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Chemical Composition and Minerals Content as Influenced by Cooking of Some Saudi Traditional Diets

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Abstract: The main objective of the current study was to evaluate the chemical composition of traditional diets consumed regularly in Saudi Arabia. In the present study, five Saudi Arabian traditional diets (kabsa, gursan, garish, saleeg and hunaini) were investigated for their chemical composition. The moisture, protein, fat, fiber, ash, carbohydrate and energy content of cooked kabsa, gursan, garish, saleeg and hunaini were significantly ($p \leq 0.05$) differ from those of commercial and uncooked samples. Lower values of protein content were found in saleeg (2.47-2.94%) whereas higher values were found in gursan (8.5-8.67%). Higher ash content was observed in cooked saleeg (1.64%) whereas lower one was in commercial garish (0.9%). Cooking significantly ($p \leq 0.05$) affect ash, fiber and carbohydrate contents of all diets. Energy content of hunaini (300-309 kcal) was higher compared to that of kabsa (126-140 Kcal), gursan (100-125 Kcal), garish (88.2-149 Kcal) and saleeg (73.3-138 Kcal). Kabsa, gursan, garish, saleeg and hunaini contained variable amounts of macro-elements (K, Ca, Na, Mg, and Mn) and trace elements (Fe, Cu and Zn). Higher K content was found in hunaini (488.5-637.5 mg/100 g), while lower content was found in kabsa (72.3-100.5 mg/100 g). Cooking significantly ($p \leq 0.05$) decreased K content of kabsa, gursan, garish and saleeg, whereas it significantly ($p \leq 0.05$) increased it in hunaini. Ca content of the diets showed considerable variations. Na content of the investigated diets varied from 26.3 to 584.0 mg/100 g and Fe varied from 0.04 to 9.5 mg/100 g.

Key words: Chemical composition, garish, gursan, hunaini, kabsa, minerals, saleeg

INTRODUCTION

Many widely-consumed foods in Saudi Arabia are made mainly from cereals, legumes and oilseed crops as well as meat and fruits. Such foods are good sources of proteins, minerals and vitamins for humans and they can make a significant contribution to meet the nutritional requirement of populations, particularly those of low income (FAO, 1987). The traditional cereals and legume-based foods form an important part of the diet of people in Saudi Arabia. They are greatly divergent in their recipes, processing methods, baking conditions and cooking procedures. Protein/energy malnutrition is a worldwide problem especially in developing countries (Blackburn, 2001). Mokhalalati (1990) reported moderate to mild types of protein/energy malnutrition were recorded in Saudi Arabia. Improvement of quality of protein and other nutrients in foods commonly consumed in the Arab World are available (Al-Khalifa, 1993; Al-Kanhal *et al*., 1994; Al-Nozha and Osman, 1998; Kenawi, 2000). Traditional diets in Saudi Arabia are those diets related to food habits and culture of Saudi people and which prepared locally and consumed in different regions of the country. The ingredients and way of preparation of these diets may differ from one region to the other, and the knowledge of traditional diet preparation is passed from one generation to another. Kabsa is considered to be the most known traditional dish in Saudi Arabia, sinee 89% of Saudi families consumed it as a main dish (Al-Kanhal, 1989). Other traditional foods include for example: Mataziz jcrish, qursan, harris, hunaini and almuhala. Al-Jassir *et al*. (1998) stated that there are few studies regarding the chemical composition, ratios of ingredients and way of preparation of traditional foods. This has led to the necessity of assembling more complete food composition tables, yielding information

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Table 1: Ingredients of foods investigated in the study

