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The Proximate and Elemental Composition of Wheat Flour and Major Types of Bread Consumed in Kuwait

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ABSTRACT

*The proximate compositions of major types of pita bread and the wheat flour (*Triticum aestivum*) used in the preparation of the major types of bread in Kuwait were determined. A significant loss in fat content ($P < 0.01$) was noted in all types of bread when compared to the corresponding wheat flour. Ash percentage was higher in bread than in the flour.*

The contents of zinc, copper, manganese, calcium, magnesium and iron were determined in bread and wheat flour. In general, significant losses ($P < 0.05$) in most of the minerals were found in bread, when compared to wheat flour.

INTRODUCTION

Bread is a staple food item in the Middle East including the Arabian Gulf countries. In Kuwait, the average daily bread consumption is 277 g per capita (Eid & Bouresly, 1986*a*). This amount supplies one-third of the energy and one half of the protein requirements (Eid & Bouresly, 1986*b*). Wheat is not commercially produced in Kuwait in spite of efforts by the Kuwaiti

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authorities. Therefore, all the wheat grain requirement (180 thousand metric tons in 1988) is imported, mainly from Saudi Arabia and Australia.

Three types of wheat flour; namely, flour 00 (F20) flour 000 (F30) and flour 0000 (F40) are produced by the Kuwait Flour Mills with extraction rates (ER) of 95, 90 and 78%, respectively. These three types of wheat flour are used by the Kuwait Bakery Co. and other smaller bakeries to produce all the pita bread available in Kuwait. White pita bread (WPB) is made from type F40, brown pita bread (BPB) is made from F20 flour, while extra bran pita bread (EBPB) is made by adding bran to type F20 flour during baking. These three types of pita bread represent 54% of the total bread consumed in Kuwait. The F30 type of flour is commonly used at household level in preparing some local pastries as well as a common bread type (Rougag). The Irani or Tanouri bread (TB) represents an additional 27% of the total bread consumption in Kuwait (Eid & Bouresly, 1986*b*). Tanouri bread is made from mixtures of F20 and F40 flours usually at a ratio of 1:1; however, a ratio as low as 1:2 may occasionally be used.

Few published studies have dealt with the nutrient composition of wheat flour and bread in Kuwait. Eid and Bouresly (1986*a*) suggested levels for fortification of flour with certain micronutrients. The same workers (Eid & Bouresly, 1986*b*) carried out a statistical study on bread consumption in the State of Kuwait.

The objective of this study was to determine the proximate and elemental composition of the main types of flour and bread produced in Kuwait.

MATERIALS AND METHODS

Six samples of each type of flour; namely, F20, F30 and F40 were purchased from six different local shops. Similarly, six samples of each WPB, BPB and EBPB produced by the Kuwait Bakeries Co. were purchased from local shops in a 1 month period. Due to the high variability in mixing the flour used for TB manufacture, Tanouri flour (TF) and TB were collected from six different Iranian bakeries representing different areas of the State of Kuwait. After determining the moisture content, the samples were wrapped in polyethylene bags and kept at 5°C for further analysis.

All chemicals and solvents used were AnalaR grade, purchased from BDH Chemicals. Glass double-distilled, deionized water was used in the determination of the mineral elements.

Methods of analysis

The methods used in this study were those recommended by the Association of Official Analytical Chemists (AOAC, 1980) i.e. crude protein (N × 5·7), by

the micro-kjeldahl method (Digestion System 20 Model 1015 and Kjeltec Auto Analyser Model 1030, Tecator Co.) and crude fibre by calculating the loss in weight of the dried residue remaining after digestion of a fat-free sample with 0·128M H_2SO_4 and 0·223M NaOH under specified conditions (Fibro Tech System, Model 1010 HE, Tecator Co.). Moisture content (flour samples) was by using the Moisture System Model 6010 GP, Tecator Co.). Moisture content (bread samples) was by the oven-drying method (105°C for 6 h). Ash was by incineration of samples in a muffle furnace (Gallenkamp size 1) at 550°C for 16 h. Crude lipids was by exhaustive extraction of a known weight of dried sample with diethyl ether (Soxtec System HT MOdel 1043, Tecator Co.). Salt (NaCl) was by using Volhards method (Pearson, 1976).

For the determination of the micro mineral element content (Zn, Cu, Mn, Ca, and Fe) the ash was dissolved in 25% HCl. The final diluted solution for Ca and Mg contained 20% Lanthanum Oxide (5·865% w/v in H_2O) in order to overcome interference caused by other elements (*Standard Methods for the Examination of Water and Waste Water*, 1975). All mineral elements were determined by using air–acetylene flame Atomic Absorption Spectrophotometry (Model Spectro AA 30, Varian Co).

The statistical analyses were performed using the Computer Program SPSS (Statistical Package for Social Science, SPSS, Inc. Chicago, IL).

RESULTS AND DISCUSSION

The proximate and mineral element compositions of four types of wheat flour used in the preparation of the bread consumed in Kuwait are shown in Table 1. The moisture contents of the different types of flour were similar. However, the other components (except NFE) decreased as the ER was reduced. The sample variability was low; therefore, small inter-sample differences were statistically significant ($P < 0·05$). The ash, lipids, protein and crude fibre content of the F20 type was higher than the corresponding values reported by the FAO (1972) for 93% ER flour. Type F40 flour showed ash, lipids and crude fibre contents similar to 80% ER flour reported by FAO (1972). These differences may be due to differences in wheat varieties or in agricultural practices (Ghanbari & Mameesh, 1971). The mineral element content in wheat flour decreased ($P < 0·05$) as the ER was reduced, especially in type F40 flour. The calcium and iron contents in the flour samples analysed were higher than corresponding values reported by FAO (1972).

