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Nutrient contents of some traditional Kuwaiti dishes: proximate composition, and phytate content

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Abstract

Thirty-two Kuwaiti composite dishes were analyzed for their proximate composition and phytate content. The moisture content ranged from 89.5% in vegetable soup to 0.89% in rahash (a traditional sweet). The fat content varied from 0.99 to 29.2%. Fish dishes showed the highest protein content (20.9%) while vegetable soup had the lowest (1.19%). Carbohydrate content of the 32 dishes varied from 3.5% in fried fish to 53.3% in rahash. The ash content ranged from 5.1% in hallomi cheese to as low as 0.39% in legemat (sweet dumpling). Phytate content, ranged from 2835 mg/100 g in rahash to 32.6 mg/100 g in labnah (strained yoghurt).

Keywords: Proximate composition; Kuwaiti dishes; Fat; Protein phytate; Carbohydrate; Fiber; Energy; Moisture;

1. Introduction

The need to establish food composition tables in Kuwait and the Arabian Gulf area [Saudi Arabia, Qatar, Bahrain, United Arab Emirates (UAE), Oman] has been emphasized by many scientists and specialists in the food and health area. Such data could be used in planning adequate diets, food consumption pattern, nutritional assessment of food and clinical nutrition research, where the relationships between degenerative diseases and diet are being studied. The importance of food composition tables has also been recognized by all levels of governments, consumer organizations and individual consumers throughout the world (Beecher & Vandeslice, 1984; Dwyer, 1994; Greenfield & Southgate, 1992; Samuda et al., 1998; Vanderveen & Pennington, 1983).

In the State of Kuwait, during the early 1980s, a few attempts to develop food composition tables were made (Al Nesf, 1980; Kamal & Allam, 1980). Eid and Al-Awadi (1989) reported, for the first time, the complete nutritive value of 16 Kuwaiti dishes, which was based on chemical analyses of standardized cooked recipes. Sawaya and Al-Awadhi (1995) analyzed another 22 dishes and combined the data of both studies into the First Kuwaiti Food Composition Tables (Sawaya, Al-Awadhi, Eid, & Dashti, 1998), which covered proximate analysis, phytate, dietary fibre (soluble and unsoluble), fatty acid profile, cholesterol, protein quality, minerals and vitamins.

Among the other Arabian Gulf countries, comprehensive data on the nutritive value of 20 Saudi Arabian composite dishes have been reported, including proximate composition, nine minerals, nine vitamins, fatty acid and amino acid patterns, *in vitro* protein digestibility and cholesterol content (Al-Jebrin, Sawaya, Salji, Ayaz, & Khalil, 1983; Sawaya, Al-Jebrin, Salji, Ayaz, & Khalil, 1985). In Bahrain, Musaiger, and Al-Dallal (1985) reported complete analyses of five Bahraini dishes and proximate analyses for another 38 dishes, and the vitamin and mineral contents of these 38 dishes were theoretically computed. Also, the proximate composition and mineral content of four types of fermented dairy products were analyzed (Musaiger, Al-Saad, Al-Hooti, & Khunji, 1998). In Qatar, 17 traditional Qatari dishes were analyzed for proximate composition (Al-Nadgy, Sawsan, Abd-El Ghani, & Abdel-Rahman, 1994), whereas in the UAE, eight composite dishes were analyzed for proximate composition (Ali, Musaiger, Ahmed, & Rao, 1995). The chemical composition (proximate composition, mineral, fatty acid and cholesterol contents) of 20 Omani dishes was also reported (Musaiger et al., 1998).

The purpose of this study was to determine the proximate composition, and phytate content of 32 Kuwaiti dishes.

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2. Materials and methods

2.1. Preparation and standardization of the recipes

A total of 32 dishes were selected for the present study. Among these, three dishes were ready-made while the remaining 29 were cooked dishes.