Food	Ingredients
Kabsa	Rice (480 g), chicken meat (500 g), tomato (250 g), oil (40 g), onion (180 g), hot pepper (15 g), spices (5 g)
Garish	Low fat milk (1200 g), ground wheat (480 g), rice (240 g), hot pepper (10.2 g), butter (10 g), ground kamon (5 g), salt (3 g), animal fat (15 g)
Gursan	Gursan (500 g), bone less met (500 g), green bean (12 g), kosa (12 g), carrot (12 g), yellow pumkin (12 g), tomato (500 g), oil (30 g), tomato paste (160 g), onion (250 g), hot pepper (15 g), spices (5 g)
Saleeg	Sliced met (1100 g), rice (470 g), powdered milk (80 g), butter (5 g), salt (3 g), water (3840 g), wheat flour (500 g)
Hunaini	Date (1000 g) wheat flour (500 g), butter (120 g)

not only about the traditional nutrients but also on micronutrients, amino acids, fiber content and digestibility. Thus, the main objective of the present study is to evaluate the chemical composition and mineral content of traditional diets consumed regularly in Saudi Arabia. This evaluation may be of interest to those who are involved in nutrition and public health, since traditional foods are consumed by many sectors in Saudi community and little or no information is available concerning nutritive values of such diets.

MATERIALS AND METHODS

This study was conducted in Saudi Arabia at the Department of Food Science and Nutrition, Faculty of Agriculture and Food Science, King Saud University, Riyadh, Saudi Arabia, between 2007 and 2010.

Materials:

- Three samples of each food were prepared as follows:
    - Uncooked samples of kabsa, gursan, garish, saleeg and hunaini were prepared at the laboratory. The ingredients (Table 1) and method of preparation was followed as in Al-Jassir *et al*. (1998).
    - Portions of uncooked samples were prepared as cooked samples according to the appropriate temperature for each food (Al-Jassir *et al*., 1998).
    - Commercial samples of each mentioned foods were collected from local markets in Riyadh. Ten samples of each food were collected from different places and pooled.
- Small portions of the three samples of each food item were kept for proximate analysis, the rest of the samples were freeze dried, ground to powder and kept at -20ºC for further analysis.
- Five samples of ingredients namely: date, rice, brown flour, chicken and lamb meat were purchased from markets in Riyadh. The fresh samples of these items were freeze dried and all samples were ground to fine powder and kept as above.

Chemical analysis of samples:

Chemical composition: The chemical composition of each sample was determined according to the Standard Official Methods of Analysis (AOAC, 1995). Total carbohydrate of the samples was calculated by subtracting the value of protein, oil, fiber, ash and moisture content from 100.

Total energy: Energy was calculated as described by Osborne and Voogt (1978) using the Atwater factors 1 g of carbohydrate (c) provides (4 Kcalories), 1 g of protein (p) provides (4 Kcal), and 1g fat (f) provides (9 Kcalories).

c. (g) × 4: Kcal of carbohydrate
p. (g) × 4: Kcal of protein
f. (g) × 9: Kcal of fat

Determination of mineral content by atomic absorption spectrophotometer: Determination of Macro- and Micro-elements was carried out following the method described by AOAC (1990) using atomic absorption spectroscopy. Samples (100 g) were dried in 20% sulphuric acid and then ashed at 500ºC under gradual increase (about 50ºC/h) in temperature. 6 N HCl (1:1) was added and the solution was evaporated to dryness. Ash was dissolved in 2 mL of HNO_3 1:1 (v/v) (analytical grade Merck, Germany) allowed for 18 h to dissolve completely and passed through a filter paper. Macro elements Na, K, Ca, Mg and micro elements Fe, Zn, Mn, Cu were determined by means of an atomic absorption spectrophotometer (HITACHI-Z-5000), equipped with hollow cathode lamps (AOAC, 1990).

Statistical analysis: Each sample was analysed in triplicate and the tables were then averaged. Data were compared using analyses of variance (ANOVA) (Snedecor and Cochran, 1989) and by the Duncan multiple range test with a probability $p \leq 0.05$ (Duncan, 1955).

