from TF) a 15% reduction in phytic acid was noticed; BPB (made from F20) showed a reduction of about 40% in phytic acid while a reduction of about 78% was found in WPB (made from F40). These variations in phytic acid reduction among bread types may be due to differences in fermentation time and baking temperature (Ronhotra *et al.*, 1974). However, de Lang *et al.* (1961) showed that hydrolysis of phytate is much more effective in bread made from 80% extraction rate than in breads made from 90 or 100% extraction rate.

The results presented in this study suggest fairly high levels of phytic acid in wheat flour and various bread types, except WPB. Eid and Bouresly (1986) reported that the average bread consumption in Kuwait was 277 g/capita/day and one-third of the population are consuming TB, BPB and EBPB as staple items in their diets. In simple calculations from Table 1, it appears that about one-third of the population of Kuwait ingested 1·4–2·1 g of phytic acid per day. In view of the reported decrease in the bioavailability of some nutrient mineral elements by phytic acid, it may be useful to study the effectiveness of measures which reduce the phytic acid content of bread, such as use of low extraction rate flour, longer time of yeast fermentation and the addition of phytase to wheat flour (Ronhotra, 1973; Ronhotra & Loewe, 1975).

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