



# *ESTABLISHING FOOD COMPOSITION DATA FOR THE NEAR EAST*



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FOR THE NEAR EAST***

**Proceedings of a workshop held in Manama, Bahrain 14-16 June, 1998**

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**Edited by**

***Abdulrahman O. Musaiger***

**and**

***Samir S. Miladi***

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## ***PREFACE***

The Near East Region has experienced rapid changes on social and economic situation during the last three decades. This has made great changes in the living standards and lifestyle patterns. As a result, new social and health problems have occurred and of course some of the problems might have been disappeared. Consequently, official bodies have established various plans and programmes to overcome these problems. Establishing a database on food composition or on any other matter has been considered by several organizations in this region and agreed that it will be a vital step to solve these problems.

This publication based on the papers presented in the workshop on establishing food composition data for the Near East Region, which was held in Bahrain, 14 – 16 June, 1998. The workshop was organized by FAO, Regional Office in Cairo, in cooperation with Bahrain Center for Studies and Research and Arab Nutrition Society. We hope that information provided in this publication is useful for those interested in food composition data in the Region.



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**Dr. Salman Al-Zayani**  
**Secretary General**  
**Bahrain Center for Studies & Research**

# THE USES OF FOOD COMPOSITION DATA

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## ***Introduction***

Food composition activities are receiving renewed attention worldwide. This is due in part to the continuing recognition of the importance of food composition information in formulating policies and programmes to improve nutrition. It is also due to the new and broader applications for food composition data that are currently emerging in marketing, trade and consumer information.

In the last few years, several meetings on this topic have been supported by FAO in the region: one in 1995 in the United Arab Emirates for the Arab Countries of the Gulf (GULFOODS); another in 1997 in Cyprus for the Mediterranean countries (MEFOODS) and now here in Bahrain for the Near East Region. At the same time, many similar meetings have been held in other regions. The number of discussions that have taken place to encourage and facilitate the establishment and updating of food composition data at both the country and regional level is an indication of the importance we place on this activity.

All of you participating in this meeting are involved in one way or another - as users or gatherers, or both - with food composition data. We hope to come away from this meeting with a better understanding of where each of your respective countries stands in the development of food composition data, with a clearer indication of how we can work together to advance these activities at the country and regional level. I hope that our discussions will lead to concrete action that will focus on meeting the needs of the users of food composition information. Our goal in strengthening activities in food composition data is to generate, disseminate and promote the use of high quality information by a wide range of researchers, policy-makers and practitioners in both the public and private sector.

## *Uses of Food Composition Data*

Renewed efforts to promote food composition activities must continue to include the critical traditional uses for evaluating the nutritional adequacy of diets and conducting epidemiological research. They must also consider the emerging, broader applications of food composition data. There is currently an unprecedented opportunity for wider support for food composition work, ranging from the food industry to consumer groups. Consumers in all countries want more, and more reliable information on the content and nutritional value of the foods they eat. This interest on the part of the consumer has led in recent years to legislation in many countries to require nutrition information for foods. Food manufacturers have responded to consumer interest by seeking new formulations of foods that are consistent with current health recommendations, an activity that is based on food and ingredient composition.

At the same time, the global nature of food processing and the anticipated expansion of world trade as a result of new trade agreements increase the likelihood of greater food trade and more exchange of goods and ingredients across international borders. This also stimulates the need for food composition for labelling, regulatory and other purposes related to such trade and exchange. All of this has resulted in a greatly expanded number of users of food composition information.

### *Traditional uses*

Let us first review some of the most important so-called “traditional uses” of food composition data. Food composition information is an essential element in formulating policies and programmes to improve nutrition. Accurate, precise and current food composition data are an integral part of the assessment of the nutritional adequacy of diets and of the food supply. The development of accurate and current food composition data also facilitates agricultural development and trade, supports investigations of diet-health hypotheses and assists regulatory activities related to the food supply.

Extensive food composition information is needed as a basic tool for public and private health service providers and for researchers. Medical and other clinical nutrition users require particularly precise information, as under some conditions an excess or deficit in levels of nutrients may alter the final outcome of a particular disease. Examples such as the

vitamin A content of food for infants with protein energy malnutrition or metabolic such as PKU (phenylketonuria) show how critical food composition information may be for a given set of patients.

Clinical investigations of diet-related hypotheses require precise food composition data, as well as indicators of component variability to define experimental diets. Nutritional epidemiology investigations to establish diet-health relationships at the population level rely on a detailed and comprehensive knowledge of food composition. Dietary antioxidants, specific fatty acids, and trace elements may be key components in our understanding of how diet affects the occurrence and severity of cardiovascular disease, cancer, hypertension, osteoporosis and other chronic diseases. It is essential that we know the composition of foods if we are to understand how nutrients and genes interact in determining how we grow and mature, or how we get sick or remain healthy.

Food fortification programmes require comprehensive and accurate composition information on foods consumed in order to define both proper vehicles and levels of fortification. The monitoring of such programmes also requires updated information on foods consumed and their composition. Emergency feeding programmes and famine relief require general food composition data to ensure the adequacy of critical nutrients in the prescribed diet.

Agricultural planning requires food composition information for guidance in crop selection, development of new varieties and in traditional crop trade, although a lesser degree of precision is needed. The industry that relates to fundamental handling of commodities with basic processing uses food composition data to facilitate trade. The definition and standards for food commodities rely on basic, broad, well-established data on food composition.

### ***Emerging uses***

In addition to these essential uses, and also closely related, food composition data are now experiencing broader uses, particularly in the areas of trade and food product development, and food safety and consumer interests.

Within the food industry there is an emerging application of food composition data, especially food ingredients, in the development of and planning for food products. Data for ingredients, as well as for the

finished product, are being used to determine and adjust specific formulations for nutrient content. They are also being used for the determination of cost. Food technologists within the industry are increasingly realizing that accurate and detailed composition data provide the opportunity to select the ingredients to make foods that are safe, more uniform, more nutritious and less costly.

Information on finished food products is needed to meet international standards for trade and the regulations of import partners, and to verify the claim statements on the product label. Data on the composition of ingredients is essential for predicting appropriate levels of food components within finished products. Food manufacturers are increasingly turning to specific information on the composition of ingredients in direct response to consumer demand for specific types of food products, such as those higher in fibre or lower in fat.

Consumers are a rapidly growing group of users of food composition information. The recommendations of food-based dietary guidelines to promote good health and nutrition has resulted in increased efforts on the part of consumers in many countries to select foods consistent with those recommendations. To do so, consumers must have the necessary information about the nutritional content of the foods they eat. It is considered very likely that consumer interest in food composition information will continue to increase worldwide, thus placing greater pressure on both the food industry and governments to provide accurate information. This is likely to result in increased regulations world-wide for nutrition labelling on foods, thus further increasing the need for food composition data.

Food composition data have a direct application to the issues involved in food safety. Concerns about naturally-occurring or environmental contaminants require databases for food composition, specifically those that go beyond the traditional nutrients and consider such components as lead and nitrates. Food composition information is essential for national food control systems. In addition, the concepts of food safety have recently been evolving to encompass a more comprehensive approach centering on the strategies of risk analysis. Specifically, there is a growing recognition of the importance of an overall dietary exposure estimate, rather than just a monitoring of levels in particularly problematic foods. Such an estimate requires information on the content of all foods in a total diet in order to calculate total daily intake.

The use of food composition data to address issues of world trade and international food standards is perhaps the fastest growing use over the last few years. With an estimated 40% of ingredients for foods coming from countries other than the one in which the food is formulated, these are issues of wide-spread importance to developed and developing countries alike.

The Codex Alimentarius, which provides the only set of international rules and guidelines for food standards, establishes uniform methods for the use of food composition information on the labels of numerous types of foods, thus reconfirming the importance and utility of food composition data. Beyond these international standards - agreed to voluntarily by participating countries - international trade agreements are developing rapidly. They are stimulated by the increasingly global nature of commerce and by the extensive changes in food processing techniques. The GATT trade agreement (General Agreement on Tariffs and Trade), which includes about 112 member countries, has recognized the use of Codex standards. This, in turn, will increasingly necessitate food labelling and subsequently, current and accurate food composition data.

Food nutrient and ingredient labelling is meaningful and pertinent only if it is supported by accurate and current food composition information. The need for data for such purposes on the part of both the food industry and governments has the greatest potential impact on efforts to develop and strengthen food composition activities. Interestingly, this is an emerging use of food composition data that is driven by both consumer demand and international trade. Although to date nutrition labelling of foods has been of interest primarily in developed countries where chronic diseases are a major health concern and a wide variety of foods are available, the existence of regulations requiring labelling clearly will affect those who wish to export foods, or raw ingredients for foods, to such countries. Given the role of trade in economic development, nutrition labeling of foods and the consequent need for food composition data is a critical factor in the need to develop the capacities of all countries to conduct food composition activities.

### *Other Issues*

In closing, I would like to make a few brief remarks on some critical issues in generating and using food composition data.

*Firstly*, from an operational point of view, a broad approach to the potential uses and users of food composition information is needed as national programmes are established and strengthened. Focusing only on highly sophisticated data management systems may not meet the requirements of many users in developing countries where such data systems are difficult to operate over time. A mix of information collection, processing, and dissemination systems will be necessary.

*Secondly*, it is critical to balance the generation of new food composition data against the costs. The specific need for and use of any new data, together with the costs to achieve the required data quality, always need to be carefully examined.

*Thirdly*, the usefulness of food composition data is decided by the users in relation to the uses they have for the data. Users need descriptions with the right level of detail in order to select data of appropriate quality. Alternative ways may be needed of describing the detail that users need to make their selections and match the use they have for the data with desired quality and representativeness.

*Fourthly*, as national food composition programmes are initiated and strengthened, linkages to existing and complementary systems should be encouraged.

*Lastly*, increased coordination and standardization is necessary at the national, regional and international level to harmonize the different systems working with food composition data in order to improve data sharing. Compatibility of databases is essential to reduce expenditures associated with generating and maintaining composition data on a global basis and to assist countries in lessening the costs of producing reliable food composition data.

# FOOD COMPOSITION ACTIVITIES IN THE NEAR EAST REGION

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## ***Introduction***

The terms Middle East or Near East are often used without any clear definite connotation of the territorial limits involved. There has never been a general agreement on their precise meaning and the countries to be covered. The FAO Near East Region included for discussion in this paper comprises 26 countries (20 Arab countries which are members of the Arab League, in addition to six non-Arabic speaking countries, which are Turkey, Iran, Pakistan, Afghanistan, Cyprus and Malta). The FAO food composition tables for the Near East which were published in 1982 referred to 22 countries, since the 4 other countries were not members of the FAO Near East Office. This means that data from the 22 countries are included; however, very limited information was available regarding the Arab countries of the Gulf as well as Mauritania, Yemen and Djibouti.

The region under consideration sits astride the lines of communication with Europe, Africa and West Asia, and it has been as a result subject to influences in terms of food habits from the East, West and North as well as the South. The total land area of the Near East Region is about 16.5 million Km<sup>2</sup> out of which 75% is desert, 20% is range and forestry and the remaining 5% is used as arable land and for permanent crops. The total population of the regions is about 500 millions. The region is characterized by the highest population growth rate in the world of 3.1% (population will double within 23 years); this is coupled with a high rate of urbanization of 4 to 6%. The region has the poorest and the richest countries of the world. Most of the countries of the Near East have a negative food trade balance, with the exception of Turkey. The food import in the Near East Region is estimated to be 20 billion US Dollars. This represents 10% of the World Food Trade. All these factors contribute to the high degree of variation in the type of foods available for consumption.

## *Food Composition Activities in the Near East*

Food and nutrition activities in the Near East have always followed world trends. In the early thirties, two important events happened in the world. The first was the establishment of the dietary requirements for health, and the second was the discovery of widespread malnutrition in the most advanced countries. The pioneering study was prepared by Johan Boyr Orr (who became later the first Director General of FAO) and showed no less than one-third of the population of Great Britain was malnourished, mainly because of inadequate consumption of milk, vegetables and fruits. His findings and conclusions were associated with the interpretation of dietary intakes using food composition tables. Research on dietary requirement and food consumption was always associated with the interpretation of dietary intakes using food composition tables. Research on dietary requirement and food consumption was always associated with food composition tables.