RESULTS AND DISCUSSION

Proximate composition and total energy of traditional Saudi diets: The proximate composition data of the diets, expressed on fresh weight basis is shown in Table 2. The moisture content of cooked kabsa, gursan, garish, saleeg and hunaini was significantly ($p \leq 0.05$) different from commercial and uncooked kabsa, gursan, garish, saleeg and hunaini, respectively. In general the moisture content for all samples decreased after cooking. The moisture content ranged from 25.0% for commercial hunaini to

Table 2: Proximate composition (%) and total energy (Kacl) before and after cooking (fresh weight basis) of traditional Saudi diet

Sample	Moisture	Protein	Fat	Ash	Fiber	Carbohydrate	Energy (Kacl)
Kabsa before cooking	68.40±0.10^{b}*	8.15±0.46^{b}	4.15±0.03^{c}	1.40±0.03^{b}	0.43±0.03^{b}	17.50±0.19^{b}	140±7.84^{b}
Kabsa after cooking	67.63±0.20^{c}	8.27±0.05^{a}	4.50±0.07^{a}	1.10±0.08^{c}	0.37±0.02^{c}	18.20±0.17^{a}	146±5.52^{a}
Kabsa-commercial	71.6±0.20^{a}	7.32±0.07^{c}	4.48±0.05^{b}	1.50±0.04^{a}	1.07±0.08^{a}	14.00±0.05^{c}	126±7.71^{c}
Gursan before cooking	77.40±0.40^{a}	8.63±0.01^{a}	4.27±0.03^{a}	1.80±0.06^{a}	1.07±0.04^{b}	6.85±0.25^{c}	100±3.91^{c}
Gursan after cooking	76.20±0.20^{b}	8.67±0.53^{a}	4.13±0.03^{b}	1.70±0.02^{b}	1.18±0.06^{a}	8.14±0.13^{b}	104±5.54^{b}
Gursan-commercial	72.10±0.15^{c}	8.50±0.19^{a}	4.02±0.05^{a}	1.51±0.03^{c}	0.53±0.03^{c}	13.3±0.32^{a}	125±6.13^{a}
Garish before cooking	80.10±0.10^{a}	3.82±0.06^{a}	3.17±0.07^{a}	1.75±0.06^{b}	0.51±0.03^{b}	11.1±0.15^{c}	88.2±4.13^{c}
Garish after cooking	76.40±0.30^{b}	3.70±0.04^{b}	2.84±0.01^{b}	1.68±0.03^{a}	0.38±006^{a}	14.9±0.21^{b}	100±3.76^{b}
Garish-commercial	64.50±0.56^{c}	3.12±0.01^{c}	2.73±0.04^{b}	0.90±0.003^{c}	0.80±0.04^{a}	27.9±0.16^{a}	149±4.58^{a}
Seleeg before cooking	84.50±0.05^{a}	2.94±0.09^{a}	3.79±0.07^{a}	1.15±0.06^{c}	0.31±0.01^{a}	7.30±0.13^{b}	75.1±2.29^{b}
Seleeg after cooking	83.70±0.33^{b}	2.57±0.06^{b}	3.20±0.02^{b}	1.64±0.04^{a}	0.31±0.02^{a}	8.55±0.22^{b}	73.3±4.36^{c}
Seleeg-commercial	68.30±0.22^{c}	2.47±0.05^{b}	3.70±0.08^{a}	1.53±0.03^{b}	0.26±0.01^{b}	23.7±0.20^{a}	138±6.54^{a}
Hunaini before cooking	28.20±0.27^{a}	5.33±0.01^{b}	4.23±0.03^{b}	0.90±0.005^{c}	1.2 7±0.05^{b}	59.9±0.14^{b}	300±4.29^{c}
Hunaini after cooking	27.20±0.22^{b}	5.85±0.02^{a}	4.63±0.06^{a}	1.07±0.04^{b}	1.55±0.04^{a}	59.7±0.45^{b}	304±3.83^{b}
Hunaini-commercial	25.00±0.24^{c}	5.59±0.04^{b}	4.23±0.12^{b}	1.23±0.02^{a}	1.56±0.02^{a}	62.4±0.24^{a}	309±2.23^{a}
Date	12.00±0.10	1.87±0.01	0.00	1.64±0.02	2.04±0.07	82.42±0.41	337.2±1.14
Rice	7.10±0.10	8.54±0.13	1.34±0.01	1.44±0.07	1.29±0.04	80.29±0.13	367.4±0.94
Chicken	70.80±0.10	20.50±0.24	6.85±0.16	1.84±0.04	0.00	0.00	144.6±1.42
Brown flour	7.10±0.10	13.87±0.13	2.48±0.08	1.58 ±0.01	1.85 ±0.04	73.2±0.10	370.3±0.82
Meat (lamb)	68.50±0.48	20.1 0±0.78	10.12±0.06	1.12 ±0.06	0.14 ±0.03	0.00	171.5±2.72