The proximate and mineral element compositions of the major types of bread consumed in Kuwait are presented in Table 2. The moisture contents

TABLE 1
Proximate and Mineral Element Composition of Wheat Flour Used for Bread-Making in Kuwait

Flour type	*F20*	*F30*	*F40*	*TF*	*FAO (1972)*	
Extraction rate (%)	*95*	*90*	*78*	*(83–87)*	*80*	*90*
I. Proximate composition (g/100 g)						
Moisture	12·5 ± 0·1	12·6 ± 0·08	12·6 ± 0·1	12·6 ± 0·1	12·0	12·0
Ash	1·44 ± 0·01	1·12 ± 0·01	0·56 ± 0·01	1·09 ± 0·05	0·6	1·3
Crude lipid	2·07 ± 0·08	1·85 ± 0·08	1·34 ± 0·02	1·74 ± 0·06	1·4	1·7
C. protein	12·10 ± 0·1	11·7 ± 0·1	11·5 ± 0·1	11·9 ± 0·1	9·0	8·9
C. fibre[a]	1·89 ± 0·01	1·21 ± 0·01	0·31 ± 0·01	1·23 ± 0·01	0·4	1·6
NFE[b]	70·00	71·52	73·69	71·44	76·6	74·5
II. Mineral elements (mg/100 g)						
Calcium	47·8 ± 2·1	44·0 ± 1·3	27·4 ± 1·1	38·6 ± 2·5	18	31
Magnesium	133·0 ± 6·9	120·0 ± 5·6	59·0 ± 1·9	102·0 ± 6·6	—	—
Iron	2·93 ± 0·04	2·39 ± 0·09	10·01 ± 0·04	2·14 ± 0·22	1·2	2·5
Copper	0·36 ± 0·02	0·22 ± 0·01	0·13 ± 0·01	0·20 ± 0·01	—	—
Manganse	1·03 ± 0·01	0·82 ± 0·05	0·25 ± 0·01	1·68 ± 0·05	—	—
Zinc	2·77 ± 0·02	2·22 ± 0·03	0·93 ± 0·03	1·83 ± 0·07	—	—

Values are mean of six determinations ± SEM.
[a] Mean of two determinations.
[b] NFE (Nitrogen-free extract) determined by difference.

of the different types of bread were similar and complied with the Kuwaiti standard specifications (1988). All other components, except NFE, were elevated as the bran content of bread increased. The ash, protein and crude fibre contents in BPB presented in Table 2 were higher than those reported by FAO (1972) for wholemeal bread (DB). However, only the ash content in WPB was found to be higher than that reported by FAO (1972). In bread, the lipid content was lower and the ash content was higher ($P < 0{\cdot}01$) than the corresponding wheat flour, possibly due to the addition of salt (NaCl) to the dough. The calcium and iron contents of BPB were higher than values reported by FAO (1972) for wholemeal bread (DB) whereas the calcium and iron contents of WPB were lower than values reported by FAO (1972).

The data presented in this study include estimates of variability between different market samples of flour and pita bread as well as a more complete mineral element composition, including zinc, copper, manganese and magnesium, than reported in previous studies (FAO, 1972; Khatchadourian *et al.*, 1985; Eid & Bouresly, 1986*a*,*b*; Musaiger *et al.*, 1988). Furthermore, the nutrient compositions of the different types of bread are important for

TABLE 2
Proximate and Mineral Element Composition of the Major Types of Bread Consumed in Kuwait

Bread type	*F20*	*F30*	*F40*	*TF*	*FAO (1972)*	
Extraction rate (%)	*95*	*90*	*78*	*(83–87)*	*80*	*90*
I. Proximate Composition (g/100 g)						
Moisture	30·3 ± 0·6	29·2 ± 0·3	29·3 ± 0·5	31·0 ± 0·5	31·6	33·8
Ash	2·74 ± 0·08	2·34 ± 0·02	1·98 ± 0·01	1·58 ± 0·03	1·1	1·1
Crude lipid	0·47 ± 0·06	0·27 ± 0·01	0·31 ± 0·01	0·29 ± 0·01	1·2	0·8
C. protein	9·5 ± 0·08	9·2 ± 0·04	8·2 ± 0·05	8·6 ± 0·17	8·8	8·4
C. fibre[a]	2·8 ± 0·01	1·6 ± 0·01	0·42 ± 0·01	1·31 ± 0·01	0·4	0·4
NFE[b]	54·19	57·39	59·79	57·22	56·9	55·5
II. Mineral elements (mg/100 g)						
Calcium	33·8 ± 1·6	29·8 ± 0·5	15·9 ± 0·4	31·4 ± 2·4	18	16
Magnesium	130·9 ± 2·7	100·0 ± 5·6	34·4 ± 0·6	72·8 ± 0·7	—	—
Iron	3·0 ± 0·05	1·98 ± 0·03	0·08 ± 0·02	1·44 ± 0·04	1·0	1·6
Copper	0·30 ± 0·01	0·22 ± 0·01	0·1 ± 0·01	0·17 ± 0·01	—	—
Manganese	1·02 ± 0·01	0·69 ± 0·01	0·2 ± 0·01	1·51 ± 0·01	—	—
Zinc	2·9 ± 0·06	2·1 ± 0·09	0·81 ± 0·02	1·46 ± 0·03	—	—
NaCl	1·07	1·12	1·29	0·42	—	—

Values are mean of six determinations ± SEM.
[a] Mean of two determinations.
[b] NFE (Nitrogen-free extract) determined by difference.

Kuwait and other Arab Gulf countries since bread is the main food staple and they are different from that reported by FAO (1972).

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