In Egypt the National Food and Nutrition Committee was created in 1939 to assess the dietary habits of the Egyptian population and to recommend necessary action. The Committee carried out the first food consumption survey in villages in Lower and Upper Egypt on a relatively small sample size. The results of the survey showed low intake of calories and protein. These findings were extremely helpful in the establishment of the Ministry of Supply and Internal Trade and the introduction for the first time of a food rationing system. The second function of this newly-established Ministry was the fixation of prices of basic food commodities (these different actions were what we now call a practical approach to household food security). It should be noted that Egypt issued the first laws on adulteration (especially of food) in 1941. The implementation of the laws called on the establishment of food standards which were based on the food composition and analysis.

FAO was founded in 1945. One of its first tasks was to prepare a survey on current information on the world's food problems. FAO published its first world food survey in 1946, which covered 70 countries comprising 90% of the earth's population. The survey was pioneering in analysing the world food situation. It drew attention to the degree of malnutrition based on food availability, nutritional requirement and purchasing power. The result of the survey proposed nutritional targets for intake of the main food groups, and calculated country by country the increases in food production and consumption that would be needed to attain them. Such a survey could not be achieved without information on the composition of

foods produced and consumed. The main weakness of the result of the survey was that much information on certain traditional or wild plants and animals which are consumed in certain parts of the world, mainly Africa, the Far East and Latin America, was not known in terms of their composition and nutritional value. This drew attention to the need for food analysis and preparation of national, and later regional, food composition tables. Also food composition tables were needed for the preparation of the Food Balance Sheet which at that time was necessary to give an estimation of food availability, dietary habits and nutritional requirement for several countries. The Food Balance Sheet was helpful also in examining the food gap and the trend in consumption. All these activities were extremely useful in spite of the limitation of available information.

It should be also noted that the FAO Regional Office for the Near East was established in 1949 with a Regional Representative and a Regional Nutrition Officer. The fact that the first technical officer in the Near East Office was a nutritionist clearly demonstrated the importance of nutrition in the Near East Region in that period. Manpower development in the different aspects of the nutrition field was the main task of FAO in the Region and accordingly the first regional training center for the training of professional staff was organized in 1950. FAO assisted some countries for the creation of a National Institute for Nutrition; the first was in Egypt in 1950 and later the National Institute of Nutrition in Iraq in 1954. The main task of these institutions was the assessment of the nutritional situation and dietary habits. Food analyses were extremely helpful in the interpretation of the data of these surveys. Each institute had at that time an active food analysis laboratory.

Also during the fifties and early sixties, several countries in the Region which had just gained their independence implemented large nutrition intervention programmes, mainly school feeding programmes coupled with nutrition education. Food composition tables were used as an essential tool for the implementation of these programmes.

During the sixties, Tunisia started its first national food consumption survey. The data could not be analysed without a food composition table. This was based on the analysis of certain foods for certain nutrients. The remaining data was obtained from other sources outside the region. Similar surveys were carried out later in Algeria, Morocco and other countries.

During the same period, with the high increase in urbanization many of the traditional foods such as Harissa, (hot spice sauce) commonly consumed in North Africa, were processed through the food industry. There was a need for its analysis for the establishment of a food standard. Tehina in West Asia and Halawah were also traditional foods which came on the market after they were processed. During the seventies, with the rapid economic growth due to the increase in the price of oil, the region witnessed a large population migration within and outside the region, especially from Asia. The immigrants came with their own food habits and influenced the food consumption patterns in the region, especially in the Arab Gulf Countries. Also fast foods became very popular. With the increase in income in several countries of the Near East and the open door policy (Economic Reform) for the free import of foods without taxation, food in its different forms from all over the world was introduced in the Near East.

### ***FAO Activities in Food Composition Tables***

The first FAO food composition tables were published in 1949. The food composition tables for Latin America were published by INCAP in 1961. FAO published the Regional Food Composition Tables for Africa in 1968 and for Asia in 1972. In the early seventies, the American University of Beirut published Food Composition Tables for the Middle East. The title is misleading since the data included an analysis of Lebanese foods which are also consumed in Jordan and Syria. It was an extremely useful publication. The FAO regional office for the Near East, in cooperation with the FAO Food Policy and Nutrition Division (ESN), collected published and unpublished food composition data from different institutions and individuals in the region. These data were compiled and published by FAO in 1982 as "Food Composition Tables for the Near East". This publication covered a limited number of foods, limited nutrients, and in some cases the methods used for certain analyses are no longer valid. The sampling techniques were not specified and infact the analysis of most of these foods was generally for meeting specific purposes.

### ***Need for a Food Composition Data for the Near East***

This area needs great emphasis and attention, and should be given greater priority. Consumers in most of the Near East countries are demanding more information on the food they consume. They are more aware of fat,

cholesterol, sugar, fiber, pesticide residues and additives. They are concerned with food contamination and food labelling. With the expansion of the food industry in several countries of the region, the processing of some traditional foods, the development of new food formulae, the increase in food imports, and the promotion of food exports, the need for food analysis to meet the local and the international market becomes of great economic importance. Furthermore, FAO technical assistance for the strengthening of the food control system in most of the countries of the region has given special attention to the upgrading of food control laboratories in terms of equipment and training of personnel. It should be noted that on the other hand, the issuing of food laws and Codex standards, is very limited and lags behind. Codex Alimentarius is used by several countries in the region. However food standards for traditional foods in the region are generally not included in the work of the Codex. The food control laboratories, especially those existing in the Arab countries of the Gulf, with their sophisticated equipment and highly qualified staff, can contribute to the preparation of national food composition tables. In some other countries of the Near East region, the laboratories need to be upgraded in terms of facilities including equipment, training of personnel, sampling techniques and extra funds for the running costs. Certain food control laboratories charge fees for food analysis, such as in Jordan and Morocco. These laboratories, with the extra funds they receive for their services from the private sector, are able to improve their system and employ higher qualified staff.

National Nutrition Institutes, which exist in some countries of the region such as Egypt, Iraq, Iran and Tunisia, can play a major role in the analysis of foods and the establishment of national food composition tables.

Food chemistry laboratories for the analysis of new varieties which have been selected by the agronomists exist in most of the Agricultural Research Centers such as in Egypt, Tunisia and Morocco. These laboratories could play a part in a food composition programme.

In several countries of the region, the consumer has become aware of the relation of nutrition to disease. Consumers in certain countries, such as Cyprus, Malta and the Arab Gulf are demanding foods that are low in fat, high in fiber, and low in cholesterol. Such foods have become locally processed or imported and they are increasingly available in the local market.

In most countries the Faculties of Agriculture have a Department of Food Science and Nutrition, or Food Technology. These Departments not only offer undergraduate education but also graduate Masters and PhD degrees. The research programmes of graduate students include in most cases food analysis. Unfortunately many of the Masters and Ph.D theses are not published and the data are not disseminated.

With the economic reform (liberalization policy) such as in Egypt, Morocco, Tunisia and Jordan, several multinational companies started branches for their food industries. However, they are facing unfair competition from the local industry which does not comply with food regulations since national food standards do not exist, or the food control system is not efficient. The private sector in the field of food industry can play a role in the promotion of activities and in assuring fair competition and avoiding poor manufacturing practices or false claims. Cooperation between the private sector, government agencies and non-government organizations (NGO) such as consumer protection associations should be strengthened. Trade unions could be also involved in the national food composition programme.

### ***Actions needed for the Development of Food Composition Activities in the Near East***

Action is required at the national, sub-regional and regional levels for the updating and development of food composition activities in the Near East. The requirements and priorities for countries such as the UAE or Kuwait will be completely different from those of countries like Sudan or Mauritania. Each country will have to set up its own priorities depending on its needs. Consideration should be given in a particular country to whether it is a food importer or exporter, to membership of the GATT, and available resources. The policy commitment towards implementation of the ICN recommendations should be utilized to strengthen food composition and analysis activities.

### ***Actions Needed***

#### ***National Level***

A country which desires to develop its national food composition data should establish a coordinating committee with a focal point or a

coordinator. The committee has to assess available resources, update their information on the status of their food composition, set up priorities and request financial and technical support as needed. They should formulate a plan of action, and agree on procedures such as sampling techniques, method of analysis and the collection and dissemination of the food composition data. They should avoid duplication and waste of resources. The members of the committee will vary according to the existing institutions which deal with food analysis in the country, but the involvement of the food control laboratories, academic and research institutions, private sector and NGO is essential.

### ***Sub-Regional Network***

In the Arab Gulf Countries which have a similarity in their dietary habit and are undergoing rapid socio-economic change, a sub-regional network for the establishment of food composition data is recommended. The national focal point in each country should be a member of the sub-regional network. The purposes of the sub-regional network are to exchange information, share experiences and expertise, set up priorities and avoid duplication. A similar sub-regional network could be established for the North African countries (Tunisia, Libya, Algeria and Morocco). Another could be established for the Arab Countries of West Asia (Syria, Lebanon, Jordan, Iraq and Egypt). A similar sub-regional network could be established for Iran, Pakistan and Turkey.

### ***Regional Net Work***

Data from the different sub-regional networks could be collected and disseminated to the regional network on food composition which will be linked with the World Data Network to facilitate interchange of data and exchange of experience.

### ***The Role of FAO***

FAO has a long historical experience and involvement in the development of regional food composition tables for the Near East. FAO assisted most of the countries of the Near East in the strengthening of their food analysis laboratories, mainly dealing with food control. The Secretariat of the Codex Alimentarius Commission, which is based in FAO, provides an international set of rules and guidelines intended to establish definitions and requirement for food, harmonize food standards and in turn facilitate international trade and protect the health of the consumers. Furthermore, the Codex Alimentarius food standards are

recognized by the General Agreement on Tariffs and Trade (GATT). This in turn will increase the necessity for food labelling and subsequently food composition data.

FAO can assist the regional food composition network in the following areas:

1. Formulate and up-date standards and procedures that specify minimum quality criteria required for food composition data.
2. Assist in the selection of priority constituents of food to be analysed, such as nutrient additives, natural toxins and contaminants in foods. These priorities should be associated with public health problems and trade in the region.
3. Assist in the introduction of quality assurance systems so that the quality of the food composition data is accurate and valid.
4. Provide information and guidance on sampling procedures, selection of analytical methodologies and, above all, training manuals.
5. Play a major role in the dissemination and continuous revision of data on food composition that occur due to changes in product formulation, food processing techniques, food varieties, agriculture production systems and improvements in analytical technique.

# ACTIVITIES TO ESTABLISH FOOD COMPOSITION TABLES IN THE ARAB GULF COUNTRIES (GULFOODS)

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## ***Introduction***

The activities related to establishing food composition data in the Arab Gulf countries started at beginning of 1980 when the Kuwait Institute for Scientific Research established the first data on composition and protein quality of foods and dishes consumed in Kuwait. Since then, several activities have been carried out in some Arab Gulf countries, mainly in Bahrain, Saudi Arabia and Kuwait. The purpose of this report is to summarize the main work done on establishing food composition data in the Arab Gulf region.

## ***Composition and Protein Quality of food consumed in Kuwait***

Data on 232 foods were analysed for their proximate composition, minerals (Zn, K, Mg, Ca, Na and P), and vitamin C content. The foods were classified into nine groups; cereal and cereal products, dairy and dairy products, fruits, vegetables, meat and poultry, fish, beverages and juices, miscellaneous and spices, and composite dishes (Kannel and Allam, 1979, 1980).

## ***Food Composition Tables for use in Bahrain***

An attempt was made here to establish data on composition of foods commonly consumed in Bahrain. Three methods were used to collect such data. First, through literature review, since Bahrain is highly dependent on imported foods, information on the chemical analysis of imported raw and processed foods was derived from their country of origin. Second, direct chemical analysis of composite dishes and ready-made foods was done. Third, recipe calculation was used to obtain mineral and vitamin composition. It can be concluded that for a country

like Bahrain where most foods consumed are imported, composition of foods may be obtained from countries which have good food composition data. However, chemical analysis should be done for traditional dishes, ready-made foods, and food imported from countries which have no database on the composition of their foods. Computer programmes can produce relevant information on the composition of recipes if the ingredients are carefully measured (Musaiger and Al-Dallal, 1985).

### ***Nutritive Value of Foods***

Information on proximate composition, some minerals (Fe, P, Ca) and some vitamins (vit A, B<sub>1</sub>, B<sub>2</sub> and C) were provided, as per household measures (e.g. cups, spoons, and pieces) for raw and ready-to-eat foods. The data were based on the food composition tables used in Bahrain (Musaiger and Al-Dalla, 1987).

