

NUTRITIVE VALUE OF SOME WHEAT BASED DISHES CONSUMED IN THE KINGDOM OF SAUDI ARABIA

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Nutrient composition and nutritional quality of six Saudi Arabian dishes based on wheat were studied. The dishes, on fresh weight basis, contained 2.4-6.7% protein (N × 6.25), 0.4-6.0% fat, 10.4-31.4% carbohydrates, 1.7-4.6 dietary fibre, 0.7-2.0% ash and 66-206 kcal per 100 g. The concentrations of vitamin A (Retinol Equivalent), thiamin, riboflavin and vitamin C ranged from 0-411 µg, 0.02-0.06 mg, 0.04-0.94 mg and 0.52-2.87 mg per 100 g respectively. The mineral contents (mg/100 g) were: calcium 0-35.5, phosphorus 5.4-5.9, iron 0.5-1.8, sodium 109.8-305.5 and potassium 49.9-294.7. The dishes contributed 13-20%, 5-27% and 57-82% of the total food energy from protein, fat and carbohydrate respectively. The nutritional quality of all dishes were adequate to meet the protein requirements of all age groups when compared with reference protein energy ratios (PE %).

KEY WORDS: Saudi Arabian Dishes, Wheat based diets, food composition, nutrient composition, nutritional quality

INTRODUCTION

Cereal grains are the dietary mainstay of mankind. They provide three quarters of man's energy need, and more than one half of his protein needs (Bender and Bender, 1982, Khan *et al.*, 1987). In Saudi Arabia, cereals provide 46% and 42% of the total available food energy and protein in the diet respectively (FAO, 1990).

Wheat is the major cereal grown and consumed in the Kingdom of Saudi Arabia. The total production of wheat rose from 3,000 tons in 1975 to 3,067,142 tons in 1987-89 (Al-Mokhalalati, 1990, Ministry of Agriculture and Water, 1987-89). The protein content of the world wheat collection varies from 6-22% depending on the production environment (Johnson, 1977). Wheat protein lacks the balance of essential amino acids required for its complete biological utilization. According to Bender (1968) and Khan and Eggum (1978a), the order of limiting amino acids in wheat protein is lysine, threonine and valine. Mixed human diets based on wheat have been shown to be deficient in lysine and threonine (Khan and Eggum, 1978b), and such diets have been reported to meet the protein

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requirements of various age groups in the population (Khan and Eggum, 1978b, 1979).

Although some work on the chemical composition of wheat varieties (Al-Mashhadi *et al.*, 1989), commercially milled wheat flour (Lorenz *et al.*, 1980), pearl millet flour and bread (Khalil and Sawaya, 1984), various cereal breads (Sawaya *et al.*, 1984, Mousa *et al.*, 1992), legumes (Khalil *et al.*, 1986) and Kabsah (Al-Kanhal, 1991) consumed in the Kingdom have been reported, yet, available information on nutritional quality of mixed wheat based dishes is inadequate. The objective of the present investigation was thus, initiated to study the nutritive value in terms of nutrient composition and quality of wheat based dishes commonly consumed in the kingdom of Saudi Arabia.

MATERIALS AND METHODS

Selection and Preparation

Six wheat-based dishes commonly consumed in the central region of the Kingdom of Saudi Arabia were selected for this study. Ten students of the College, residing in different parts of Riyadh city were selected for the purchase of ingredients and preparation of these dishes by their mothers according to the traditional cooking methods (Table I). Since the composition of these dishes may vary from house to house, the quantity of ingredients used in each dish was left to individual mothers according to their family practices. Ten samples of each dish after cooking were collected from each house and were pooled to make one representative sample and homogenized. A portion of the representative samples was withdrawn for the determination of moisture and vitamin C while the remainder was freeze dried, ground and stored in a deep freezer for further analysis.

Chemical Analysis

All the samples were analyzed for their chemical composition in the Department of Food Science, College of Agriculture, King Saud University, Riyadh. Moisture, protein ($N \times 6.25$), fat, and ash were determined according to standard methods 10.164–10.165 and 14.002–14.003, 24.038–24.040, 7.062, and 14.006 respectively of AOAC (1984). Total dietary fibre was estimated using a combination of enzymatic and gravimetric methods as described in the technical bulletin No. TDFAB-1 of Sigma Chemical Company (1985) based on the methods of Prosky *et al.*, (1984, 1985). Carbohydrate was calculated by difference. Energy content was calculated by multiplying the protein, fat and carbohydrates by factors of 4, 9 and 4 respectively. Metabolizable energy (M.E.) was calculated according to Miller and Payne (1959).