For the standardization and preparation of the cooked dishes, a procedure reported by Sawaya Al-Awadhi, Neeni, Al-Sayegh, Ahmed, and Khalafawi (1998) was followed; however, for the three ready-made dishes, *labnah* (strained yogurt), *hallomi* cheese and *rahash* (a traditional sweet made of sesame pulp and sugar), a pooled sample for each dish was collected from the local market from among the most popular brand names being consumed in the State of Kuwait. Major ingredients (% w/w) of the 32 recipes and their codes are presented in Table 1. Dishes were coded according to the type and nature of the raw ingredient used in the preparation. Classification of those dishes was as follows: seven fish dishes (F1–F7), six salad dishes (V1–V6), six pastries (P1–P6), four sweet dishes (S1–S4), two soup dishes (L1–L2), two sandwich dishes (SN1–SN2), three *kuba* dishes (C1–C3), and two dairy products (D1–D2). All dishes were prepared in triplicate.

2.2. Sample preparation

The whole cooked dishes, along with the ready-made, were thoroughly homogenized and then sampled for moisture analysis. The remaining sample was freeze-dried for further analysis.

2.3. Proximate analysis

Moisture, crude protein, fat, crude fibre and ash contents were determined by the standard procedures of the AOAC (1990). Carbohydrates were calculated by difference, and energy content by multiplying the protein, fat and carbohydrates by factors of 4, 9 and 4, respectively.

2.4. Phytic acid

Phytic acid was determined according to the method of Plaami and Kumpulainen (1991).

3. Results and discussion

3.1. Proximate analysis

Data on the proximate analysis of 32 dishes are presented in Table 2. Vegetable soup (L1) showed the highest moisture content (89.5%) with *rahash* (S4) being the lowest (0.89%). Leafy salad dishes (*fattoosh* V5 and *tabola* V6) have relatively high moisture content (86.44–82.1%). The moisture content of the fish dishes ranged from a high of 78.8% in *khathra* (F4) to a low of 55.5% in *shrimp panéé* (F6), whereas for pastries dishes, it ranged from 26.1 to 41.8%. Such variation among the 32 dishes could be due to the different food ingredients of each dish, and the preparation/cooking methods used. This was more clearly shown in the sweet dishes where the moisture content ranged from 0.89 to 68.2% and, to a lesser extent, dairy and kuba dishes with moisture contents ranging from 45.8 to 72.5% and from 53.09 to 60.3%, respectively.

The fat content varied from 0.99% in vegetable soup (L1) to 29.2% in *rahash* (S4). As expected, the deep-fried and high-fat dishes such as *kuba* (C1, C2, and C3), *sambosak* (P3, P4, and P6), fried sweets (S2 and S3) and *rahash* had the highest fat contents (7.7–29.2%), with the rest of the dishes containing varying amounts of fat. This is reflected in the energy content of these dishes. The energy content from fat varied from 39.5 kcal in the vegetable soup (L1) to 534 in *rahash* sweet (S4), the latter being mainly made of *tehina* (sesame seed paste) and sugar. Comparing with Musaiger and Al-Dallal's (1985) study on the composition of ready-made foods consumed in Bahrain, the composition of the Bahrani *rahash* was similar to that of the Kuwaiti with respect to its fat (29%) and protein (16%) contents.

The fish dishes showed the highest protein contents (3.87–21.8%). The main sources of protein in these dishes were fish and shrimp. Fish was the major ingredient in these dishes, ranging from 24% in *khathra* (F4) to 93% in fried fish (F5) and grilled shrimp (F7). The dairy products *labneh* (D1) and *hallomi* cheese (D2) came next in protein content, ranging from 8.79 (D1) to 17.5% (D2), respectively. These were followed by chicken and meat sandwiches (SN1 and SN2) with protein contents of 12.3 to 11.5%. The protein content of the pastries (P1 to P6) ranged from 5.9% in vegetable *sambosak* (P6) to 10.9% in meat *sambosak* (P4), whereas that of the *kuba* dishes (C1, C2, C3) ranged from 5.07 to 8.8%. The soups (L1, L2) had the lowest protein contents, with an average of only 3.29%. There is a significant variation in the protein content within the same as well as among different groups. These variations may be attributed to the quantity of the protein derived from the ingredients used in different dishes. Such variation is expressed more clearly in the salad and sweet dishes, with ranges of 1.5–11.9 and 3.19–14.3%, respectively.