### ***Kuwait Composite Dishes, Phase I (1989)***

Proximate composition, minerals (Na, K, Ca, P, Mg, Fe, Cu, Zn and Mn), vitamins (vit C, B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, Niacin, B<sub>12</sub>, folic acid, vit A and vit E), fatty acid profile and cholesterol and amino acids composition for 16 dishes commonly consumed in Kuwait were analysed. The dishes were prepared according to recipes used in Kuwaiti households (Eid et al, 1989).

### ***Traditional Foods in the Arab Gulf***

The purpose of this work is to provide information about traditional foods in the Arab Gulf countries of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Traditional foods are those that are familiar, acceptable, and available to a population and that are commonly consumed because of custom and cultural tradition. Information about traditional foods in Arab Gulf countries is especially important because the consumption of these products has decreased in recent years in favour of imported products.

This publication includes four pages of introduction and the main text, which includes information on 57 foods presented within 6 food groups (cereals, pulses, and their products; milk and milk products; meat, fish,

and their products; fruits and vegetables; confectioneries and sweets; and other products). The information for each food includes a description of the product, its method of preparation, and its nutritive value, proximate composition and mineral composition (Ca, P, Na, Fe, and Zn per 100 g edible portion). The food description explains in which Arab Gulf countries the food is consumed, the specific populations (i.e. pastoral, desert, urban) that use it, and how it fits into the daily meal pattern (Musaiger, 1993).

### ***National Food Composition Tables for Saudi Arabia***

A national research project aiming at assessing the nutritional status of Saudis was conducted with the financial support of King Abdul Aziz City for Science and Technology (KACST). One of the main objectives of this project was to establish a national food composition database. Food composition tables comprising foods commonly consumed in Saudi Arabia were constructed. Ten samples of each food item were collected from different parts of the kingdom. More than 140 food items were analysed for proximate composition, including dietary fibres, minerals (Na, Ca, K, p and Fe) and vitamins (Retinol, carotene, B1, B2 and C) according to standard methods. Other foods were obtained from existing food composition tables. Both analysed and obtained food items were linked to 24 hrs recall data to determine the per capita nutrients intake of Saudi individuals. Obstacles encountered were: lack of trained personnel, improper maintenance of analytical equipment and difficulty in transporting of samples. Some dishes with the same components have different local names and in some cases it was not easy to ascertain the components of the dish, which led to the exclusion of some samples.

### ***Traditional Dishes of the Arabian Gulf***

Books published about dishes in Arabian Gulf countries lack information on their nutritive values. The present book, therefore, provides unique information on the method of preparation of traditional dishes in the Arabian Gulf as well as their nutritive values. The information on nutrient composition of the dishes provided here was extracted from direct chemical analysis and calculation from ingredients of the dishes. Data on moisture, protein, fat, crude fiber, carbohydrate, energy, calcium, iron and vitamin C contents of each dish are provided.

It is important to mention that some of the dishes provided here were introduced by immigrants long ago, and have become popular among Gulf communities. The best examples are Biryani, Keema, Dahal, Aaloo, Kabab and Sambosa which were brought by Indians from the subcontinent. Other dishes are mainly consumed during social occasions. For example, Thareed and Hareese are prepared during Ramadan (the fasting month), Qadah Al-Eid is mostly consumed during Eids (feasts), and Hesso and Gellab are eaten by postpartum mothers; they believe that such dishes increase milk secretion and help to clean the uterus of blood. All the other dishes are commonly consumed by Gulf families. Main dishes are mostly consumed at lunch (the main meal), while snacks are usually eaten at breakfast or supper.

### ***Traditional Dishes of Oman***

This publication provides methods of preparation of 20 traditional dishes commonly consumed in the Sultanate of Oman, as well as their composition. Protein, fat, carbohydrate, and energy contents were included, based on direct chemical analysis (Musaiger, 1997).

### ***Traditional Foods in the Arab Gulf Countries (Revised and updated)***

This publication includes more comprehensive data on nutritive value and methods of processing of traditional foods consumed in the Arab Gulf countries. Information was provided in five chapters; bread, milk and dairy products, meat, fish and their products, fruit and vegetables and miscellaneous. Proximate composition and mineral contents (Ca, P, Na, Fe and Zn) were provided for each traditional food (Musaiger, 1997).

### ***Composition of Kuwait Composite Dishes***

Kuwait has long experience on establishing food composition tables. The first attempt to analyse local and some raw foods was done in 1979 and 1980 by Kuwait Institute for Scientific Research (KISR). However, the information provided in this work was not disseminated and not published, leading to unavailability of these data to the users. In 1995, KISR established the food composition tables for some local dishes.

The nutritive values of 38 Kuwaiti composite dishes were determined, including proximate analysis, minerals, vitamins, amino acids, phytic acid, protein quality, fatty acids profile and cholesterol (Sawaya, et al 1997).

### ***Works Published in Scientific Journals***

Numerous works were done on food composition analysis of foods and dishes consumed in Saudi Arabia and published in scientific journals during 1983-1998. Published papers on food composition in other countries are limited in some countries (Kuwait and Bahrain) and, at most, scanty in other countries (Qatar, U.A.E. and Oman).

### ***Conclusions***

The first meeting for establishing food composition data for the Arab Countries of the Gulf (GULFOODS) was held in Al-Ain, the United Arab Emirates, in November, 1995. The main objectives of this meeting were: to formulate recommendations and project proposals to promote the establishment of national food composition programmes, and disseminate and exchange relevant data. The meeting concluded to designate regional coordinating secretariat and national committees.

Although a national committee was not established in each country as recommended by the participants, several activities were carried out during the past two years to obtain more data on food composition in the Gulf.

The GULFOODS secretariat at the Bahrain Center for Studies and Research has established a programme to collect all the data (published and unpublished) related to food composition in the Gulf, to prepare the first draft of Food Composition Tables for use in the Arab Gulf Countries. The secretariat has also worked jointly with many laboratories in the region to analyse local foods and dishes. For example, two studies were carried out jointly with the Dubai Food Laboratory to analyse Omani dishes and traditional sweets in the Gulf. A more comprehensive study will be done shortly on composition of the United Arab Emirates dishes with the same laboratory. A study on composition on fermented dairy products in Bahrain was done jointly with the Public Health Laboratory at the Ministry of Health, Bahrain.

A proposal for analysing some Qatari dishes is in progress jointly with the Central Laboratories in Qatar. Additionally, Saudi Arabia has finalized its food composition data, while Kuwait has finished the first phase of composition of Kuwaiti composite dishes.

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## *Appendix 1*

### *History of Establishing Food Composition Data in the Gulf Unpublished and Published Documents*

Activities	Published	Language	Year	Source	Country
Composition & Protein Quality of Foods Consumed	No	E	1979, 1980 (Phase I & II)	KISR	Kuwait
Food Composition Tables for Use in Bahrain	Yes	E & A	1985	MOH	Bahrain
Nutritive Value of Foods (Simplified Food Composition Tables/Household Measurements)	Yes	A	1987	MOH	Bahrain
Kuwait Composite Dishes (Phase I)	No	E	1989	KISR MOH	Kuwait
Traditional Foods in the Arab Gulf	Yes	E	1993	FAO/ RNE AGU	Cairo Bahrain
National Food Composition Tables	No	E	1995	KACST	S.Arabia
Traditional Dishes of Arabian Gulf	Yes	E & A	1996	Private	Gulf
Traditional Dishes of Oman	Yes	E & A	1997	Private	Oman
Traditional Foods in the Gulf (Revised & updated)	Yes	A	1997	Private	Gulf
Kuwait Composite Dishes (Phase II)	Yes	E	1998	KISR	Kuwait

KISR: Kuwait Institute for Scientific Research, MOH: Ministry of Health, FAO/RNE: Food and Agriculture Organization, Regional Office, Cairo;

AGU: Arabian Gulf University, Bahrain; KACST: King Abdulaziz City for Science and Technology.

## *Appendix 2*

### *History of Establishing Food Composition Data in the Gulf*

#### *Published Papers in Scientific Journals*

<i>Activities</i>	<i>Year</i>	<i>No. of papers</i>	<i>Country</i>
- Composition of raw foods, ready-made foods and traditional dishes	1983-1998	More than 100	S. Arabia
- Composition of ready-made foods and traditional dishes	1985-1998	14	Bahrain
- Composition of canned foods, ready-made and traditional dishes	1990-1997	8	Kuwait
- Composition of fish and traditional dishes	1993-1995	2	Qatar
- Composition of dates	1990-1997	2	U.A.E.
- Composition of traditional dishes	1998	1	Oman

### Appendix 3

#### Summary of Main Activities Related to Food Composition Data in the Arab Gulf Countries

Country	Availability of Published Food Composition Tables	Nutrients Included	Availability of Data	Missing Foods
<i>Bahrain</i>	+	Proximate Ca, P, Fe, VitA, B <sub>1</sub> , B <sub>2</sub> , Niacin, VitC	+++	Trad.Ready Made Foods
<i>Kuwait</i>	- Composite Dishes	- Proximate Minerals (most) Vitamins (most) Amino Acid Cholesterol +FA	+++	- Trad.Ready Made Foods - Raw Foods
<i>S. Arabia</i>	- Composite Dishes	- Proximate, Minerals Amino acids Cholesterol +FA	++++	- Trad.Ready Made Foods
<i>Qatar</i>	- Composite Dishes	- Proximate Minerals	- +	- Most Foods
<i>U.A.E.</i>	-	-	-	Most Foods
<i>Oman</i>	- Composite Dishes	- Proximate Minerals Cholesterol +FA	- +	- - Ready Made Foods - Raw Foods

# **OVERVIEW: INFOODS ACTIVITIES AND REGIONAL DATA CENTER FOR THE COUNTRIES OF THE MIDDLE EAST AND GULF STATES**

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## ***Introduction***

When INFOODS was created in 1983, one of its goals was to establish regional data centers around the world, to improve the quality and quantity of food composition data, especially in developing countries; and to enhance and encourage development of standards, harmonisation efforts, and interchange of food composition data. Measurable progress has been achieved. Internationally, a set of standards and guidelines have been prepared and published. Regionally, most countries are affiliated with an active, well-functioning regional data center, and nationally, many more countries have food composition programmes and have implemented many of the INFOODS recommendations and standards.

## ***Regional Data Center Activities***

In this section, some of the recent activities in regional data centers will be described.

AFROFOODS has had significant activity in its ECSAFOODS subregion. The countries of Eastern, Central and Southern Africa held a Food Composition Workshop in July 1997 with approximately 20 participants from 13 countries of the subregion. The course was a regional version of the Wageningen Agricultural University's Food Comp course, prepared by Professor Clive West, and coordinated locally by South Africa's Medical Research Council. Another course is being planned for the region, and will take place in July 1999 in Pretoria. Regional data center coordinator, Professor Lilian Marovatsanga, is hoping to involve participants from other subregions, particularly West Africa.

ASEANFOODS is in the final stages of preparation of the first regional food composition database for the region. Dr. Prapasri Puwastien from Thailand has been coordinating activities with the other five countries in

the region with active national programmes and national food composition databases. This database will be completed soon, and presented at a conference in November 1998. ASEANFOODS has taken the lead in laboratory quality control and assurance, with its development of certified reference materials. These materials – fishmeal, soy-cereal, and dairy formula – have been distributed to laboratories intra-and inter-regionally, and “consensus” values have been defined for approximately 14 nutrients. The materials, continually monitored for stability, are available freely, or at a nominal price.

EUROFOODS has a very active regional data center, with technical groups operating, and tackling the difficult issues of food nomenclature and terminology, data interchange and data quality assessment. With Professor West as the regional data center coordinator, EUROFOODS has taken a leading role in training. The “Food Comp” training course developed by Professor West is offered in alternate years in the Netherlands, and in different regions in the world in intervening years. This region has put forward a proposal for creation of a subregional data center for Central and Eastern European countries, to be coordinated from Slovakia. EUROFOODS, together with FAO, will be sponsoring the 3<sup>rd</sup> International Food Data Conference, in July 1999 in Rome.

NORAMFOODS presented itself formally to the United States’ food composition community with a session at the 22<sup>nd</sup> National Nutrient Data Bank Conference. The session was chaired by the INFOODS coordinator, and presentations were given by representatives from Canada, United States, Mexico and Jamaica. Joanne Holden from the USDA is the coordinator of this regional data center and she put forward the plan of activities for the region, including intra-regional data exchange, standardisation of formats, development of dictionaries/thesauri of food terms in English, Spanish and French, and liaison activities between food labeling legislation and food composition.