*: Mean± standard deviation (N = 3); Duncan's groupings a, b, c refers to significant differences between the same diets in a column

84.5% for saleeg before cooking. The high moisture content of the traditional diets suit the hot weather most prevalent in Saudi Arabia. Moisture content of kabsa, gursan, garish, saleeg and hunaini after cooking were comparable to the values reported by Al-Jassir *et al*. (1998) for the same foods. The moisture content of the ingredients used for preparation of such diets was lower in rice and brown flour (7.1%) and higher in chicken (70.8%) and meat (68.5%). Low values of protein content were found in saleeg (2.47-2.94%) whereas high values were found in gursan (8.5-8.67%). Higher concentration of protein in gursan comes from the green beans and lamb meat used in the preparation of this diet. Similar observation was reported by Al-Jassir *et al*. (1998) who found that qursan had higher protein content compared to kabsa, garish, hunaini and saleeg. Cooking does not affect the protein content of gursan compared to commercial and uncooked samples, whereas it significantly ($p \leq 0.05$) affect the protein content of kabsa (8.27%), garish (3.70%), saleeg (2.57%) and hunaini (5.85%). For the ingredients used for preparations of the diets, higher protein content was observed in chicken (20.5%), while lower content was found in date (1.87%). There are no big differences in the fat content for kabsa, gursan and hunaini (4.02-4.63), whereas slight lower content was found in garish and saleeg (2.7-3.79%). Fat content of cooked hunaini and kabsa was significantly ($p \leq 0.05$) higher than that of commercial and uncooked samples of both diets. Higher ash content was observed in cooked saleeg (1.64%) and lower one in commercial garish (0.9%). Cooking significantly ($p \leq 0.05$) affect ash, fiber and carbohydrate content of all diets. For all investigated samples, carbohydrate content was inversely related to moisture content. Energy content of hunaini (300-309 Kcal) was higher compared to that of kabsa (126-140 Kcal), gursan (100-125 Kcal), garish (88.2-149 Kcal) and saleeg (73.3-138 Kcal). The high energy of hunaini is due to the fact that both date (337.2 Kcal) and brown flour (370.3 Kcal) are the main ingredient of this diet. Similar observation was reported by Al-Jassir *et al*. (1998) for the same diets. There are significant ($p \leq 0.05$) differences in energy content of the diets before and after cooking. Generally, energy content of commercial traditional diets are higher compared to cooked and uncooked ones except kabsa after cooking showed higher energy content. The data in Table 3 shows a proximate composition of the diets expressed on dry weight basis. The results are consistent with those expressed on the wet weight basis. As a general trend, there are significant ($p \leq 0.05$) differences in moisture, protein, fat, fiber, ash and carbohydrate between cooked and uncooked diets.

Minerals content of traditional Saudi diets: Minerals content of the diets (kabsa, gursan, garish, saleeg and hunaini) and their ingredients, as mg/100 g sample on dry weight basis, are presented in Table 4. The diets of kabsa, gursan, garish, saleeg and hunaini contained variable amounts of macro-elements (K, Ca, Na, Mg, and Mn) and trace elements (Fe, Cu and Zn). Such variations among the diets could be due to difference in food ingredients of each dish, and the preparation/cooking methods used. For all diets higher amount of K was observed compared to other elements. In the investigated diets higher K content was found in hunaini (488.5-637.5 mg/100 g), while lower content was found in kabsa (72.3-100.5 mg/100 g). Dates as the main ingredient for hunaini contained high amount of K (883.2 mg/100 g), consequently the three hunaini samples contained higher amount of K compared to other samples. Although, the values of K in this study are higher than those reported previously (Al-Jassir *et al*.,1998) for the same diets, also high K content

