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Chemical and Amino Acid Composition of Four Traditional Foods Consumed in the Arab Gulf States

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ABSTRACT

*The chemical and amino acid compositions of four traditional foods commonly consumed in the Arabian Gulf states were investigated. These foods are two kinds of fermented fish sauces (*tareeh *and* mehiawah*) and two types of bread made from date and cheese. The results indicated that* tareeh *had higher levels of protein, ash, Ca, Na, Mg, P and Zn than* mehiawah*, whereas the second fish sauce had higher amounts of moisture, fat, carbohydrates, Fe and K. For the breads, cheese bread (*khubez-jebin*) had higher levels of protein, fat, ash, Ca, P and Na than date bread (*khubez-tamer*). However, the breads made from dates were higher in most minerals (Fe, K, Mg, Cu and Zn) than cheese bread. The amino acid profiles in both fermented fish sauces were superior to those of date or cheese breads. It was concluded that these traditional foods can provide substantial amounts of nutrients to the normal daily diets of Arab Gulf inhabitants. Nevertheless, attention should be paid to the high sodium levels in fermented fish sauces.*

INTRODUCTION

Traditional foods are those foods which are locally available and consumed by a large sector of the community. They are highly accepted and included in the meal. A great emphasis has been recently made on the role of traditional foods in improving the nutritional status of the people. Many of these foods

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are nutritionally important in the diet and can make a significant contribution in meeting the nutritional requirements of a population, particularly those of low income and those living in remote areas such as in deserts or mountains (FAO, 1987).

The rapid change in food habits in the Arab Gulf countries, which has resulted from high increases in *per capita* income, has adversely affected the consumption of many traditional foods. Consequently, these foods have gradually disappeared from the food table (Musaiger, 1987). Nowadays, the Gulf countries have been making substantial efforts to increase their food production and promote health and the nutritional well-being of the community. Nevertheless, traditional foods are neglected in nutrition intervention programmes. This is mainly due to the lack of information on the dietary aspects of traditional foods. Promoting the consumption of such foods, therefore, would not be possible without understanding their nutrient composition.

Previous studies in the Gulf were focused on the traditional foods based on dairy products (Al-Mashhadi *et al.*, 1986), fruits (Sawaya *et al.*, 1983; Al-Mohizea *et al.*, 1986) and bakery products (Sawaya *et al.*, 1984; Musaiger *et al.*, 1988). However, this study adds new information on four types of traditional foods commonly consumed in some Arab Gulf states, namely, Bahrain, Kuwait, Qatar and United Arab Emirates. The foods investigated include two types of fermented fish sauces (*tareeh* and *mehiawah*), and two types of breads prepared from dates and cheese (*khubez-tamer* and *khubez-jebin*). Information concerning the composition of these foods would be helpful for both local health and food authorities, and for many foreign nutrition professionals working in the Gulf, as well as for those who lack information on the composition of local foods.

MATERIALS AND METHODS

Materials

Many traditional foods are made only in the home (and could not be obtained from markets) while others are also available in the local market. For the purpose of this study an investigation was first carried out to identify the families and local shops preparing the traditional fish sauces and breads made from date and cheese in Bahrain. The two fish sauces (*tareeh* and *mehiawah*) are mainly prepared in the home by some families, who either sell these products to local shops or use them for their personal consumption. *Tareeh* is rarely available in the market; therefore, in order to consider the variation in its preparation three samples were obtained from three different

families who are experienced in preparing such products. Two samples of *mehiawah* were obtained from two local shops.

Based on an investigation, it was found that four local bakeries in Bahrain prepare the traditional date bread; therefore, an attempt was made to obtain samples from all these bakeries (four samples). Cheese bread is only prepared on request in some local bakeries. Two samples of cheese bread were obtained from two bakeries preparing such bread.

Information on ingredients and method of preparation of the four traditional foods was also obtained from the families and bakeries.