OCEANIAFOODS held its 5<sup>th</sup> meeting in May 1998. This data center includes two countries – Australia and New Zealand – with well – established and well-functioning national programmes. These countries have assisted the developing Pacific Island countries in the building up of laboratory capabilities in Fiji, and data compilation and preparation of the Pacific Islands Food Composition Tables and database in New Caledonia. Training in the use of food composition data has also been provided to clinicians, agriculturalists, and health educators in the Island Countries. In addition, the regional data center coordinator, Professor Bill Aalbersberg was awarded a UNU fellowship for attending the Wageningen Food Comp course. The next focus for this region is the building up of capabilities in Papua New Guinea.

SAARCFOODS, representing the seven countries of South Asia, is a relatively new regional data center. Coordinated by Professor Jehangir Khan Khalil, the regional data center personnel have had three weeks of intensive training, and on-site help from New Zealand with support from INFOODS and the United Nations TOKTEN programme, in preparation of the Pakistani national and the SAARCFOODS regional food composition data base. The second SAARCFOODS meeting is scheduled to be held in Nepal in late 1998.

Most countries in the world are now part a regional data center, and this participation has been built into the normal operations of their national programmes. In this organisational structure, many countries have improved their laboratory quality assurance, increased the quality and quantity of data available to themselves and their national users; and have developed regional standards that are implemented nationally, eliminating the laborious, confusing and redundant process of re-inventing systems in each country.

The country by country association with regional data centers is determined by those countries, and can be based on common culture, language, geographic proximity or trading bloc agreements.

The UNU/FAO/INFOODS regional data center(s) in the countries of the Middle East and Gulf States is not firmly in place. A structure for countries in this region will be one of the subjects for discussion during this meeting.

### ***Technical Issues***

Recent activities of INFOODS have included some technical standards development and some strategic alignments related to technical standards.

INFOODS tagnames are a fundamental standard for incorporation into food composition database, mainly created for interchange purposes. A tagname specifies the nutrient entity, the default unit of expression, and the method of analysis when the method is "empirical" rather than "rational". With empirical methods, the correct numerical data are specific to the method rather than the nutrient entity itself. Familiar examples include "fibre" and "carbohydrate". Fibre as non-starch polysaccharide measurement will produce a different correct result than fibre by the Prosky method. Similarly, carbohydrate expressed as "total carbohydrate by difference" gives a very different result when compared

to carbohydrate as the sum of analysed mono-, di-oligo-saccharides and starch. INFOODS has been given observer status in Codex, and this will be used most importantly to align with the work of the Codex Committee on Sampling and Methods of Analysis, specifically in expanding the area of identification of food components.

Another fundamental standard that helps when constructing a versatile, useful food composition database is incorporation of the INFOODS food nomenclature and terminology system. This system, or some regionally modified version of it, will allow for ease of maintenance in a data system, it will provide straightforward use in printed food composition tables and diet applications software products, it is compiler friendly and it accommodates a country's language and culture while still allowing for unambiguous identification of foods. INFOODS is a multi-faceted system for describing foods in a systematic fashion. Another international system is LANGUAL, which is language and culture independent, and a potentially useful system when codes for foods are required. The two systems can be used simultaneously in the same database. INFOODS interacts with the Europe-based LANGUAL committee.

Other standards are being developed internationally, and many of these will be useful in national data systems. Topics currently being addressed, or soon to be readdressed, include:

- ❑ Interchange protocols for international exchange of food composition data.
- ❑ The extension of INFOODS tagnames and identification of food components; empirical rational methods of analysis.
- ❑ Further elaboration of nomenclature, terminology and classifications systems for identification of foods and the food samples analysed, include images.
- ❑ Elaboration of the relevant food trade issues and their implications for food composition programmes.
- ❑ Food composition data generation and compilation appropriate for food balance sheets and hunger mapping.
- ❑ Representations of data quality and data source.

INFOODS strives to keep the entire professional food composition community advised of activities around the world. On the research side,

it does this mainly through the Journal of Food Composition and Analysis. For interactive dialogue, it does this through the food-comp discussion list. And for provision of information, it does this through its World Wide Web site.

# ESTABLISHING STANDARD RECIPES FOR PRODUCING FOOD COMPOSITION DATA (Experience in the Sultanate of Oman)

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## ***Introduction***

There is no information on the composition of foods commonly consumed in Oman. The need for data on nutrient values of local foods has been emphasized by the Ministry of Health for therapeutic and educational purposes. An attempt was made here to establish standardized recipes to be used for food composition purposes in Oman. The study was carried out in three phases:

## ***Selection of the dishes***

A rapid survey on 65 households from three geographical regions of Oman was carried out to obtain detailed information on common dishes consumed in this country. The regions were selected purposely based on their geographical and population characteristics. The sample included 20, 25 and 20 households from the southern area, Muscat (the capital) and central (rural) areas respectively.

Housewives were interviewed by home economics students using a structured questionnaire to obtain data on main dishes consumed in Oman. The questionnaire contained information on main dishes commonly consumed by the households, dishes consumed at puerperium and dishes consumed in Ramadan (the fasting month for Muslims). Ingredients and methods of preparation of three dishes commonly consumed, two dishes consumed at puerperium and one dish consumed in Ramadan were also obtained.

About 60 dishes were mentioned and described by the housewives. Only 20 dishes were selected in this project as a first phase. The criteria for selection of the dishes were: consumed by large percentage of household, consumed on special occasions, and consumed by special ethnic groups.

### *Standardization of the dishes*

The list of ingredients for each dish was obtained in each household. Then the average of each ingredient was calculated and used as a general guide for preparation of the recipe. The number and quantity of ingredients for the same dish were found to differ from household to household. For the purpose of this project, therefore, only the major ingredients were included in the recipes. Tables 1-3 illustrate examples of variation in ingredients in some selected dishes. This variation is due to several factors such as size of household, preferences, ethnic origin and geographical areas.

**Table 1. Range in ingredients in meat curry (Saloonat Laham)  
(Total sample = 16 Households)**

Main Ingredients	No. Mentioned	Mean	Range
<i>Meat</i>	16	1.0	1/2-3 kg
Tomatoes	14	4.2	2-6 pieces
Potatoes	11	2.3	1-4 pieces
Onions	16	2.3	1-5 pieces
Garlic	12	4.6	1-10 pieces
Eggplant	8	1.3	1-2 pieces
Oil	14	3	11/2Tbs-1/2 cup
Ghee	2	1	1 Tbsp
Salt	16	0.9	1/2-1 Tbsp

Total ingredients included in the recipe = 25

**Table 2. Range in ingredients in rice with meat (Machbous Laham)  
(Total sample = 13 Households)**

Main Ingredients	No. Mentioned	Mean	Range
Rice	13	4.8	3-10 cups
Meat	13	1	1/2-1 kg
Onions	13	2.4	2-3 pieces
Tomatoes	13	3.8	2-9 pieces
Garlic	12	7	3-10 pieces
Water	13	5.6	4-7 cups
Oil	8	0.7	0.3-1 cup
Ghee	5	0.8	0.3-2cups
Potatoes	3	2.3	2-3 pieces
Tomato Paste	3	1.3	1-2 pieces
Black lemon (Dried)	2	3.5	3-4 pieces

Total ingredients included in the recipe = 22

**Table 3. Range in ingredients in fish curry (Saloonat Samek)  
(Total sample = 19 Households)**

Main Ingredients	No. Mentioned	Mean	Range
<i>Fish</i>	19	1.6	1-6 fishes
Onions	19	2.9	2-5 pieces
Tomatoes	17	3.2	2-5 pieces
Tomato paste	14	1.1	1-2 Tbsp
Oil	14	1.6	1-2 Tbsp
Ghee	5	4.8	3 Tbsp – 1/2cup
Salt	19	0.5	1.5 Tbsp-2Tbsp
Coconut water	3	1.8	1.5-2 cups
Water	19	2.7	2-4 cups

Total ingredients included in the recipe = 33

### *Preparation of dishes*

Dishes were prepared by an experienced housewife. Most ingredients were purchased from markets of Oman. Other ingredients, namely meat and fish, were obtained from markets of the United Arab Emirates. All the ingredients were weighed carefully using a scale accurate to 1.00 gram. The dishes were prepared at least twice to adjust the recipe to common texture and flavour. This led to decreasing or increasing the average of some ingredients to adjust the recipes. The final method of preparation was then adopted for each dish (see example in figures 1-3).

### *Difficulties Encountered*

1. Lack of trained personnel for collecting reliable information on ingredients and method of preparation of dishes.
2. Differences in household measurements such as spoons and cups caused some difficulties in obtaining actual amounts of ingredients.
3. Differences in size and weight of vegetables included in the recipes created some difficulties in estimating the size of vegetables used in preparation of the dishes.
4. Many housewives did not recall the actual amount of some ingredients. This is particularly true for the amount of water used in recipes.

5. Differences in ingredients and methods of preparation for the same dish mainly due to ethnic and geographical variations.
6. The average of ingredients did not provide the common texture and flavour when preparing the dish. Therefore, this average was used as a general guideline to adjust a recipe to its common version.

### ***Recommendations***

1. In-depth surveys on dishes commonly consumed in Oman should be carried out with adequate and representative household samples. More emphasis should be given to variations in method of preparation according to geographical areas and ethnic groups.
2. A survey on size and measurements of kitchen utensils should be done to standardized these utensils.
3. It is preferable to standardize the size and weight of some vegetables and fruits. This can be done through grading these foods to three main sizes; small, medium and large. An average weight of each size can then be used for all food composition purposes.
4. Dishes for chemical analysis should be prepared by local housewives and preferably from the geographical area ethnic group that is related to the dishes.
5. Proper training should be done for those involved in collecting the data on ingredients and methods of preparation of the recipes.

## COMPUTER PROGRAMME FOR FOOD COMPOSITION DATA

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Developing programmes is an expensive proposition, and a consortium of programmers from national food composition programmes in different countries should be established. The consortium would elaborate the tasks, assess the skills, negotiate the tools and distribute the tasks as modules for development.

Computer, information and communications technologies are developing at a faster pace than any other industries in the world. The developments include both hardware and software and there are significant implications for food composition activities. Currently the technologies readily available allow for thorough and efficient food composition data compilation, dissemination and use.

There are two important and very different types of computer programmes. One is a data compilation system, and the other is a data applications system. Most of this paper will deal with data compilation systems, the programmes needed by those involved in national regional food composition database development.

Data applications programmes are widely available for clinicians evaluating patients' diets, for epidemiologists conducting nutrition surveys, for food industries to model new products and recipes on the basis of nutrient content, and most of the common data uses in health, agriculture and commerce. The best software applications products are developed commercially, and are available at reasonable prices. These products have two parts, the software and the data. The data come from you, and your compilation system and can be incorporated into the software package.

Data compilation programmes are entirely different. This is the programme that allows you to document everything, capture all data, process those data, systematically evaluate those data, manipulate those data for a variety of purposes, and disseminate those data for use.

Food composition database management programmes that were state-of-the-art a few years ago are today limiting and restrictive. Others were only ever designed to be electronic versions of food composition tables, and therefore were not adequate in terms of documentation capabilities, data manipulation features, and data integrity testing. Many countries have developed their own food composition data management systems, but none of these is suitable for all other countries.

The solution is not necessarily a single, standardised data system, but rather implementation of rules, standards and documentation guidelines that make the database of high quality, permit easy use of the data for multiple purposes, and will facilitate food composition data interchange. The system should also be constructed in a modular fashion, so that new features can be added over time, and existing features can be replaced and updated over time.

These rules and standards and guidelines must be adopted at the start and integrated throughout the basic program and in all the modular or accessory programs. One fundamental rule is the incorporation of INFOODS tagnames as the highest level food component identifier. Tagnames are keys, between two and nine characters in length, that allow for unambiguous identification of food components. They incorporate a default unit measure, although a unit other than default can be specified within the tagnames structure. Tagnames also specify the method of analysis where the method is "empirical" and not "rational", and the expression of a food component when this can be calculated in more than one way. The most striking examples of empirical methods are those for fibre determination (e.g. crude fibre, total dietary fibre, non-starch polysaccharides), where your correct answer will be different and completely dependent on the method used. Examples of tagnames resulting from calculations include protein that can be calculated from total nitrogen, amino nitrogen, or protein nitrogen, and the choice of factors which can be 6.25 for all, or a range of different factors. Carbohydrate is another important example of the need for tagnames, because the correct answer will be very different dependent on whether the value is obtained by summation of analytical values for individual saccharides, or obtained as "total carbohydrate by difference" (i.e. the sum of the other proximates subtracted from 100). The use of total carbohydrate by difference has been long discouraged by many research scientists, editors of scientific journals, INFOODS, and in expert consultations. A recent FAO/WHO expert carbohydrate consultation stated "*That food laboratories measure total carbohydrate in the diet (in a food sample) as the sum of the individual carbohydrate constituents, and not calculate the value by difference*". Energy is another example

where several different factors can be used, and therefore must be specified within the context of tagnames.