The carbohydrate content of the 32 dishes varied from 3.9% in fried fish (F5) to 53.2% in *rahash* (S4). These variations were due to the amount and type of different ingredients used in the preparation of these dishes. Ash content ranged from 5.1% in *hallomi* cheese (D2) to as low as 0.39% in *legemat* (S2). Chicken and meat sandwiches had the highest ash content, with an average of 4.01% while sweet dishes had the lowest ash

Table 1
Ingredients of 32 Kuwaiti dishes

Dishes	Major ingredients (%)
Fish-based dishes	
F1. Fish saneya (baked fish with vegetables)	Fish 54.61, onion 10.75, tomato 14.2, green pepper 12.62, lemon juice 2.5, oil 2.0, garlic 1.32, spice 0.23, cumin 0.36, black pepper 0.27, salt 1.28
F2. Fish kofta (fried fish ball)	Fish 52.47, onion 20.41, egg 11.16, fresh coriander 5.99, rusk 5.75, salt 1.5, garlic 1.95, spice 0.34, dried lemon 0.47
F3. Matfee (thick fish stew)	Fish 43.69, tomato 21.59, onion 12. 23, water 9.07, fresh coriander 4.47, tomato sauce 5.26, garlic 1.73, dried lemon 0.69, turmeric 0.31, salt 1.21, spice 0.32
F4. Khathra (mixed fish and rice)	Fish 24.00, rice 21.66, water 25.61, tomato 12. 85, onion 6.01, coriander 1.73, garlic 0.98, turmeric 0.17, black pepper 0.05, tomato sauce 4.26, spice 0.15, salt 0.72, dried lemon 0.62, oil 1.34
F5. Fried fish	Fish 93.22, garlic 2.24, lemon juice 1.48, salt 1.51, turmeric 0.96, spice 0.59
F6. Shrimp banee (fried shrimp)	Shrimp 63.99, flour 12.15, egg 10.7, sumak 7.35, lemon juice 3.27, garlic 2.19, spice 0. 59, black pepper 0.35, salt 1.4
F7. Grilled shrimp	Shrimp 93.08, salt 3.17, garlic 1.97, lemon juice 1.76, spice 0.75
Salad	
V1. Tabola	Burgol 6.88, onion 13.89, tomato 22.69, olive oil 3.37, parsley 41.45, salt 0.70, mint 7.11, lemon juice 4.18
V2. Motabal	Eggplant 83.38, tahina 7.27, garlic 1.43, salt 1.03, lemon juice 4.80, cumin 0.58, olive oil 1.69
V3. Hommas	Hommas 82.63, tahina 8.49, olive oil 2.54, lemon juice 2.84, garlic 2.06, salt 1.32
V4. Foul modammas	Broad beans 66.49, tomato 23.39, garlic 1.33, cumin 2.12, salt 1.39, olive oil 3.17, lemon juice 2.11
V5. Fattoosh	Tomato 23.19, cucumber 20.08, parsley 6.42, mint 6.54, onion 8.70, garlic 0.25, olive oil 2.46, lettuce 6.74, bread (arabic) 5.55, lemon 2.11, salt 0.78, semak 0.51, leek 6.69, pepper (green) 9.96
V6. Falafel	Broad beans 51.02, parsley 10.16, salt 0.94, coriander 5.36, cumin 0.98, green onion 13.22, garlic 2.37, onion 13.78, black pepper 0.72, sodium bicarbonate 0.64, red pepper 0.27, spice 0.54
Pastries	
P1. Spinach pastry (baked)	Flour 39.73, water 14.74, fresh spinach 21.2, onions 9.65, oil 5.49, powdered milk 1.72, sumak 1.22, lemon juice 1.92, salt 0.6, yeast 0.55, eggs 3.7
P2. Cheese pastry (baked)	Flour 47.3, water 18.69, cheese 11.76, powdered milk 1.58, mint 6.81, oil 6.74, egg, 5.25, sugar 0.82, yeast 0.58, salt 0.52.
P3. Cheese sambosak (deep fried cheese pastry)	Sambosak 59.98, cheese 24.19, mint 7.57, water 6.59, flour 2.60
P4. Meat samboask (deep fried meat pastry)	Sambosak 46.12, minced meat 30.79, onion 20.72, spices 0.58, black pepper 0.52, salt 1.25
P5. Thyme pastry (baked)	Flour 47.2, powdered milk 2.79, oil 6.03, egg 6.23, thyme 7.3, water 17.39, olive oil 7.71, salt 0.56, yeast 0.67, sugar 1.25
P6. Vegetable sambosak (deep fried vegetable pastry)	Sambosak 47.14, frozen vegetables 33.59, onion 17.75, salt 0.95, spices 0.58
Sweet	
S1. Mahalabia (milky sweet)	Milk 80.51, sugar 11.01, starch 7.17, rose water 0.91, cardamom 0.40
S2. Legemat	White flour 20.071, brown flour 25.55, yoghurt 24.59, water 28.59, yeast 1.2
S3. Sab-Al-Gafsha (fried dumpling dipped in sugar syrup)	Brown flour, 15.67, gramflour 9.73, water 40.58, egg 16.31, white flour 16.43, cardamom 0.36, saffron 0.13, yeast 0.78
S4. Rahash	Readymade traditional sweet made of 50% sesame pulp and 50% sugar
Sandwiches	
SN1. Chicken shawerma (chicken sandwich)	Chicken 50.64, bread 25.13, tomato 9.6, oil 1.56, garlic 0.46, salt 0.93, spice 025, onion 10.64, black pepper 0.3, sumak 0.46
SN2. Meat shawarma (meat sandwich)	Meat 48.96, onion 11.95, bread 22.38, oil 1.57, salt 1.25, tomato 12.98, black pepper 0.29, spice 0.25
Kuba Dishes	
C1. Rice kuba (fried meat-rice balls)	Rice 37.84, meat 24.64, onion 27.57, egg 5.5, currant 1.45, salt 1.49, spice 0.5, turmeric 0.48
C2. Burgol kuba (fried burgol-meat balls)	Burgol 32.72, meat 48.87, onion 14.5, pine 1.53, salt 0.83, black pepper 0.29, spice 0.36, garlic 0.79