Methods

All samples were collected on the same day. Fish sauces are usually kept in glass containers of about $1\frac{1}{4}$ litre size, while bread samples were kept in polyethylene bags. All samples were first sent to the laboratory for moisture determination. Samples were then freeze-dried and refrigerated for further analysis.

Moisture, protein (N × 6·25), fat, crude fibre and ash were determined according to the standard method (AOAC, 1984). Total carbohydrates were calculated by difference. Energy was estimated using the factors 4, 4 and 9 kcal/g for protein, carbohydrates, and fat, respectively.

Minerals were measured by wet-ashing as described in Osborn and Voogt (1978). Concentrations of Na and K were determined by an Eppenorf 200 Flame Photometer. Other minerals were determined by using an IL25L Atomic Absorption Spectrophotometer. The amino acid compositions, other than tryptophan, were determined by acid hydrolysis of protein with 6N HCl using an LKB Amino Acid Analyser (Model 4150 ALPHA) (LKB, 1983). Tryptophan was measured colorimetrically as described in Spies (1967).

RESULTS AND DISCUSSION

Ingredients and methods of preparation of the four traditional foods are listed in Table 1. Dates and/or date syrup are usually used in the preparation of date bread. A straight dough method with little time of fermentation is the method of preparation of both types of bread (date and cheese breads). The low fermentation period affects the utilization of some minerals, as fermentation increases destruction of phytic acid, which adversely affects the bioavailability of iron, zinc and calcium (Reinhold *et al.*, 1975).

Fish is used in the preparation of many popular dishes in the Gulf. One commonly consumed fish-based preparation is fermented fish, which is locally made by a traditional process handed down from generation to

TABLE 1
Ingredients and Methods of Preparation of Traditional Foods Consumed in the Arab Gulf States

Local name	*Common name*	*Ingredients*	*Method of preparation*
Khubez-tamer	Date bread	Date and/or date syrup, wheat flour, sugar, salt, yeast and water.	Dissolving sugar in the water. Adding date and/or date syrup, flour, salt and yeast, and mixing for 15 min. Rounding, flattening and baking.
Khubez-jebin	Cheese bread	Wheat flour, cream cheese, water, yeast, salt, and Na-bicarbonate	Dissolving salt, yeast and Na-bicarbonate in the water. Adding flour and mixing for 15 min. Adding cream cheese and mixing. Rounding, flattening and baking.
Tareeh	Concentrated fermented fish sauce	Fish (Indian oil sardine), cumins, red chillies, salt and water.	Washing the fish, draining and mixing with other ingredients. Put in a container and keeping under sunlight for 1 week.
Mehiawah	Fermented fish sauce	Fish (Indian oil sardine), mixed spices (cumins, black peppers, dry corianders and red chillies), salt, oil and water.	Washing the fish, draining, and mixing with salt and water. Put in a container and keeping under sunlight for 7–10 days. Roasting the mixed spices with little oil. Mixing the spices with fermented fish. Keeping for further fermentation for 1 week.

generation. Indian oil sardine is the main fish used in the preparation of the two fish sauces, *tareeh* and *mehiawah*, but the use of spices is lower in the former food. Although the processing technique of these traditional foods is very simple, the product differs from home to home. This is mainly dependent on the amount and quality of fish and spices used, amount of salt added, and condition of storage after processing.

The proximate and mineral compositions of traditional foods studied are presented in Table 2. The moisture levels of the two breads varied, mainly due to baking temperature, relative humidity and elapsed time between baking and analysis (Koushestani *et al.*, 1969; Tabekhia & Toma, 1979). Moisture content plays an important role in the shelf-life of bread. When compared with other breads produced in the Arabian Gulf (Sawaya *et al.*, 1984; Musaiger *et al.*, 1988) date bread had the lowest moisture content, indicating a longer shelflife.

The addition of cheese to the bread improves its proximate composition in protein, fat and ash, while the addition of dates increases the carbohydrate content and consequently the energy value of date bread.