Another fundamental rule relates to food nomenclature, terminology, classifications and descriptions. There are two systems that have standardised the naming of foods, and they are different. One is the INFOODS system, prepared by Truswell et al., and the other is the Languag system, prepared originally by the US FDA, but only ever used by the EUROFOODS regional data centre. The most pragmatic rule, however, for naming foods is to facet the name in a systematic fashion, and to include a "shortname" with a limited number of characters, to permit ease of use in printed tables and applications packages.

Other desirable features of a compilation system include raw analytical data capture facilities so that proper representation of "central" values and biological variability can be expressed. Data recorded in this way can be aggregated and disaggregated at will for the various purposes required. Creation of fields to allow proper documentation of the sample plan, the samples themselves, sample handling, sample preparation, methods of analysis, and quality control materials and procedures is also desirable, as is documentation by image.

Interchange purpose are many, but the most important are sharing data with other countries with which you have export relationships or share a common food supply, and for ease of incorporation of data into proprietary applications software packages for data use (e.g. clinical diet analysis packages, epidemiology packages, food industry and food service management packages).

New Zealand developed its food composition data system over a period of about eight years, with very active, on-going development and two dedicated programmers and systems analysts. The software environment is old-fashioned now (e.g. it runs in an MS-DOS environment), but the principles and algorithms are still appropriate and the system is still in active use. More and more frequently, however, the data from the system are exported and then imported into other more up-to-date and powerful packages such as spreadsheets, statistics packages, sophisticated editors, etc.

Data users rely on applications packages prepared by software development companies as commercial products. It has been a difficult thing to attract commercial software companies into the data compilation area, because in most cases there is only one customer per country. On the other hand, each country has many hundreds, or thousands, or more, potential users of the data once compiled. With standards in place in data

compilation systems, these national and regional data sets can be systematically exported from the compilation system and imported into several different applications packages that can then be made available in the countries. A variety of arrangements are possible with the software companies, including sales and distribution through the national centre to its countries users. Remembering that these products have two components – your data and their applications – it is reasonable for the revenue to be apportioned for both the national data centre and the software company.

Now and for the immediate future, we see certain trends developing:

- Increasing use of Web browsers to access data.
- Client-server designs will be introduced to allow varying types of managed access to the data and to facilitate use of networks.
- Increasing use of standards-based and freely available software for databases, file formats, and programs, together with an increasing influence of the INFOODS interchange formats on database design.

Immediately we see the increasing use of Web browsers interacting with controlled-access Web servers for access to databases, and for development and management of databases and for interchange of data. Web browsers provide a familiar user interface, which allows users to look up data, and obtain documents from Web servers. They can be used both locally and on the Internet. Netscape has just released its source code so it will rapidly become an industry standard. Web browsers support a number of image formats (e.g. gif, jpeg and the emerging network standard PNG), and are available for several different operating systems. Some Web browsers provide built-in languages which can be used to construct programs for manipulating food composition databases and data.

Web servers are used to supply documents and links to information to the Web browsers. However, they can also be set up to accept data files and to run programs in response to requests sent from Web browsers. They can be set up with access controls and version control software systems to enable workers at widely separated locations to collaborate on database management projects, preparation of documentation, and development of computer programmes. The main tool is Perl for analysis and manipulation of data. SQL is for managing data.

We are experimenting with Web browser/Web server technologies for using and managing the New Zealand Food Composition Database. A

system is being set up to allow users to activate programmes (from their web browsers) for searching databases and selecting subsets of the data, for performing sophisticated data integrity tests, for calculating composition of recipes, and for diet analysis and design.

Developing programmes is an expensive proposition, and therefore, one of the high priority INFOODS projects is to establish a consortium of programmers from national food composition programmes in different countries. The consortium would elaborate the tasks, assess the skills, negotiate the tools and distribute the tasks as modules for development. Once developed, these could be used wholly or in part by different regional and national food composition programs. They would also permit user by user customisation based on a country or region's requirements.

# ESTABLISHING FOOD COMPOSITION TABLES FOR BAHRAIN

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## ***Introduction***

Bahrain like other Arab Gulf countries experienced a drastic change in socioeconomic status and food consumption patterns during the last three decades as a result of rise in income. The rapid decline in agriculture and increase in population have led the country to depend heavily on food importation. It is estimated that 95% of foods consumed are imported from various countries all over the world (Musaiger, 1995).

## ***Steps in Establishing the Food Composition Tables***

### ***Obtaining food composition data from literature review***

Since Bahrain is highly dependent on imported foods, data for imported raw and processed foods were derived from values reported in the country of origin. Bahrain has good and reliable statistics from the country of origin of each imported food item, which are published annually by the Central Statistics Organization (CSO, 1983). The main countries which export foods to Bahrain were recorded based on type of foods exported.

The nutrient data on foods were extracted from tables of food composition in these countries. However, only countries which have well-established food composition tables were included in this project.

### ***Obtaining data on composition of food through chemical analysis***

Chemical analysis for 43 local dishes and 7 ready-made foods available in the market of Bahrain were done. Due to a shortage of facilities and trained personnel, the chemical analysis was carried out in the Institute of Nutrition, Bangkok, Thailand. Only proximate analysis was done [Protein, fat, crude fibre, ash, carbohydrates (by difference) and energy].

The ingredients were purchased from two sources. First, the market of Bangkok; this included most ingredients with the same origin or brand names as in Bahrain. Second, from the market of Bahrain; this included ingredients which were unavailable in Bangkok. All ready-made foods were purchased from Bahrain. Recipes of dishes were obtained from several local recipe books. The selection of dishes was based on Ramadan (the fasting month for Muslims), wedding, feasts and during puerperium. An experienced Bahraini housewife was selected to prepare the dishes. Dishes were prepared at least once to adjust the recipe to its most commonly consumed version. The dishes were then standardized and all ingredients were weighed carefully using a scale of a minimum capacity of 1 gram. The weight of dishes before and after cooking were obtained to determine the amount of water lost during cooking.

### ***Obtaining food composition data from recipe calculation***

Five dishes were chemically analysed for calcium and iron in addition to proximate composition. An attempt was first made to calculate the nutrients using a combination of food composition tables available in the region. In general, the values for protein, fat energy, calcium and iron were lower than the values by calculation. Vitamins were excluded from the calculation because of absent vitamin values in some food composition tables.

The U.K. recipe programme (Food Research Institute, 1985) was then used for calculation of nutrients for the same five dishes. It was found that the calculations using this programme were in good agreement with the chemical analysis. Therefore it was decided to use the UK recipe programme for calculation of minerals and vitamins for the 43 composite dishes. The loss of water and the effect of cooking on some vitamins were taken into consideration when calculating the nutrients of the dishes.

It is worth noting that the UK Recipe programme is based on foods available in the UK. This may affect the validity of the calculated values for nutrients a little, but will provide a useful guide to the average dishes commonly consumed in Bahrain.

### ***Presentation of the food composition data***

The food composition data were presented in five tables. The names of the foods and dishes are provided in English and Arabic. The tables were presented as follows (Musaiger and AL-Dallal, 1985):

**Table 1. Composition of edible portion of foods (based on literature review)**

This table includes information on proximate analysis, three minerals (Ca, P, Fe) and five vitamins (vitamins A, B, B2, Niacin and C). The source of data for each food item was mentioned.

**Table 2. Proximate composition of ready-made foods**

This table includes proximate composition of seven ready-made foods chemically analysed.

**Table 3. Composition of composite dishes**

For the sake of comparison, data on composite dishes in this table were the same as those included in Table 1.

**Table 4. Mineral composition of composite dishes**

Seven minerals were included in this table, potassium, magnesium, sulphur, chloride, zinc, copper and sodium.

**Table 5. Vitamin composition of composite dishes**

Seven vitamins were included in this table, namely vitamins D, E, B6, B12, folic acid, biotin and pantothenic acid.

***Methods of preparation of dishes***

The type and weight of ingredients (in grams) and the method of preparation of each dish were provided with these tables to give a general picture of these dishes for the users.

***Appendices***

Three appendices were included in the final publication. These are: chemical composition of tap water according to geographical areas in Bahrain, cholesterol content of foods (based on literature review), and common Arabic and Scientific names of most food items included in Table I.

## ***Obstacles***

Various obstacles were faced during preparation of these food composition tables. These can be summarized as follows:

1. Lack of trained personnel in chemical analysis of foods.
2. Lack of experience of the personnel in preparation of the food samples for analysis.
3. Absence of standardized recipes, which necessitated preparing the recipe several times to be adjusted for the commonly consumed version.
4. Difficulties in weighing some ingredients, such as garlicks and spices, because their weight in some recipes was less than one gram. To overcome this problem we weighed larger amounts of these foods and took the average weight of a piece of garlic or the average of a teaspoon of spices.
5. Absence of information on some local ingredients in the UK Recipe Programme. This emphasises the need for establishing a local recipe programme.
6. Since some foods in the UK are fortified, the calculation using the UK Recipe Programme for Bahraini dishes may give misleading information on nutrients. This is particularly true for dishes contained flour (which is usually fortified in the UK).

## ***Conclusions***

1. The food composition tables prepared in this project provide more data relevant to Bahrain, and perhaps to other Arab Gulf states.
2. The use of computer programmes to calculate the nutrients in recipes can reduce the cost of chemical analysis and at the same time produce appropriate data on composition of the recipes.
3. For a country like Bahrain, where most foods consumed are imported, the composition of foods may be obtained from countries of origin that have good food composition data.

4. The current food composition tables should be revised and updated to include more food items, dishes and traditional foods.

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# ACTIVITIES OF ESTABLISHING FOOD COMPOSITION DATA IN KUWAIT

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## ***Introduction***

The first composition tables for composite dishes that were established in the State of Kuwait in 1995, were based on experimental analyses (Sawaya and Al-Awadi, 1995). They were executed in two phases. The first phase covered 16 commonly consumed Kuwaiti dishes (Eid and Al-Awadi, 1989), while the second covered 22 dishes. The nutritive value of these dishes was determined, including proximate analysis, vitamins, dietary fibre, amino acids, protein quality, phytic acid, fatty acid profiles and cholesterol.

The nutritive data were compiled in the Kuwait food composition tables which were published in March 1998. This book represents the first published data, and hopefully, will be useful to many scientific researchers, clinical doctors and educators. It can also be used in planning special diets for sufferers of many chronic diseases, like hypertension, diabetes, cardiovascular disease and cancer. Furthermore, the nutritive value of local food can be used as a basic tool for the assessment of the nutritional status of the people.

## ***Activities of Establishing Food Composition Tables***

### ***Source of Food Composition Data***

The nutritive value of the Kuwait composite dishes studied was determined by laboratory analyses of standardized recipes. Composite dishes were prepared and analyzed according to standard methods. The data obtained were compared with other nutrient databases and food composition tables, i.e., the USDA database, the Middle East food composition tables and other publications from other GCC countries.

## ***Priorities for Selection and Sampling of Food***

A questionnaire was distributed to Kuwaiti households to determine the most popular dishes consumed in Kuwait. Based on the results of the questionnaire, 38 composite dishes were selected for the study. Information on cooking procedures, ingredients and quantities were collected, based on a field survey of over 250 Kuwaiti households (of different income groups). The recipes were standardized by identifying the major ingredients of each recipe and their weight ratio to the total weight, and ensuring that the coefficient of variation (c.v.) of the major ingredients did not exceed 20%.

The cooked dishes were prepared in the kitchen of the Ministry of Public Health based on the standardized recipes and under the supervision of experienced Kuwaiti cooks. All ingredients, including water, were weighed and three identical preparations of each dish were cooked separately and weighed. Each cooked dish was cleared of bones, homogenized and then sampled for moisture analysis. The remaining sample was freeze-dried (Virtis, Unitop 800 1), ground and kept in airtight containers in a deep freeze (-18°C) for further analysis.