(*continued on next page*)

Table 1 (*continued*)

Dishes	Major ingredients (%)
C3. Potato kuba (fried potato-meat balls)	Potato 40.8, meat 18.9, egg 6.17, onion 13.07, rusk 4.98, salt 1.29, rice 11.52, pine 3.02, spice 0.24
Soup	
L1. Vegetable soup	Squash 10.93, potato 12.8, onion 11.93, tomato 13.84, water 29.51, green beans 7.84, black pepper 0.26, salt 0.62, parsley 2.78, oil 0.94
L2. Lentil soup	Lentil 24.6, water 58.74, onion 10.62, oil 2.03, garlic 1.43, black pepper, 0.27, cumin 0.3, black lemon 0.6
Dairy Products	
D1. Labnah	Strained yoghurt
D2. Hallomi cheese	

content (an average of 0.94%). The rest of the dishes contained variable amounts of ash, somewhere between these extremes.

Compared with other studies reported by Eid and Al-Awadhi (1989) and Sawaya and Al-Awadhi (1995), the dishes in the present study had higher levels of fat. Except for the fish dishes and salads, most of the dishes are eaten only occasionally at social gatherings and on religious occasions like the month of *Ramadhan*. These include the sweets (S1, S2, S3, and S4), kuba (C1, C2, and C3), and all pastries (P1–P6). It is highly recommended by many nutritionists in the State of Kuwait to decrease the intake of fat in the diet. One way to achieve this goal is through the method of cooking. For example, deep-fried dishes, such as kuba, can be baked instead of deep-frying. Such a change in the method of

Table 2
Proximate composition + standard deviation of Kuwaiti composite dishes (g/100g edible portion)