Both breads had a low fibre level (0·54 and 0·69% for date and cheese breads, respectively), suggesting a low extraction rate of the flours used in their preparation. This finding compared favourably with those reported by Musaiger *et al.* (1988) in various breads consumed in Bahrain. But breads consumed in Saudi Arabia (Sawaya *et al.*, 1984) and Kuwait (Eid & Bourisly, 1986) had a higher fibre content, mainly because of the high extraction rate of flour used in the preparation of these breads.

With respect to mineral composition, it is obvious that addition of cream cheese to bread increases its content of calcium, phosphorus and sodium. On the other hand, the addition of dates increases the contents of the other minerals (Fe, K, Mg and Zn). However, it is difficult to correlate the mineral contents with the addition of dates or cheese without taking into consideration the type of flour used in the preparation of these breads. In most Arab Gulf countries, Saudi wheat is now used for the preparation of bread. Actually the flour of this wheat is blended with the flour of Australian wheat, for the preparation of bakery products, especially breads. The compositions of the two flours, as well as the proportion of them in the mixture, affect the mineral and other chemical contents of the final products.

The moisture content of *tareeh* (58·5%) was lower than that of *mehiawah* (67·4%). Nevertheless, it is worth mentioning that *tareeh* is usually diluted with water before consumption, making the moisture contents ultimately almost similar. *Mehiawah* had a higher level of fat and carbohydrates and hence higher energy value. The use of very small fish in the preparation of these sauces improves their calcium and phosphorus contents. This is mainly due to the availability of bones of the fish in the sauce.

TABLE 2
Proximate and Mineral Compositions of Traditional Foods Consumed in the Arab Gulf States[a]

Chemicals	*Fermented fish*				*Breads*			
	Tareeh		Mehiawah		Khubez-tamer		Khubez-jebin	
	Mean	(*Range*)	*Mean*	(*Range*)	*Mean*	(*Range*)	*Mean*	(*Range*)
Proximate composition (g/100 g)								
Moisture	58·5	(54·5–66·3)	67·4	(64·7–70·0)	22·4	(18·7–27·0)	36·5	(35·4–37·7)
Protein (N × 6·25)	14·9	(14·0–16·0)	7·9	(7·5–8·3)	8·8	(7·7–9·4)	10·4	(9·3–11·5)
Crude fat	1·8	(1·3–1·7)	3·2	(2·8–3·6)	1·9	(0·8–3·0)	6·0	(5·0–7·0)
Crude fibre	0·5	(0·3–0·8)	2·4	(2·0–2·7)	0·5	(0·4–0·7)	0·7	(0·6–0·8)
Ash	23·2	(13·2–30·1)	7·7	(7·3–8·0)	1·2	(1·0–1·5)	2·2	(2·1–2·3)
Carbohydrates	1·1	(0·0–3·7)	11·4	(8·7–14·2)	65·2	(59·8–69·0)	44·2	(43·3–45·1)
Energy (kcal/100 g)	80	(70–92·3)	106	(101–112)	307	(292–327)	269	(259–279)
Mineral composition (mg/100 g)								
Na	4 204	(2 780–5 327)	1 572	(1 570–1 573)	116	(89·1–181)	244	(235–252)
K	107	(97·4–124)	177	(170–184)	101	(57·4–149)	48·3	(47·1–49·5)
Ca	525	(339–659)	174·9	(116–234)	5·8	(5·3–6·2)	11·4	(7·3–15·6)
Mg	92·4	(89·8–95·3)	47·7	(42·4–53·0)	12·5	(10·4–15·7)	12·1	(9·8–14·4)
Fe	3·0	(2·1–4·5)	3·9	(3·0–4·7)	1·8	(1·6–2·2)	1·5	(1·4–1·6)
Cu	116	(92·2–176)	181	(162–199)	0·4	(0·3–0·4)	0·3	(0·3)
Zn	162	(150–170)	48·3	(43·2–53·3)	8·4	(6·6–9·9)	6·0	(3·0–9·1)
P	473	(378–702)	176	(166–185)	75·0	(36·5–103)	185	(173–196)
Mn	0·2	(0·14–0·25)	0·5	(0·4–0·6)	0·9	(0·6–1·5)	0·4	(0·2–0·6)

[a] Values are means of two observations for *mehiawah* and *khubez-jebin*, three observations for *tareeh* and four observations for *khubez-tamer*.