For the assays of vitamins, standard methods of AOAC (1984) were used. For determination of β -carotene and vitamin A, samples were extracted with ether-hexane, β -carotene was separated on a chromatographic column. The concentrations of β -carotene (method 43.014–43.021), vitamin A (method 43.008–43.013), thiamin (method 43.024–43.030), riboflavin (method 43.039–43.043) and vitamin C (method 43.064–43.068) were determined by methods of AOAC (1984). Vitamin A activity and β -carotene were converted to retinol equivalent (R.E.) One R.E. is equivalent to 1 μg retinol of 6 μg β -carotene. For the determination of minerals, 1–2 g samples were ashed in duplicate, dissolved in 20% HCl. Sodium and po-

TABLE I
Main Ingredients and Methods of Preparation of Saudi Dishes.

Dish	Ingredients	Method of Preparation
Marassia	Whole wheat flour, egg, whole milk, butter, honey or syrup.	Mix wheat flour, egg, milk, spices and water to make a low consistency dough. After 2 hours pour the dough on a hot plate. Bake both sides of the loaves. Serve with butter and some times with honey or syrup.
Mataziz	Whole wheat flour, mutton, carrots, peas, onion, tomato, corn oil, salt spices.	Prepare unleavened thick dough by mixing wheat flour and water. Leave for 1 hour. Cut dough into pieces and shape into balls. Turn the balls into flat and round pieces (5mm thickness × 5 cm dia). Prepare meat and vegetable stew by frying onion and meat. Add tomatoes and rest of vegetables and water. Cook until vegetables and meat become soft. Add dough pieces and cook on a medium heat for 1 hour.
Harees	Whole wheat grits, mutton, corn oil, onion, salt and spices.	Fry onion in oil. Add meat, salt, spices and water. Heat for a few minutes. Add wheat grits to the mixture and leave to cook on low heat for 4 hours.
Marqooq	Whole wheat flour, mutton, carrots, peas, beans, tomato, corn oil, salt and spices.	Preparation is similar to Mataziz except that dough balls are shaped to very thin (2mm) and larger loaves.
Gerish	Whole wheat grits, laban (sour milk), butter, onion, corn oil and salt.	Brown onion in heated oil. Add a mixture of water and laban (2.5:1) and small grits of wheat. Cook it on a low heat for 4 hours. Serve with some butter on top of the dish.
Qorsan	Wheat flour (white), mutton, carrots, peas, onion, tomato, corn oil, salt and spices.	Bake a very thin and dry bread from white wheat flour. Prepare broth of meat and vegetables by frying meat and onion in oil. Add salt, spices, tomato and water. Heat for few minutes. Add vegetables and cook until meat and vegetables become soft. The broth is added to layers of crushed bread. This step is repeated till all bread is used. Mix the ingredients thoroughly. Leave it for 15 min so that it is soft and ready for serving.

tassium were analysed with a flame photometer according to AOAC methods 14.038, 18.040–18.042 (1984). Calcium and iron were determined with Perkin-Elmer model 1100 B atomic absorption spectrophotometer and phosphorus was determined spectrophotometrically by the procedure of Watanabe and Olsen (1965). All assays were performed in duplicate.

RESULTS AND DISCUSSION

The chemical composition of wheat based dishes commonly consumed in Saudi Arabia is given in Tables II–IV. As is shown in Table II the moisture content varied between 49.3% in Marassia and 81.2% in Marqooq. The protein content ($N \times 6.25$) ranged from 2.4% in Harees to 6.7% in Marassia. The high content of protein in Marassia may be ascribed to the egg and milk usually added. Al-Jebrin *et al.* (1985) reported the protein content of some Saudi Arabia dishes

TABLE II
Chemical composition (wet basis) of some Saudi Wheat based dishes.