Code	Moisture	Ash	Fat	Protein	Carbohydrates	Energy (kcal)	Enegy (kJ)
Fl	75.47±0.755	3.05±0.300	3.726±0.109	11.8±0.198	5.99	105	436
F2	64.71±1.397	3.21±0.062	5.830±0.470	16.7±0.613	9.52	158	657
F3	71.47±1.122	2.93±0.081	7.205±0.797	11.5± 0.389	6.94	138	578
F4	78.04±0.576	0.882±0.027	0.970±0.070	3.88± 0.288	16.2	89.2	372
F5	65.98±0.144	3.24±0.245	6.300±0.469	21.0±2.700	3.51	155	645
F6	35.52±1.983	1.618±0.127	7.223±0.140	7.05±0.191	48.6	288	1200
F7	72.11±1.417	4.61±0.661	4.650±0.344	11.6± 0.325	7.07	116	486
V1	82.18±0.189	1.88±0.012	3.330±0.046	2.55± 0.020	10.1	81.0	336
V2	75.50±0.793	2.76±0.064	8.703±0.233	3.83± 0.135	9.20	131	544
V3	66.38±0.805	2.57±0.166	7.778±0.431	5.85±0.268	17.4	163	681
V4	76.72±0.248	2.88±0.042	3.159±0.026	4.6±0.056	12.6	97.4	406
V5	86.44±0.067	1.53±0.016	2.173±0.093	1.58±0.031	8.28	59.0	246
V6	49.18±1.797	2.01±0.146	8.709±0.359	11.9±0.489	28.2	239	997
S1	68.26±0.798	0.777±0.028	5.760±0.423	3.19±0.092	22.0	153	637
S2	34.22±3.175	0.391±0.015	7.851±0.097	5.27±0.248	52.3	301	1255
S3	32.56±0.168	0.422±0.040	11.024±1.073	4.39±0.283	51.6	323	1348
S4	0.893±0.030	2.19±0.043	29.28±0.359	14.3±0.158	53.3	534	2228
SNI	51.8.4±1.339	4.25±0.770	3.901±0.198	12.3±0.371	27.8	195	814
SN2	62.95±0.106	3.77±0.090	3.981±0.250	11.5±0.328	17.8	153	638
Cl	53.09±1.124	1.32±0.126	9.038±0.548	5.39±0.188	31.2	228	949
C2	58.46±3.078	1.17±0.078	16.34±0.392	8.81±0.574	15.22	243	1014
C3	60.03±2.650	2.13±0.077	9.468±0.925	6.09±0.359	22.3	199	829
P1	41.83±1.865	1.77±0.131	6.124±0.104	7.92±0.293	42.4	256	1069
P2	38.86±1.297	1.72±0.033	8.602±0.227	8.501±0.132	42.3	281	1171
P3	26.24±1.118	1.74±0.350	20.59±0.578	9.11±0.026	42.3	391	1631
P4	35.48±0.510	1.70±0.518	16.60±0.227	10.9±0.276	35.3	334	1395
P5	26.90±0.235	1.78±0.124	15.28±1.215	9.46±0.019	46	362	1509
P6	34.48±3.325	1.74±0.145	21.82±1.692	5.89±0.135	37.3	364	1520
L1	89.53±0.173	1.59±0.037	0.991±0.040	1.20±0.029	6.69	40.5	169
L2	75.45±0.132	1.57±0.045	1.601±0.076	5.39±0.046	16.0	100	417
Dl	72.61±0.031	1.26±0.016	10.31±0.095	8.80±0.010	7.03	156	651
D2	45.82±0.081	5.140±0,031	24.88±1.607	17.6±0.139	6.6	321	1337

cooking could lead to a drastic change in the amount of fat in the diet.