Iron contents of fish sauces were high (3·0 and 3·9 mg/100 g in *tareeh* and *mehiawah*, respectively) when compared to the iron levels of various fish consumed in the Gulf. Kamel (1982) found that, with the exception of boiled shrimps, the iron contents of 27 kinds of fish consumed in the Gulf ranged from 0·32 to 2·61 mg/100 g. The relatively low moisture contents of fish sauces compared to fresh fish, in addition to the use of spices, are probably the main cause of the higher value of iron in the fish sauce.

Iron content is particularly important, as iron-deficiency anaemia is one of the main public health problems in this region (Musaiger, 1987), and therefore encouragement of consumption of fish may help in part to prevent this anaemia. Fish sauces also contain good amounts of protein and most minerals. However, there are two factors that limit the utilization of these fish sauces. First, the manner of consumption, as these sauces are usually consumed by immersing a small piece of bread in the sauce, so that the contribution of fish is minimal. The second important factor is the high

TABLE 3
Amino Acid Compositions of Traditional Foods Consumed in the Arab Gulf States[a] (g/100 g protein)

Amino acid	*Fermented fish*		*Breads*	
	Tareeh	Mehiawah	Khubez-tamer	Khubez-jebin
Aspartic	15·6	10·0	2·7	4·2
Threonine	6·7	4·0	1·6	2·3
Serine	4·6	3·5	1·8	1·9
Glutamic	25·8	23·8	18·4	18·0
Proline	4·2	6·2	11·3	18·9
Glycine	9·7	7·6	1·7	2·0
Alanine	12·3	12·0	3·9	5·6
Cystine	1·4	1·0	1·6	2·3
Valine	9·5	7·7	3·5	5·6
Methionine	5·7	3·3	1·2	2·0
Isoleucine	7·1	5·2	3·8	4·3
Leucine	12·5	9·5	5·4	7·5
Tyrosine	6·7	2·9	1·4	2·2
Phenylalanine	6·0	4·4	3·0	4·3
Histidine	3·8	3·2	1·1	2·1
Lysine	17·8	10·9	0·6	1·9
Arginine	4·5	3·0	2·2	3·8
Tryptophan	1·2	1·1	0·9	1·1
Ammonia	1·8	2·4	2·3	2·5

[a] Values are means of two observations for *mehiawah* and *khubez-jebin*, three observations for *tareeh* and four observations for *khubez-tamer*.

content of sodium in the fish sauces (4704 and 1572 mg/100 g in *tareeh* and *mehiawah*, respectively), which limits its intake by hypertensive and some obese individuals.

An attempt was made to compare the fish sauces studied with salted sardine consumed in Egypt (Salama *et al.*, 1977). Our analysis showed that the Gulf fish sauces were lower in fat, protein and phosphorus, but higher in moisture and ash, than salted fish in Egypt.

The amino acid composition of the traditional foods is presented in Table 3. For the fish sauces, *tareeh* shows superiority in all amino acids (except proline), whereas for the breads, cheese bread had higher levels of all amino acids than date bread. When compared with FAO/WHO (1973) reference proteins, lysine and threonine were the first and second limiting amino acids in both date and cheese breads. These findings are in good agreement with other data on various breads consumed in the Gulf (Sawaya *et al.*, 1984; Musaiger *et al.*, 1988). Date breads were also deficient in valine, isoleucine and leucine when compared to the FAO/WHO standard, but these amino acids were found to be in appropriate amounts in cheese bread. Because of the high biological value of fish protein, the amino acid profiles in both fish sauces were found to be superior to those of the breads studied.