## ***Methods of Analysis and Quality Assurance***

### ***Proximate Analysis***

Proximate composition, including moisture, crude protein (N x 6.25), crude fat, ash and crude fibre, was determined in triplicate by the standard procedures of the AOAC (1990). Carbohydrates were calculated by differencing. Energy content was calculated by multiplying the protein, fat and carbohydrate values by the factors 4, 9 and 4, respectively.

### ***Phytic Acid***

The phytates were determined in accordance with Plaami and Kupulainen (1991) by separating the phytic acid in the sample extract and then concentrating it by ion-exchange chromatography. The phytic acid concentration was then quantitatively determined as P by inductively coupled plasma atomic emission spectrometry (ICP-AES).

### ***Dietary Fibre Analysis***

Soluble (SDF), insoluble (IDF) and total dietary fibre (TDF) were determined by an enzymatic-gravimetric method according to Prosky et al

(1988, 1992). The dietary fibre value reported is the sum of the SDF and IDF.

### ***Mineral Analysis***

Sodium, potassium, calcium, phosphorus, magnesium, iron, zinc, copper, manganese, boron, chromium, aluminium and molybdenum were determined using conductivity-coupled plasma optical emission spectrometry (ICP-OES, Jobin-Yvon model JY-24). The results were evaluated by calibrating of the method, using a metal mixed standard (E-Merch, Germany). Selenium was analyzed using hydride-generation atomic absorption spectrometry (Varian Plus). The accuracy of the method was checked by analyzing certified reference standards along with the samples, for example: wheat flour (SRM 1567a), oyster tissue (SRM 1566a), bovine liver (SRM 1577b), and tomato leaves (SRM 1573). Iodine was analyzed calorimetrically in accordance with AOAC (1990), Binnerts (1954), and Heerspink and Deweech (1971).

### ***Cholesterol and Fatty Acid Analyses***

Cholesterol was determined quantitatively by gas-liquid chromatography (GLC, HP 5890) according to the procedure outlined in AOAC (1984). Cholestane was used as an internal standard.

Fatty acids were analyzed by GLC as their methylesters with a modified version of the procedure advocated by Aziz and Abu-Dagga (1991). The GC used was an HP-5890 equipped with a split injector and a flame ionization detector, using 25 m x 0.2 mm fused-silica capillary columns coated with OV-225 (or FFAP, OV-351). The column temperature used was 235°C with a temperature programming of 10°C/min and 50°C initial temperature for 7 min at 235°C. The flow rate of the carrier gas, helium, was 1.5 ml/min with flow rates of 30 ml/min and 400 ml/min for hydrogen and air, respectively. Identification of different peaks was done by comparing their retention times with those of authentic standards, and peak areas were integrated by a computing integrator. Quantitation was carried out using the internal standard method. The limit of detection was 0.10%.

### ***Vitamins Analysis***

B-carotene (provitamin A), Vitamin A, thiamin hydrochloride (thiochrome method), riboflavin, niacin, pantothenic acid and vitamin B12 were assayed by procedures outlined in AOAC (1990) and the U.S. Pharmacopeia (1990). Assays were done for pyridoxine hydrochloride (AOAC, 1990; Atkin et al., 1943), folacin (Hurdle et al., 1968), biotin

(Wright and Skeggs, 1944; Scheiner and De Ritter, 1975), vitamin D (AOAC, 1990; Thompson et al., 1985; McMurray et al., 1980) and vitamin C (Deutsch and Weeks, 1965; AOAC, 1990). The data for vitamin A included chemically determined performed vitamin A and provitamin-A ( $\beta$ -carotene). Vitamin A activity was expressed in International Units (IUs). One IU was equivalent to 0.3 g retinol (vitamin A). The concentration of  $\beta$ -carotene was also expressed in IU. One IU was equivalent to 0.6 g of  $\beta$ -carotene. For the dishes, the vitamin A activity was converted to the retinol equivalent (RE), with 1.0 RE being equivalent to 3.33 IU of all-trans retinol or 10 IU of all-trans  $\beta$ -carotene. Vitamin E was calculated as IUs and expressed the equivalent as milligrams of alpha tocopherol (mg TE/100 g). One milligram of DL-alpha tocopherol equals to 1.10 of vitamin E. Vitamin D was reported as IU/100 g. One IU of vitamin D was defined as 0.025 g of cholecalciferol, or the biological activity of cholecalciferol, equal to 40 IU/g. For validation of the vitamin assays, a standard reference material, i.e. infant formula was used.

### ***Amino Acids Analysis***

Samples of 2 to 5 mg of protein were hydrolyzed by 6N HCL for 24 h at 110°C (Moore and Stein, 1963). Cystine was determined as cysteic acid by performic acid treatment of the sample (Moore, 1963) and hydrolyzed as earlier. Tryptophan was released by the alkaline hydrolysis (NaOH) procedure of Hugli and Moore (1972). All the hydrolyzates were determined with a Beckman 121 amino acid analyzer. Correction values for incomplete recovery of amino acids were used.

For tryptophan, 5-methyl-tryptophan was used as an internal standard during hydrolysis. The chemical score was calculated by dividing the essential amino acid content in the test protein by the contents of the same amino acid requirement pattern of the WHO (1985). The amino acid with the lowest score was considered the limiting essential amino acid.

### ***In-Vitro Protein Digestibility (IVPD) and Calculated Protein Efficiency Ratio (C-PER)***

The IVPD of the protein of each dish was estimated by the multienzyme procedure of Hsu et al. (1977) and a modified version of the procedure of Saterlee et al. (1979). The C-PER was calculated from the data on essential amino acids and IVPD, as described by Saterlee et al. (1979).

### ***Protein Digestibility Corrected Amino Acid Score (PDCAAS)***

The PDCAAS of the composite dishes was calculated by multiplying the lowest amino acid score by the protein digestibility as described by the FAO/WHO (1989).

### ***Use of Calculations and Computer Programs for Recipes***

#### ***Standardization of Recipes***

All of the major ingredients of each recipe were entered into the computer using Excel 5.0, and the mean value, standard deviation and c.v. were computed. For a c.v. above 20%, more recipes were added to dilute the differences between the major ingredients and within the same recipe.

#### ***Data of the Chemical Analyses***

Data obtained per one hundred grams from the chemical analysis were converted from a dry basis to a wet basis by being multiplied by a moisture factor. Mean values, with the standard deviation were calculated using Excel 5.0. The final data were expressed for 100 g edible portions.

### ***Presentation of Food Composition***

The Kuwaiti food composition tables were introduced in a three-string plastic file. The file was divided into four parts: Introduction, Food Composition Tables, References and Appendices.

The food composition tables were divided into seven sections according to the main ingredients of the dishes: meat-based dishes, chicken-based dishes, seafood dishes, cereal-based dishes, legume-based dishes, salads and sweets. The numbering system of each section was done on a serial basis to allow enough flexibility to add future data. The nutritive information for each dish was presented in a single table. At the back of the table, information on the amounts of ingredients and methods of cooking was tabulated. For each dish, the name is provided in Arabic and English, and the nutritive value expressed for 100-g edible portions.

## *Conclusions*

The Kuwaiti food composition tables are considered the only tables in the Gulf region that are based on standardized recipes and chemical analyses.

Difficulties encountered in establishing food composition tables are summarized in the following:

- Standardizing the recipes: We encountered some problems in standardizing recipes because of the variation in the quantities of main ingredients used in the same recipes. This caused a c.v. of over 20% in some recipes. To solve this problem, more recipes were used to dilute the differences in the quantities of the major ingredients.
- Sampling of food: Since Kuwait is dependent on food imports, the sampling of food from the recipes was limited, especially for vegetables. The season, origin, crop media and storage conditions could all affect the nutritional value of the vegetables, meat, fish, and chicken. We were limited to using the food available in the market during the time of analysis. Selections were based on wholesomeness and freshness.
- Preparation of the samples: Deboning was a critical point in sample preparation. Samples should be completely deboned to avoid discrepancies in the results, especially for calcium and phosphorus. Homogenization of certain food samples (e.g., dates) was difficult. Special homogenizers (Robot-Cop) were used for the recipes containing dates.
- Technical difficulties: Breakdown of equipment, availability of trained personnel, availability of certified references, and hours worked were the major problems faced during the study. Because of the workload problems, some of the vitamin analyses were carried out abroad.
- Availability of funding and financial support to secure the continuation of the study.

## ***Future Activities***

The study needs to be continued to cover more dishes and to study the effect of cooking on the nutritive value of the food. Currently, the third phase of the study is in progress covering Kuwaiti snacks, sweets, pastries and fish dishes.

## ***Recommendations***

***Country Level:*** More studies should be initiated to study the nutritive values of other dishes. The food composition tables should be used for food consumption surveys nutritional assessments of food, and adequate diet planning and other nutritional and educational purposes. Also, the effect of cooking on the nutritive retention of food should be studied.

***Regional Levels:*** Development of GCC food composition tables, and at a later stage, Middle Eastern food composition tables, could be achieved via cooperation with other GCC countries by:

- Conducting annual meetings to discuss and exchange experience.
- Preparing standard guidelines for sample selection and preparation for GCC countries.
- Using standard methods for chemical analysis.
- Cooperating and coordinating activities between GCC laboratories.
- Developing a standard format for data presentation.

Here, at the Kuwait Institute for Scientific Research (KISR), we have excellent laboratories including well equipped chemical and microbiological laboratories, for the nutritional evaluation of food. Thus, KISR can play an important role in achieving the goal of establishing food composition tables for the GCC countries.

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# ***ACTIVITIES TO ESTABLISH FOOD COMPOSITION DATA IN DUBAI – U.A.E.***

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## ***Introduction***

The importance of food composition data has long been recognized by the Health Authorities in the U.A.E. as well as International Agencies such as FAO/WHO to serve as a guide to take appropriate steps on nutritional deficiencies, plan special diets and to provide consumer education. Accurate food composition data is required to show association between food and nutrition status and to design interventions, apply regulatory standards, properly label food and assist in product formulation.

With limited agricultural resources, the Arabian Gulf Countries are largely dependent on imported foods. Dubai is a focal point with about three million tons of food imported every year from 100 countries all over the globe, about two thirds of it re-exported to other Gulf countries, the Middle East, Africa etc. As food is imported from different geographical regions with varied pre/post harvest and environmental controls, the safety and wholesomeness of the raw materials (used in the preparation of different dishes) as well as processed/ready-to-eat foods play an important role in nutrition.

With the advent of fast foods and harmony among different ethnic communities, eating habits have drastically changed in recent years. Fast and other community foods have become a part of daily diet. Different age groups within one community have started eating different dishes. As a result, the percentage of traditional food in the total diet has been decreasing to 10-20%. The percent consumption may be slightly higher with the older generation. This complex situation makes it more difficult to target nutritional deficiencies unless the compositional data is available on prepared dishes of all communities, fast foods and ready-to-eat foods, and comprehensive information on eating habits.

In recent years, consumer awareness on the intake of different nutrients, calorific value of different foods, uses of different foods and hazards/risks associated with different contaminants and additives, has increased, which has resulted in label declaration of nutritional information on food products by the manufacturers. With a variety of foods around and

limited laboratory facilities, the priority of quality control laboratories has been the food safety (food borne infections and diseases arising from contaminants and additives) rather than food composition. With the load of work on food safety, Quality Control Laboratory (Q. C. Lab.), has given a low priority for compositional analysis except in the case of infant/baby foods. The Food & Environmental Laboratory at Dubai Municipality has made an attempt in this direction, analyzing some important traditional foods, to get initial data to plan for systematic work on the composition of different dishes consumed in the U.A.E.

## ***Activities to Establish Food Composition Data***

### ***Collection of Traditional Foods***

Since there was no information available on standard recipes and main dishes commonly consumed in the U.A.E., an initial study was undertaken to collect and analyze some traditional foods from different households of U.A.E. citizens. About 200 grams of each sample of traditional foods such as Harees, Machboos, Fageh, Kanfarooosh, Aash Mash, Shamey, Hareesh, Margooga, Pakora and Aseed was collected in two sample bags. Preliminary information on the ingredients used and method of preparation, was also collected.

### ***Analysis of Traditional Foods***

#### ***Chemical Analysis***

One unit of each sample was homogenized by blending in a homogenizer for 2-3 minutes, transferred into air-tight containers and were stored in a refrigerator. The samples were analyzed for proximate composition (moisture, ash, fat, protein, carbohydrates, crude fibre, calorific value), minerals, heavy metals, fatty acid profile and cholesterol.