Table 3: Proximate composition (%) before and after cooking (dry weight basis) of traditional Saudi diets

Sample	Protein	Fat	Ash	Fiber	Carbohydrate
Kabsa before cooking	25.79±0.46[a]	13.2±0.36[b]	4.46±0.15[a]	1.36±0.03[b]	55.17±0.90[a]*
Kabsa after cooking	26.57±0.85[a]	13.90±0.70[b]	3.83±0.08[a]	1.14±0.02[b]	55.56±0.62[a]
Kabsa-commercial	25.78±0.71[a]	15.78±0.85[a]	4.97±0.17[a]	3.77±0.08[a]	49.70±0.30[b]
Gursan before cooking	38.23±0.01[a]	18.91±0.33[a]	7.14±0.07[a]	4.74±0.09[a]	30.99±0.28[c]
Gursan after cooking	36.42±0.53[b]	17.35±0.18[b]	6.47±0.18[a]	4.95±0.08[a]	34.81±0.3[b]
Gursan-commercial	30.46±0.19[c]	15.05±0.85[c]	4.80±0.08[b]	1.90±0.03[b]	47.79±0.32[a]
Garish before cooking	19.18±0.09[a]	15.92±0.67[a]	6.83±0.02[a]	2.56±0.03[a]	55.51±0.27[c]
Garish after cooking	15.66±0.04[b]	12.01±0.30[b]	6.42±0.06[a]	1.60±0.06[c]	64.49±0.42[b]
Garish-commercial	8.79±0.01[c]	7.69±0.14[c]	2.92±0.06[b]	2.25±0.06[b]	78.35±0.92[a]
Seleeg before cooking	18.96±0.90[a]	24.45±0.57[a]	8.41±0.11[a]	2.00±0.06[a]	46.18±0.56[c]
Seleeg after cooking	15.78±0.36[b]	19.66±0.22[b]	8.69±0.33[a]	1.91±0.01[a]	53.96±0.20[b]
Seleeg-commercial	7.80±0.17[c]	11.68±0.38[c]	4.40±0.03[b]	0.82±0.02[b]	76.30±0.20[a]
Hunaini before cooking	7.42±0.18[b]	5.89±0.13[ab]	1.54±0.05[c]	1.77±0.095[a]	84.38±0.10[a]
Hunaini after cooking	8.03±0.23[b]	6.35±0.02[a]	1.62±0.04[a]	2.13±0.007[a]	81.87±0.10[b]
Hunaini-commercial	7.45±0.24[b]	5.64±0.0[b]	1.79±0.02[a]	2.08±0.01[a]	83.04±0.20[a]
Date	2.29±0.01[b]	-----	1.73±0.03	2.45±0.01	93.53±0.40
Rice	9.19±0.13	1.44 ±0.01	1.55±0.07	1.38±0.04	86.44±0.74
Chicken	70.53±0.24	23.76 ±0.26	5.71±0.41	-----	-----
Brown flour	14.83±0.13	4.65 ±0.1	1.60±0.01	-----	78.92 ±0.80
Meat (lamb)	64.50±0.78	31.49 ±0.65	4.01±0.01	-----	-----

*: Mean±standard deviation (N = 3); Duncan's groupings a, b, c refer to significant differences between the same diets in a column

Table 4: Minerals content (mg/100g) before and after cooking of traditional diets consumed in Saudi Arabia