In conclusion, the traditional foods studied here can make a substantial contribution to the nutrient contents of the diet of the Arab Gulf states. This is particularly true since breads are usually consumed with other foods which tend to supplement the nutrient composition of the bread. Fish sauces are usually eaten with bread and fresh vegetables, which, in turn, improve the nutritional value of the diet. Attention should be given to the high amount of salt in fish sauces, especially in therapeutic diets. More studies in traditional foods in the Gulf region are highly recommended. It is hoped that this study will stimulate other investigators to explore the chemical compositions of other local foods in the region.

REFERENCES

Al-Mashhadi, A. S., Saadi, S. R., Ismail, A. & Salji, P. (1986). Traditional fermented dairy products in Saudi Arabia. *Cultured Dairy Prod. J.*, **22**, 24–6.

Al-Mohizea, I. S., El-Behery, M. M. & Havlass, M. A. (1986). Physico-chemical characteristics of jujube fruits grown in the Central Region of Saudi Arabia. *J. Coll. Agric. King Saud Univ.*, **8**, 337–44.

AOAC (1984). *Official Methods of Analysis* (14th edn). Association of Official Chemists, Washington, DC.

Eid, N. & Bourisly, N. (1986). Bread consumption in Kuwait. *Nut. Rep. Int.*, **33**, 967–71.

FAO/WHO (1973). Energy and protein requirements. World Health Organization, Technical Report Series No. 522, Geneva.

FAO (1987). Promoting under-exploited food plants in Africa. FAO, Rome.

Kamel, B. (1982). Proximate, macro and micro elements analysis of Arabian Gulf fish. *Lebensm. Wiss. U. Technol.*, **15**, 22–5.

Koushestani, A., Ghaviffkr, H., Rahman, M., Mayubian, H. & Sarkissian, N. (1969). Composition and preparation of Iranian breads. *J. Am. Diet. Ass.*, **55**, 262–6.

LKB (1983). LKB protein chemistry. Note No. 27, LKB, Biochrom Ltd. Cambridge, UK.

Musaiger, A. O. (1987). The state of food and nutrition in the Arabian Gulf countries. *World Rev. Nutr. Diet.*, **54**, 105–73.

Musaiger, A. O., Alloush, S. & Abu-Dagga, F. (1988). Chemical and amino acid composition of various breads consumed in Bahrain. *Ecol. Food Nutr.*, **21**, 211–17.

Osborne, D. R. & Voogt, P. (1978). *The Analysis of Nutrients in Foods.* Academic Press, London.

Reinhold, J. G., Ismail-Beigi, F. & Faradji, B. (1975). Fiber versus Phytate as determination of the availability of calcium, zinc and iron. *Nut. Rep. Int.*, **12**, 75–85.

Salama, M. E. A., Moustafa, E. K. & Safwat, M. M. (1977). Chemical and quality attributes of salted sardine sold on the Alexandria market. *Sudan J. Food Sci. Technol.*, **9**, 47–54.

Sawaya, W. N., Khalil, J. K., Safi, W. J. & Al-Shalhat, A. (1983). Physical and chemical characterization of three Saudi date cultivars at varous stages of development. *Can. Inst. Food Sci. Technol. J.*, **16**, 87–91.

Sawaya, W. N., Khalil, J. K., Khatchasourian, H. A. & Al-Mohammed, M. M. (1984). Nutritional evaluation of various breads consumed in Saudi Arabia. *Nut. Rep. Int.*, **29**, 1161–70.

Spies, J. R. (1967). Determination of tryptophan in proteins. *Anal. Chem.*, **39**, 1412–17.

Tabekhia, M. M. & Toma, R. B. (1979). Chemical composition of various types of Egyptian breads. *Nut. Rep. Int.*, **19**, 377–82.