Products	g per 100 g						Energy/100 g kilocalories	
	Moisture	Protein (N × 6.25)	Fat	Carbohydrate	Dietary Fibre	Ash	G.E.	M.E.
Marassia	49.3	6.7	6.0	31.4	4.6	2.0	206	196
Mataziz	76.6	3.7	2.7	13.9	1.7	1.3	95	91
Harees	79.5	2.4	0.4	14.5	2.7	0.7	70	67
Marqooq	81.2	3.1	1.3	10.4	2.6	1.4	66	62
Gerish	79.9	2.5	1.8	12.7	1.9	1.2	77	73
Qorsan	76.7	4.3	2.3	12.5	2.7	1.6	88	84

G.E. = Gross Energy

M.E. = Metabolizable Energy

based on cereals and legumes ranging from 2.6 to 7.5%. Similar protein contents of some Pakistani wheat based dishes have been reported by Khan and Eggum (1978b; 1979) and Khan and Kissana (1985). The fat content ranged from 0.4 to 6.0% while the carbohydrate was highest (31.4%) in Marassia and lowest (10.4%) in Marqooq. Similar values for fat (0.5–4.9%) and carbohydrates (12.6–38.7%) were observed in Saudi Arabian dishes based on cereals and legumes (Al-Jebrin *et al.*, 1985). The dietary fibre content was highest (4.6%) in Marassia and lowest (1.7%) in Mataziz. All the dishes seem to provide low levels of fibre. The ash content varied between 0.7 and 2.0%. The gross energy ranged from 66 kcal/100 g in Marqooq to 206 kcal/100 g in Marassia. Similar values (92–193 kcal/100 g) in cereal legumes based Saudi dishes have been reported (Al Jebrin *et al.*, 1985).

The food composition data becomes more meaningful when it is compared to the daily needs of these nutrients. In the absence of local Recommended Dietary Allowances (RDA), the present data are compared with the RDA of American adult male (19–24 years) and female of the same age (NRC, 1989). According to National Research Council (1989) the daily allowances for protein and energy for adult man vs woman are 58 vs 46 g and 2900 vs 2200 kcals, respectively. A 100 g intake of Saudi wheat based dishes meet 4–12% vs 5–15% and 2–7% vs 3–9% of RDA for protein and energy for adult male vs female, respectively. The average daily per caput energy and protein requirements for Saudi population have been reported to be 2100 kcal and 47 g (NPU 0.8) respectively (Khan 1994). Based on these requirements, 100 g of these diets can meet 3–10% and 5–14% of energy and protein requirements per person per day respectively.

The recommended allowances for dietary fibre for the management of diabetes or coronary heart disease and for preventing constipation are 16–24 g per day (WHO, 1991). Thus 100 g of Saudi wheat based dishes can meet 11–29% of lower limit of the allowance for the management of diabetes or for individuals at risk of coronary heart disease. An inverse relationship between dietary fibre consumption and incidence of diverticulosis, cardiovascular disease, colonic cancer and diabetes has been reported (Spiller and Kay, 1980). The vitamin contents of Saudi wheat based dishes are given in Table III. The vitamin A was highest (411 µg R.E./100 g) in Marassia most probably due to addition of eggs, while in contrast it was absent in Harees. The thiamin contents ranged from 0.03–0.06 mg/100 g.

TABLE III
Vitamin Contents (wet basis) of some Wheat based Saudi dishes.

Products	Vitamin A Retinol Equivalent µg/100 g	mg per 100 g		
		Thiamin	Riboflavin	Vitamin C
Marassia	411	0.03	0.94	0.89
Mataziz	65	0.03	0.19	1.04
Harees	0	0.04	0.04	0.52
Marqooq	59	0.05	0.36	2.87
Gerish	148	0.03	0.26	0.98
Qorsan	144	0.06	0.52	1.60

Riboflavin was highest (0.94 mg/100 g) in Marassia and lowest (0.04 mg/100 g) in Harees. All the products appear to contain low levels of vitamin C. Marqooq, however, had the highest content (2.87 mg/100 g) of vitamin C.

The daily allowances for vitamin A, thiamin, riboflavin and vitamin C for adult male vs female are 1000 vs 800 µg R.E. 1.5 vs 1.1 mg, 1.7 vs 1.3 mg and 60 vs 60 mg, respectively (NRC, 1989). Among Saudi wheat based dishes a 100 g intake of Marassia can meet 41% vs over 51% of R.D.A. for vitamin A, whereas Gerish provided vitamin A to meet 15% and 19% of daily allowances for adult male and female respectively. Qorsan can meet 4% and 6% of thiamin daily requirement for adult man and woman, respectively. Riboflavin in 100 g of Marassia, was adequate to meet 55% and 72% of the requirement of adult men and women respectively. The vitamin C contents were low in all products. Even Marqooq, the highest, would only meet 5% of daily requirement of vitamin C for adult man and woman.