Sample	K	Ca	Na	Mg	Mn	Fe	Cu	Zn
Kabsa before cooking	100.50±0.40[a]	81.40±0.2[a]	190.40±0.4[c]	19.50±0.3[a]	0.09±0.009[a]	1.77±0.02[a]	0.10±0.00[a]	0.70±0.00[a]
Kabsa after cooking	72.30±0.24[c]	49.20±0.1[c]	262.00±0.2[b]	16.30±0.23[b]	0.06±0.002[a]	1.60±0.03[c]	0.02±0.001[b]	0.20±0.01[b]
Kabsa-commercial	95.40±0.30[b]	62.50±0.22[b]	395.70±0.3[a]	16.00±0.1[b]	0.02±0.001[a]	6.90±0.41[b]	0.04±0.002[b]	0.23±0.01[b]
Gursan before cooking	439.00±0.10[a]	79.10±0.1[a]	395.50±0.1[b]	59.30±0.1[a]	0.93±0.06[a]	9.50±0.40[a]	0.15±0.005[a]	9.00±0.08[a]
Gursan after cooking	313.40±0.10[c]	50.00±0.4[c]	412.30±0.2[a]	42.70±0.2[c]	0.60±0.001[b]	0.05±0.001[b]	0.04±0.002[b]	0.83±0.02[b]
Gursan-commercial	415.70±0.40[a]	52.40±0.1[b]	323.20±0.2[c]	49.30±0.2[b]	0.40±0.01[b]	0.043±0.001[b]	0.10±0.00[ab]	0.43±0.01[b]
Garish before cooking	237.20±0.40[a]	104.20±0.4[b]	567.50±0.1[a]	39.30±0.3[a]	0.43±0.02[a]	6.30±0.30[b]	0.10±0.00[a]	0.40±0.02[a]
Garish after cooking	214.20±0.25[b]	95.50±0.2[c]	155.20±0.2[c]	36.50±0.2[b]	0.20±0.01[b]	0.05±0.003[c]	0.08±0.002[a]	0.43±0.05[a]
Garish-commercial	135.60±0.30[c]	118.80±0.1[a]	299.50±0.1[b]	26.40±0.2[c]	0.20±0.00[b]	7.90±0.00[a]	0.10±0.00[a]	0.53±0.03[a]
Seleeg before cooking	204.40±0.30[b]	115.30±0.2[a]	66.20±0.2[c]	26.50±0.1[a]	0.10±0.00[b]	1.40±0.01[c]	0.10±0.00[a]	1.30±0.00[b]
Seleeg after cooking	105.30±0.30[c]	79.10±0.1[c]	379.30±0.2[b]	19.80±0.1[c]	0.20±0.00[a]	2.50±0.00[b]	0.04±0.002[b]	6.00±0.00[a]
Seleeg-commercial	264.30±0.10[c]	109.00±0.0[b]	584.00±0.1[a]	23.20±0.1[b]	0.10±0.00[b]	7.80±0.10[a]	0.05±0.001[b]	0.70±0.00[c]
Hunaini before cooking	488.50±0.40[a]	45.70±0.7[c]	26.30±0.3[c]	69.40±0.1[c]	1.00±0.00[b]	7.70±0.10[b]	0.20±0.00[b]	0.23±0.010[c]
Hunaini after cooking	637.50±0.36[a]	147.40±0.1[b]	46.40±0.2[b]	82.50±0.0[a]	0.10±0.00[c]	7.70±0.10[b]	0.20±0.00[a]	4.20±0.20[b]
Hunaini-commercial	514.40±0.56[b]	174.50±0.4[a]	115.20±0.3[a]	76.00±0.1[b]	1.20±0.05[a]	9.10±0.20[a]	0.20±0.00[c]	11.60±0.60[a]
Date	883.20±0.15	194.40±0.3	36.10±0.2	71.30±0.3	0.30±0.00	7.50±0.10	0.20±0.00	9.80±0.10
Rice	171.30±0.21	101.80±0.2	49.30±0.2	42.60±0.2	0.30±0.00	4.70±0.20	0.20±0.00	8.90±0.00
Chicken	435.30±0.30	36.00±0.3	376.10±0.1	29.40±0.3	0.20±0.00	4.90±0.00	0.05±0.001	0.50±0.01
Brown flour	557.30±0.35	214.40±0.1	62.40±0.3	184.80±0.0	0.40±0.02	21.30±0.10	0.30±0.00	3.13±0.15
Meat (lamb)	134.70±8.50	85.40±0.4	132.50±0.5	32.70±0.2	0.30±0.00	9.50±0.50	0.08±0.002	11.13±0.08