#### ***Proximate composition***

Laboratory validated standard operating procedures (S. O. P.s) were used for analyzing the samples. The samples were analyzed in duplicate and the average results were reported. Moisture was determined by drying a known quantity of sample at  $102\pm 3^{\circ}\text{C}$  in an air-oven. Acid washed, ignited sand was used in some cases to facilitate removal of water. Ash was determined by charring the sample and ashing in a muffle furnace at  $450^{\circ}\text{C}$ . For 8 hrs., hydrogen peroxide was used to facilitate ashing. Fat

was analyzed by Rose-Gottlieb method in samples containing added sugar and by Werner-Schmidt method in samples containing meat. Kjeldhal method using Buchi Protein Analyzer was used for the 6.25 for deducing the protein content. Crude fibre was measured according to the standard AOAC Method. Total carbohydrates were calculated by difference. Energy was estimated using the factors 4.0, 4.0, 9.0 Kcal/g for protein, carbohydrates and fat respectively. Salt content was analyzed by dissolving the ash in hot water and analyzing the chloride by argentometric titration. The results are reported in Table-1.

### ***Minerals and Heavy Metals***

The ash obtained was dissolved in 5 mL of Con. HCl and made up to a known volume. The Minerals (Na, K, Ca, Fe, Cu, Zn) were analyzed by flame AAS. Heavy metals (Pb, Cd) were analyzed using Graphite furnace AAS. The results are reported in Table-2.

### ***Fatty acid Profile and Cholesterol***

The fatty acid profile of the fat was determined by transesterification and the resultant fatty acid methyl 1 esters were analyzed by Gas Chromatography (Table-3). The cholesterol in the unsaponifiable fraction of the fat was extracted following the AOAC procedure and was separated and quantified by Gas chromatography. The results are expressed as mg/100g of sample (Table-3).

### ***Findings***

Proximate composition per 100 grams of each dish are given in Table 1. It can be seen from the table that Shamey, aash kanfaroosh and mixed rice with meat has the highest protein content (8.1-12.5%). Fageh and pokora has the highest fat content (18.9-29%). The ash content ranged from 0.4 to 1.4% in different dishes with salt content ranging from as low as 0.1% in aseeda to 1.0% in Hareesh.

The calorific value (Kcal/100 grams) varied from as low as 77 in harees to as high as 367 in Fageh.

The overall composition of minerals varied markedly in different dishes (Table 2). The high content of sodium in some dishes may be due to addition of common salt. Higher levels of calcium in some dishes may be due to the addition of meat. The iron content ranged from 7.30-60.4 p.m.

The iron content in many dishes is low, which may pose iron deficiency problems, and has been in the case of some children and ladies. However, further work needs to be carried out to confirm iron deficiency.

The fatty acid profile of fat and cholesterol content of the dishes was done on samples having more than 5% fat (Table 3). The fatty acid profile indicates mixed profile of vegetable and animal fat except in pakora which has vegetable fat and fagesh which has milk fat. The results are inconclusive and further work needs to be carried out.

It could be seen from Table 4 that in general traditional foods are microbiologically safe with no pathogenic bacteria detected. Varying numbers of indicator organisms in different foods may be from raw materials from different sources as well as varying cooking/handling methods. The absence of salmonella in all the dishes, particularly dishes containing chicken, indicate no cross contamination from raw materials as well as good cooking methods.

### ***Further Plan of Work***

In order to establish a composition database for the traditional recipes consumed in the U.A.E., a survey was carried out on 300 households in different Emirates. Housewives are interviewed by food and nutrition students using a pretested questionnaire to obtain information on types and methods of preparation, ingredients used, consumption patterns and storage. The data collected will be statistically analyzed, average recipe(s) will be worked out and three dishes of each will be prepared taking the help of experienced housewives following the standard recipe. The dishes will be analyzed for their proximate composition, minerals, vitamins, fatty acid and sterol profile, PUFA content, rancidity, heavy metals and microbial contaminants. This project will be carried out in collaboration with the GULFOODS Secretariat.

**TABLE 1: Proximate Composition of Traditional Foods of U.A.E.**

S. No.	Description	Moisture % w/w	Fat % w/w	Protein % w/w (N x 6.25)	Ash % w/w	Crude Fibre % w/w	Carbo- hydrates % w/w	Salt % w/w	Calorific Value (Kcal/100g)
1	Harees	79.9	2.6	4.1	0.9	0.3	12.2	0.60	89
2	Pakora	46.9	19.8	6.0	0.8	0.3	26.2	0.05	309
3	Khanfarroosh	18.9	6.3	8.1	0.8	0.1	65.7	0.09	352
4	Harees	82.7	2.0	5.5	0.5	0.2	9.00	0.50	77
5	Machpoos	68.0	5.3	5.5	0.4	0.3	20.5	0.90	152
6	Esh Mahalla	51.1	4.2	6.0	0.6	Traces	38.0	0.50	214
7	Aash Mash	78.2	3.5	8.9	0.8	0.7	7.9	0.50	99
8	Shamey	80.3	4.8	12.5	1.1	Traces	1.3	0.50	98
9	Aseeda	65.7	4.9	1.1	0.2	0.2	27.9	0.10	160
10	Mixed Rice	64.8	7.0	8.1	1.1	0.1	18.9	0.60	171
11	Eresh	73.9	6.6	6.9	1.3	0.5	10.9	1.00	130
12	Machpoos	72.1	1.6	3.7	1.1	0.2	21.0	0.80	114
13	Margooga	79.7	3.0	4.5	1.4	0.2	11.2	0.80	90
14	Fageh	29.5	17.5	5.80	0.5	0.2	46.5	0.2	367

**TABLE 2: Mineral Composition of Traditional Foods U.A.E.**

S.No.	Description	Minerals and Heavy Metals (ppm)									
		Na	K	Ca	Mg	Fe	Cu	Zn	Pb	Cd	
1	Harees	2628	53	818	158	7.30	0.58	9.05	<0.02	<0.01	
2	Pakora	4724	91	3006	206	13.4	1.37	9.00	<0.02	<0.01	
3	Khanfarooosh	1310	115	481	112	17.0	0.87	11.2	<0.02	<0.01	
4	Harees	1662	92	1171	142	9.98	0.86	9.86	<0.02	<0.01	
5	Machpoos	2948	90	1814	136	9.98	1.0	5.90	<0.02	<0.01	
6	Esh Mahalla	503	61	313	112	10.8	1.22	6.60	<0.02	<0.01	
7	Aash Mash	2016	127	3529	333	16.3	1.41	6.90	<0.02	<0.01	
8	Shamey	2866	128	3631	296	60.4	2.10	13.2	<0.02	<0.01	
9	Aseeda	632	221	1083	190	38.6	1.17	9.30	<0.02	<0.01	
10	Mixed Rice	397	62	1091	208	11.8	1.00	8.20	<0.02	<0.01	
11	Ereesh	11091	279	2091	335	33.7	1.10	6.80	<0.02	<0.01	
12	Machpoos	11127	91	629	207	13.4	0.64	7.43	<0.02	<0.01	
13	Margooga	1091	120	408	141	29.4	0.73	9.80	<0.02	<0.01	
14	Fageh	2409	69	341	150	32.1	1.37	16.8	<0.02	<0.01	

**TABLE 3:** Fatty Acid Profile and Cholesterol Content of Traditional Foods of U.A.E.

Description	Percent Fatty Acids																Cholesterol (mg/100g sample)
	6:0	8:0	10:0	12:0	14:0	15:0	16:0	16:1	17:0	18:0	18:1	18:2	18:3	20:0	20:1	22:0	
Sample																	
Pakora	0.0	0.0	0.0	0.20	2.80	0.0	32.9	0.2	0.0	6.8	35.2	20.6	0.57	0.2	0.2	0.3	<1.0
Khanfaroooh	0.52	0.65	0.52	0.48	1.04	0.1	38.2	0.35	0.30	9.61	30.3	17.1	0.26	0.3	0.37	0.68	14.6
Machpooos	0.36	0.76	2.36	3.02	11.1	0.20	30.8	3.16	1.15	11.4	24.5	7.96	0.49	0.11	0.41	0.2	5.42
Aseeda	0.38	0.90	2.84	3.62	10.8	1.98	29.4	3.32	1.2	11.5	23.5	5.74	1.86	0.30	1.1	0.28	7.74
Mixed Rice	0.0	0.0	0.0	0.21	1.0	0.11	32.7	0.36	0.18	5.34	34.8	21.6	1.08	0.28	0.16	1.58	5.93
Ereesh	0.0	0.0	0.0	0.21	0.82	0.32	32.5	0.10	1.02	3.92	37.1	23.6	0.94	0.28	0.21	0.14	18.6
Fagch	0.92	2.50	3.18	12.0	11.8	1.60	22.8	1.46	0.76	11.9	23.6	2.1	0.84	0.92	0.20	0.26	69.3

Table -4 : MICROBIOLOGICAL ANALYSIS OF TRADITIONAL FOODS

S.No.	SAMPLE	A.P.C.	COLI.	F. COLI	Moulds/ yeasts	SAL.	STAPH. AUR.	Clos. Per.	V. PARA	B.CER.
1.	Harees	H.C.	>1100	Present	H.C.	-	Staph. Capitis	-	-	-
2.	Pakora	55/g	-	-	-	-	-	-	-	-
3.	Khanfaroooh	420/g	-	-	320/g	-	-	-	-	-
4.	Harees	-	-	-	H.C.	-	Present	-	-	-
5.	Machphoss	-	-	-	-	-	-	-	-	-
6.	Eashmahalla	-	30	Present	H.C.	-	-	-	-	-
7.	Aash mash	-	-	-	-	-	-	-	-	-
8.	Shamey	H.C.	>1100	Present	-	-	-	-	-	-
9.	Aseeda	-	-	-	-	-	-	-	-	-
10.	Mixed rice	H.C.	>1100	Present	H.C.	-	-	-	-	-
11.	Ereesh	-	-	-	-	-	-	-	-	-
12.	Machpoos	-	-	-	-	-	-	-	-	-
13.	Margooga	-	-	-	-	-	-	-	-	-
14.	Fageh	-	-	-	-	-	-	-	-	-

## ***Conclusion and Recommendations***

An evolution took place in the eating habits in Gulf Countries over the last decade. As a result of different ethnic communities living together, other community foods have become a part of daily diet. With the advent of fast foods, different age groups in the same community started consuming different foods. This situation, coupled with the prolonged intake of additives and contaminants will make it very difficult to relate any nutritional deficiency or disorder to a particular diet. However, it is recommended to target the main dishes consumed by different communities and get compositional data. Emphasis shall be laid on the consumption of other dishes (fast and convenience foods, snacks, desserts etc.) apart from main meals to calculate the daily intake of different nutrients. While passing on the responsibility of labeling nutritional information on processed/fast foods to manufacturers, Q.C. Lab. shall conduct periodic checks for their compliance. It is important to initiate educational programmes to consumers on the correct use of nutritional information.

# ESTABLISHING FOOD COMPOSITION DATA FOR LEBANON

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## ***Introduction***

The Near East region is in need of developing accurate food composition data in order to satisfy the mounting desire for such information. Nutritional studies on food habits and nutrient intake in relation to health and disease are hampered by the scarcity and inaccuracy of the available data. Moreover, governments in the region need this information in order to protect the consumer from fraud and false claims. Nutrition labeling has also arisen as a necessity for encouraging consumption of locally produced foods and for export purposes. From the consumer angle there is an economic perspective to the problem. Caution is currently practised in purchasing locally produced foods, albeit cheaper, for reasons of no confidence or ignorance of ingredients.

The above factors have also contributed to slowing down of the process of formulation of food rules and regulation and providing of dietary guidelines for the public.

## ***Present Situation***

Data on nutrient composition of Middle Eastern foods are available and in use in the region. The main sources include the FAO publication of 1986 and the AUB publication of "Food and composition tables for use in the Middle East" of 1970. However, since that time, major changes have occurred regarding food consumption habits, food ingredients, and appearance of new foods. This publication, although extensively used, suffers from drawbacks, e.g.

1. Many nutrients are missing e.g. sugar, saturated fats and cholesterol.
2. No mention of dietary fiber.
3. Many composite dishes were not analyzed.
4. Vitamins were not accurately determined due to limitation of analytical procedure in the 80s.
5. Lack of data on many local processed foods.