The effect of high or even moderately fatty diets on health and food-related diseases, such as CHD, diabetes, hypertension and obesity, has always been of concern to health professionals. The National Cholesterol Education Program (NCEP, 1993) advised that the total fat calories may not exceed 30% of the total energy, with $<10\%$ of the calories coming from saturated fat. The main goal of the NCEP in these recommendations was to reduce CHD morbidity and mortality. Furthermore, the report of the World Health Organization (WHO, 1990) on diet and prevention of chronic diseases recommends that the total fat energy may not exceed 30% of the total energy, whereas total carbohydrate energy may range from 55 to 75%, and energy from protein may range from 10 to 15% of the total energy. The detailed energy contents of Kuwaiti dishes is presented in Table 3. According to the recommendations of the WHO and the NCEP, only the dishes F4, F6, L1, P1 meet their recommendations. All other deep-fried dishes and high-fat dishes, such as C2, C3, V2, S4, P3, P4, P6, D1, and D2, have higher fat energy contents. It is well known that diets high in fat and cholesterol, particularly saturated fat, coupled with a sedentary lifestyle, can lead to the development of risk factors associated with premature cardiovascular disease (CVD), which is considered to be a leading cause of death and disability in the USA and other countries (Schaefer, 1997). Furthermore, high-fat diets are also considered major causes of obesity, which is a common public health concern in the Gulf area (Musaiger & Sungpuang, 1985).

Table 3
Energy content of Kuwaiti composite dishes (kcal)

Code	Total energy	% as Fat	% as Protein	% as Carbohydrates
Fl	105	32.1	45.0	22.9
F2	158	33.3	42.5	24.2
F3	138	46.9	33.1	20
F4	89.2	9.7	17.4	72.8
F5	155	36.7	54.3	9.08
F6	288	22. 607	9.8	67.6
F7	116	36.0	39.7	24.3
Vi	80.5	37.3	12.7	50.1
V2	131	60.1	11.8	28.2
V3	163	42.9	14.3	42.7
V4	97.4	29.2	19.1	51.7
V5	59.0	33.2	10.7	56.2
V6	239	34.0	19.9	47.3
S1	153	33.5	8.37	57.7
S2	301	23.5	7.00	69.5
S3	323	30.7	5.44	63.9
S4	534	49.3	10.7	39.9
SN1	195	18.0	25.1	56.9
SN2	153	23.4	30.1	46.5
Cl	228	35.7	9.47	54.8
C2	243	60.5	14.5	25.0
C3	199	42.9	12.3	44.9
P1	256	21 .5	12.6	66.1
P2	281	27.6	12.1	60.3
P3	391	47.4	9.32	43.3
P4	334	44.7	13.1	42.3
P5	362	38.0	10.5	51.5
PB	364	53.9	6.5	41.7
L1	40.5	22.1	11.8	66.1
L2	100	14.5	21.6	64.0
D1	156	59.5	22.5	18.0
D2	321	69.9	21.9	8.25

3.2. Phytic acid

Phytic acid (inositol hexose phosphate) is considered one of the major anti-nutritional factors in cereals and legumes. It is present in many plant seeds, grains, fruits and vegetables. It is found in all cereals and several legumes, which contain 50 to 85% of their total content of phosphorus as phytate (Fredlund, Asp, Larsson, Marklinder, & Sandberg, 1997; Ranvidran, Ravidran, & Sivalogan, 1994; Thorelm & Bruce, 1982). Phytic acid acts as a strong chelating agent for many elements. It adversely affects the bioavailability of some of the dietary minerals such as iron, zinc and calcium (Hurell, Marcel, Sean, Sandra, & James, 1992). Due to the formation of mineral-phytate complexes, such minerals are not physiologically available. Studies in humans indicate that the absorption of zinc and iron from a meal corresponds directly to its phytate content (Turk, Carlsson, & Sandberg, 1996). Therefore, it is very important to determine the phytate content of foods, especially in relation to human nutrition and in the nutrient evaluation of foods.