*: Mean±standard deviation (N = 3); Duncan´s groupings a, b, c referring to significant differences among means of the same diet in a column

in hunaini (453.2 mg/100 g) was reported by Al-Jassir *et al*. (1998). On the other hand, lower K content in kabsa might be due to the fact that rice (171.3 mg/100 g) and lamb meat (134.7 mg/100 g) are the main ingredients of kabsa. Cooking significantly ($p \le 0.05$) decreased K content for kabsa, gursan, garish and saleeg, whereas it significantly ($p \le 0.05$) increased it for hunaini. Calcium content of the diets showed considerable variations. In hunaini Ca content was 45.7 mg/100 g before cooking and was 174.5 mg/100 g for commercial one. In all diets cooking significantly affect Ca content of the investigated diets. The higher amount of Ca was observed in hunaini which is likely to be due to addition of brown flour (214.4 mg/100 g) as a main ingredient of this diet. Calcium content in this study is considerably higher than those reported by Al-Jassir *et al*. (1998). This variation might be due to differences in the experimental conditions between the two studies. Although Ca content of the investigated samples is higher than that previously reported by Al-Jassir *et al*. (1998), but it is still far below the daily allowances for Ca (1200 mg) recommended by National Research Council (NCR, 1989). Sodium content of the diets varied between diets and was 26.3 mg/100 g for hunaini before cooking and 584.0 mg/100 g for commercial saleeg. Similar to others macro-elements, cooking significantly ($p \le 0.05$) affected Ca content of the diets. The amount of Na is higher than those reported previously for the same diets (Al-Jassir *et al*., 1998). Magnesium content of the investigated diets was 16.0 and 82.5 mg/100 g for commercial kabsa and cooked hunaini, respectively. Highest amount of Mg was found in hunaini (69.4-82.5 mg/100 g) while the lowest amount was found in kabsa (16.0-19.5 mg/100 g). High Mg content in hunaini resulted from the additin of brown flour (184.8 mg/100 g) and date (71.3 mg/100 g) as they are the main ingredients of this dish. There were significant ($p \leq 0.05$) variations in Mg between cooked, commercial and uncooked diets. Manganese content was found to be 0.02 and 1.20 mg/100 g for commercial kabsa and commercial hunaini, respectively. Iron content of the investigated diets was 0.04 and 9.5 mg/100 g for commercial and uncooked gursan, respectively. For all samples, cooking significantly ($p \leq 0.05$) reduced Fe content. Fe content obtained in the present study is consistent with that reported previously for the same diets (Al-Jassir *et al*., 1998). Iron content of traditional foods received more attention than others elements as observed in other studies (Al-Jassir *et al*., 1998; Al-Nozha *et al*., 1996; Al-Kanhal *et al*., 1994). This may explained the fact that traditional foods may be considered as dietary source to counteract Fe deficiency among population. Considerably lower amount Cu was detected in all tested diets, which ranged from 0.02 to 0.2 mg/100 g. Variable amounts of zinc were obtained in the investigated diets with highest amount found in commercial hunaini (11.6 mg/100 g) and lowest found in cooked kabsa (0.2 mg/100 g). Generally, the values for the various mineral elements in this study were within the range reported in the literature for different processed foods (Pennington and Calloway, 1973; FAO/ USDA, 1982) and corresponded to values for some of the mineral elements in Middle Eastern diets reported by Pellett and Shadarevian (1970).

CONCLUSION

The need to establish food composition tables in Saudi Arabia 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. In the present study, comprehensive data on the nutritive value of five Saudi Arabian traditional diets (before and after cooking) have been reported, including proximate composition and minerals content. Saudi traditional diets (kabsa, gursan, garish, saleeg and hunaini) contain considerable amounts of moisture, fat, protein, ash, carbohydrate and energy. The amounts of such components are in the range that recommended by FAO and WHO. Thus such diets are considered to be good from the nutritional stand points. Furthermore, the diets contained variable amounts of macro-elements (potassium, calcium, sodium, magnesium, and manganese) and trace elements (iron, copper and zinc).

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