The mineral contents of Saudi Arabian wheat based dishes are shown in Table IV. All products appear to be poor sources of calcium (0–35.5 mg/100 g). The phosphorus content varied from 5.0 to 86.0 mg/100 g. The concentration of iron was highest (1.8 mg/100 g) in Harees and lowest (0.5 mg/100 g) in Gerish due to absence of meat in this dish. The sodium content ranged from 109.8 to 305.5

TABLE IV
Mineral contents (wet basis) of some wheat based Saudi dishes.

Products	mg per 100 g				
	Calcium	Phosphorus	Iron	Sodium	Potassium
Marassia	1.3	72	1.2	190	57
Mataziz	35.5	86	1.1	127	295
Harees	0.0	5	1.8	110	92
Marqooq	1.5	61	1.4	306	132
Gerish	1.6	48	0.5	115	50
Qorsan	1.0	59	0.9	260	132

mg/100 g. The higher contents of sodium in Marqooq and Qorsan are due to addition of sodium chloride in the preparation of these products. The concentration of potassium was highest (294.7 mg/100 g) in Mataziz and lowest (49.9 mg/100 g) in Gerish.

The daily allowances for calcium, phosphorus, iron, sodium and potassium for adult man and woman are 1200, 1200, 10–15, 500 and 2000 mg respectively (NRC, 1989). Wheat based dishes (100 g) will generally meet little of daily calcium and phosphorus requirements. All the dishes are also poor in iron. A 100 g portion of Harees will meet 18% and 12% of daily iron requirements of adult man and woman respectively. The sodium contents in Marqooq and Qorsan were adequate to meet over 50% of daily requirement, while Mataziz will meet only 15% of the daily requirement of potassium.

Nutritional Quality

In a well-balanced diet 10–15% of the total energy is usually derived from protein, 55–75% from carbohydrate and 15–30% from fat (WHO, 1991).

According to Table V, all the wheat based dishes contribute 13–20% of the total food energy from protein indicating that the present dishes are more than adequate in quality in terms of protein. In practice, diets in most parts of the world provide 9–14% of calories as protein and any food/diet with less than 8% kcal as protein is presumably inadequate to meet the protein needs of a population (Munro and Crim, 1980). Protein does not seem to be a limiting factor in these dishes. The contribution of food energy from fat was adequate in all wheat based dishes except Harees which was low (5%) in fat. There is a need to reduce the fat content in Saudi dishes to the recommended lower limit of 15% of energy intake. This level of intake would not only be adequate to meet the essential fatty acids requirement but would also reduce the risk of chronic diseases prevalent in this country (WHO, 1991). The contribution of food energy from carbohydrates was highest (82%) in Harees. The quality of dishes studied in the present study compares well with the percentage of food energy of 12.2 and 25.2% derived from available protein and fat respectively at national level in the Kingdom (FAO, 1990).

The protein energy ratio (PE%) has been used as a convenient and useful index of measuring dietary quality in human nutrition (FAO/WHO, 1985). According to Payne (1976) the levels of protein required in terms of protein energy

TABLE V
Nutritional quality of some wheat based Saudi dishes.

Products	Percent food energy (Kcal)		
	Protein	Fats	Carbohydrates
Marassia	13	27	61
Mataziz	16	26	59
Harees	14	5	82
Marqooq	19	18	64
Gerish	13	21	66
Qorsan	20	24	57

requirement ratios for different age/sex groups i.e. 6–9 months, 1 year, 2–3 years, adult male, adult female, pregnant and lactating mothers are 6.9, 5.4, 5.3, 5.1, 4.2, 4.8 and 5.2 respectively. In comparing the required ratios with the protein energy percent of Saudi dishes (Table V), all the wheat based dishes will meet the protein requirement of all age groups provided adequate quantities of the diets are eaten to meet the energy requirements. The present results are in line with the findings of Khan and Eggum (1978b, 1979), for similar diets consumed in Pakistan.

In conclusion, the nutrient composition and nutritional quality of wheat based Saudi dishes investigated in the study indicate that these dishes can provide significant amount of many nutrients and energy to meet the nutritional needs of the population. Calcium, phosphorus, iron, thiamin, vitamin A and vitamin C contents are, however, low. These data should be useful for planners, nutritionists, food scientists and dietitians in assessing the nutritional status of Saudi Arabian population. Moreover, the data augment the efforts already being undertaken to compile local food composition tables.

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