Table 4 presents the phytate content (mg/100 g edible portion) of the Kuwaiti dishes studied. Among all the dishes, *rahash* (S4) contained the highest phytic acid content, i.e., 2835 mg/100 g. *Rahash* consists of 50% pure sesame pulp and similar amounts of sugar. Such a high phytate content came mainly from the sesame pulp used in the preparation of the rahash. It is known that the phytate content of sesame seeds, 5.36 g/100 g, is among the highest found in nature (DeBoland, Garner, & O'Dell, 1975). *Falafel* (V6) was also high in phytate content (1355 mg/100), in which phytate came mainly from the broad beans used, constituting over 50% of the whole recipe. Clear variations in the phytic acid contents of Kuwaiti dishes, as well as among the dishes of the same group, were observed. Such variation is due to the amounts of the ingredients used in these recipes.

For sweet dishes, phytate content ranged from 43.8 in *mahalabia* (S1) to 2835 mg/100 g in *rahash* (S4), with an average of 790 mg/100 g for all sweet dishes. For *legemat* and *sub-al-gafsha* (S2 and S3), the phytate was derived mainly from the wheat flour used in the recipe. In the salads (V1–V6), phytate content was as low as 44.5 mg/100 g in *fattoosh* (V5) and as high as 1355 mg/

Table 4
Phytic acid content of Kuwait dishes (mg/100-g edible portion)

Sample	Phytic acid
Fl	213
F2	102
F3	98.0
F4	35.2
F5	130
F6	257
F7	468
V1	130
V2	634
V3	731
V4	444
V5	44.5
V6	1355
S1	43.8
S2	190
S3	92.6
S4	2835
C1	60.1
C2	554
C3	252
P1	207
P2	74.0
P3	83.1
P4	86.9
P5	397.622
P6	208
SNI	137
SN2	96.1
L1	67.0
L2	207
D1	32.7
D2	46.1

100 g in *falafel* (V6), with an average of 557 mg/100 g for the vegetable dishes. The relatively high phytate content in *motabal* (V2), *hommas* (V3), and *foul modamas* (V9), (636, 731, 444 mg/100 g, respectively) came from sesame pulp in V2, chickpeas in V3 and broad beans in V4 dishes. Chickpeas have been reported to contain 0.74 g phytate/100 g phytate (USDA, 1998).

For the *kuba* dishes, C1 – C3, the phytate ranged from 60.1 mg/100 g in rice *kuba* (C1) to 554 in *bulgur kuba* (C2), with an average of 289 mg/100 g. The phytate in these dishes is derived from rice and bulgar, wheat and potato, which are the major ingredients in kuba dishes. In the pastry dishes, the phytate content ranged from 74.0 mg/100 g in cheese pastry (P3) to 398 mg/100 g in thyme pastry (P5). The average phytate content of the pastry dishes was 176 mg/100 g. The high phytate content in P5 came from sesame seeds and wheat flour used in all the pastries.

Fish dishes (F1–F8) also contained variable amounts of phytate. The phytate ranged from as low as 35.1 mg/100 g in *khathra* (F4) to as high as 257 mg/100 g in shrimp *panéé* (F6). The average phytate content of the fish dishes was 126 mg/100 g. The high phytate content in F6 is derived mainly from the flour used in the recipes. For the rest of the fish dishes, the phytate came from the vegetables used in each recipe.

The average phytate content of the soups (L1 and L2) was 137 mg/100 g. The phytate content of the lentil soup was 207 mg/100 g, most of which was derived from the lentils used in the recipe. Lentils are reported to contain 0.71 g phytate/100 g (USDA, 1998).

As for the sandwiches (SN1 and SN2), the phytate contents were 137 and 96.1 mg/100 g, respectively, with an average of 117 mg/100 g. The dairy dishes, D1 and D2, had the lowest phytate contents, with an average of 39.3 mg/100 g. In comparison with the reports of Eid and Al-Awadhi (1989) and Sawaya and Al-Awadhi (1995), the phytate contents in this study's dishes, in general, were the highest. High phytic acid content prevents the absorption of minerals in food and, consequently, could lead to iron deficiency anemia, which is a prevalent problem, both in developing and industralized countries. In Kuwait, iron deficiency anemia is a major public health problem, and it is highly recommended that the phytate consumption in the Kuwaiti diet be determined, which will, in turn, be a useful tool in the evaluation of the nutritional status of the Kuwaiti population.

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