The advancement of nutritional science during the past thirty years revealed the importance of new nutrients which were overlooked in the previous data, such as dietary fibre, monounsaturated fats, polyunsaturates, saturates and cholesterol. In addition, major advances in technology and analytical methods were developed. This factor allows for more accurate and fast analysis of nutrients.

In view of the urgent need for food composition data, there were limited individual attempts to produce such data. In Lebanon for example, one of the most popular cookbooks was analyzed for nutrients using a computer. Data were entered as ingredients and nutrients were computed per hundred grams and per serving (Table 1). The same procedure was used for a cookbook on Arabic sweets. The data obtained have the following limitations:

1. Accuracy.
2. Changes occurring in cooking.
3. Preparation losses of nutrients.
4. Standardized recipe.

### ***Justifications***

The need for a new food composition database is hence justified by the following:

1. Limited accuracy of available data.
2. The need to analyze new foods.
3. Assessment of nutritional status through dietary intake.
4. Formulation of diets for disease management.
5. Establishing dietary guidelines for the public.
6. Consumer protection from Fraud by government.
7. Labelling purposes.
8. Quality control.
9. Promoting purchases of local foods.
10. There is increased consumer awareness and demand.

### ***Recommendations***

In order to proceed in the development of a food composition database, I believe there is a need to identify the following steps:

1. Establish a regional center for coordination of food composition activities.
2. Divide foods to be analyzed among countries, starting with domestic foods.
3. Identify centers where such food composition activities can be performed.
4. Unify analysis and sampling methods.
5. Identify sources of financial support.

**Table (1): Composition of some local Lebanese foods**

	Food	Water (gm)	Energy (Kc)	CHO (gm)	Protei (gm)	Sat. Fat (gm)	Mono Fat (gm)	Poly Fat (gm)	Fat (gm)	Chol. (mg)	Diet Fib (gm)	Ca (mg)	Iron (mg)	Vit. A (R.E)	Vit. C (mg)	Vit. D (Ug)	Vit. E (mg)	% Calories from		
																		CHO	Protein	Fat
1	Akras kebbeh meklich /100 gm /Kores	25.19	450.8	20.92	8.264	5.387	10.56	22.53	37.84	0.000	2.103	42.33	1.601	31.88	1.605	0.000	26.60	18%	7%	74%
2	American rice cooked /100 gm /Serving	89.38	54.90	6.019	0.680	1.932	0.918	0.191	3.219	8.058	0.322	14.68	0.123	27.75	0.000	0.000	0.446	43%	5%	52%
3	Ayran /100 gm /Serving	229.7	141.1	15.47	1.747	4.964	2.358	0.490	8.273	20.710	0.827	37.72	0.315	71.33	0.000	0.000	1.145	43%	5%	52%
4	Bamieh bi lahme /100 gm /Serving	377.8	139.0	10.60	7.880	4.760	2.030	0.210	7.380	29.00	0.000	305.0	0.110	83.80	1.200	0.000	0.000	30%	22%	47%
5	Bourghol bil dfin /100 gm /Serving	76.99	121.8	3.892	2.191	1.693	3.225	6.925	11.09	0.000	0.842	35.84	0.803	43.72	12.28	0.000	9.332	13%	7%	80%
6	Cabbage salad /100 gm /Serving	647.6	1025	32.74	18.43	14.24	27.13	58.25	93.32	0.000	7.086	301.5	6.757	367.8	103.3	0.000	78.50	13%	7%	80%
7	Cheikh el mehchi /100 gm /Serving	65.12	165.8	13.29	5.894	1.754	3.431	6.370	10.16	0.197	1.890	36.77	1.061	17.72	1.878	0.000	5.717	32%	14%	54%
8	Cheikh el mehchi bil laban /100 gm /Serving	320.2	815.3	65.34	28.98	8.626	16.87	31.32	49.96	0.968	9.292	180.8	5.216	87.15	9.233	0.000	28.11	32%	14%	54%
9	Chich barak /100 gm /Serving	75.82	123.0	7.442	4.160	1.352	3.650	4.242	9.769	0.000	2.231	55.35	1.033	6.593	34.31	0.000	0.498	22%	12%	65%
10	Chicken soup /100 gm /Serving	141.1	228.9	13.85	7.741	2.516	6.792	7.895	18.18	0.000	4.151	103.0	1.922	12.27	63.85	0.000	0.926	22%	12%	65%
11	Chicken with rice soup /100 gm /Serving	87.90	53.31	4.928	2.522	0.239	0.421	1.012	2.822	0.000	0.950	14.13	0.709	32.32	12.19	0.000	1.386	36%	18%	46%
12	Croissant /100 gm /Serving	481.6	292.1	27.00	13.82	1.311	2.306	5.547	15.46	0.000	5.205	77.40	3.885	177.1	66.80	0.000	7.593	36%	18%	46%
13	Dajaj moussahab (grilled) /100 gm /Serving	69.97	203.84	4.307	3.508	2.775	4.701	11.02	19.57	2.110	0.954	36.72	0.520	11.62	7.444	0.000	15.06	8%	7%	85%
14	Daoud bacha /100 gm /Serving	480.9	1401	29.60	24.11	19.07	32.31	75.74	134.5	14.50	6.554	252.4	3.573	79.85	51.16	0.000	103.5	8%	7%	85%
15	Daoud bacha /100 gm /Serving	73.42	146.5	10.75	5.738	3.683	3.270	1.246	8.896	24.02	0.213	82.43	0.985	59.48	2.929	0.070	0.680	29%	16%	54%
16	Daoud bacha /100 gm /Serving	268.7	536.1	39.35	21.00	13.48	11.97	4.560	32.56	87.90	0.778	301.7	3.604	217.7	10.72	0.255	2.487	29%	16%	54%
17	Daoud bacha /100 gm /Serving	88.57	65.36	0.712	6.635	1.176	1.405	0.741	3.846	27.38	0.077	15.53	0.481	54.25	0.474	0.000	0.105	4%	41%	54%
18	Daoud bacha /100 gm /Serving	501.4	370.0	4.029	37.56	6.660	7.955	4.192	21.77	155.0	0.434	87.94	2.723	307.1	2.686	0.000	0.593	4%	41%	54%
19	Daoud bacha /100 gm /Serving	81.05	99.37	7.466	5.088	2.713	1.764	0.519	5.445	51.39	0.019	72.02	0.329	98.03	0.656	0.621	0.235	30%	21%	49%
20	Daoud bacha /100 gm /Serving	192.9	236.5	17.77	12.11	6.457	4.199	1.236	12.96	122.300	0.045	171.4	0.784	233.3	1.561	1.479	0.560	30%	21%	49%
21	Daoud bacha /100 gm /Serving	26.26	407.5	39.53	6.259	15.09	7.091	1.089	25.14	79.25	0.928	48.55	3.231	238.8	0.257	0.135	0.597	38%	6%	55%
22	Daoud bacha /100 gm /Serving	8.178	126.9	12.31	1.949	4.700	2.208	0.339	7.830	24.68	0.289	15.12	1.006	74.36	0.080	0.042	0.186	38%	6%	55%
23	Daoud bacha /100 gm /Serving	68.09	159.6	15.06	1.698	1.990	7.175	1.022	10.56	2.413	0.304	43.66	0.688	33.16	10.13	0.000	2.302	37%	4%	59%
24	Daoud bacha /100 gm /Serving	204.6	479.6	45.25	5.102	5.980	21.56	3.071	31.73	7.250	0.915	131.2	2.068	99.66	30.45	0.000	6.917	37%	4%	59%
25	Daoud bacha /100 gm /Serving	66.35	199.6	5.526	4.060	11.77	5.819	1.848	18.52	49.33	1.637	35.93	0.588	170.7	4.045	0.000	0.962	11%	8%	81%
26	Daoud bacha /100 gm /Serving	267.4	804.3	22.27	16.36	47.42	23.45	7.447	74.65	198.800	6.599	144.8	2.309	687.9	16.30	0.000	3.876	11%	8%	81%

# ACTIVITIES TO ESTABLISH FOOD COMPOSITION DATA IN JORDANI TRADITIONAL FOOD AND WILD EDIBLE PLANTS

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## ***Introduction***

Establishing acceptable data bases on food composition and the mutual collaboration and exchange of such data in the countries of the region is essential. The knowledge of the nutritional value of foods and the ability to use them are extremely important for scholars, researchers, food analysts, caterers, consumers and agriculture and health policy makers.

The need for having databases in food composition in Middle East countries has been emphasized (Musaiger and Miladi, 1996). There is a combination of food composition tables which are used in this region including the food tables of FAO (1982), Pellett and Shadarevian (1970), Kamel and Allam (1979) and Musaiger and Dallal (1985). However these tables prepared to be used in the region, or the ones in other countries, such as those of Holland et al (1992), are either not relevant to Jordan, incomplete, lack nutrient data of the local Jordainan foods or have no standardized methods of sampling.

There are traditional and local foods in different parts of the world including the Middle East, which are well-placed in the habits of people. Such foods are ecologically, culturally and nutritionally important (Messer and Kuhnlein, 1986). In Jordan, many food commodities are imported and their nutrient composition is known. However, many local foods and wild plants are traditionally included in the diet of people. Little attention has been drawn to the analysis and nutrient composition of these foods, or to the documentation of their uses in the diet.

Recently, many food items of these local and wild plants have been analyzed for their proximate composition and some of the micronutrients by many staff members of the University of Jordan. Most of data on food composition of local traditional foods consumed in Jordan were mainly achieved through work done by post-graduate students, whereas most of the work on wild edible plants was done by AL-Eisawi and Takruri

(1989) and Tukan et al (1998). About 142 wild edible plants, belonging to 28 families, were classified and collected from 19 different localities in the three main regions of the country: the Jordan Valley, the Highland and the arid desert, in (Tukan et al., 1998). Most of the plants were analyzed for proximate analysis and micronutrients; furthermore, data on methods of preparation, mode of consumption and parts used were gathered on the more popularly - used plants over a three - year period through interviews of old and middle-aged rural inhabitants of either sex who are familiar with the plants.

## ***Methodology***

### ***Collection of Plants and Data on Their Uses***

In each locality, at least 3 old or middle-aged people considered by their communities to have experience on wild plant collection and uses were interviewed (Tukan et al., 1998). Data on preparation and uses of the plants in human diet was collected for 56 plants (out of the 142) considered to be more popularly used. The plant was considered popular if it met one of the following criteria (Tukan et al., 1998):

1. Its use was described by at least 3 interviewees in 5 or more localities.
2. It was reported by at least 2 interviewees in 2 different localities to be used in more than 3 different dishes.
3. It was known by the researchers to be available in the local market.

Classification of the plants included in the study was based on Al-Eisawi (1982) and Meikle (1984).

### ***Food Analysis***

Samples were collected in polyethylene bags from at least 3 different localities. They were kept in an insulated ice box to avoid moisture loss. Part of each sample was taken for classification in the Department of Biological Sciences. The rest of the sample was taken to the Food Technology Laboratory. The edible portion was taken and divided into 3 parts: (a) a sub-sample was taken for moisture determination directly after reaching the laboratory; it was weighed and oven dried in triplicate for moisture; (b) another subsample was weighed and kept frozen in PE bags at - 18°C till analyzed for vitamin C and carotene, and (c) the rest of the sample was cleaned, dried and finely milled to pass a 500 micron sieve using an electric hammer mill (Ski: 34233 Retsch GmbH, 5675 HAAN-

West Germany), kept in polyethelene bags and stored refrigerated till analyzed. The methods used for the determination of nutrients in the samples of wild and local plants were Standard AOAC (Association of Official Analytical Chemists) methods, with some minor modification in some cases.

### ***Proximate Analysis***

***Moisture determination:*** Five gram homogenized samples were dried at 105°C in a drying oven (Memment, Karlklob – West Germany) to reach constant weight.

$$\text{Moisture content} = \frac{W1 - W2}{W1} \times 100\%$$

***Nitrogen determination:*** Nitrogen was determined using either macrokjeldahl or Kjeldahl Tecator System. Sulfuric acid was used with Na<sup>2</sup> SO<sup>4</sup> and CuSO<sup>4</sup> or with selenium dioxide tablets to catalyze digestion. The distillation process was done using a microkjedahl method (Labconco Crop, Kansas, USA) or Tecator system.

***Ether Extract:*** It was determined for oven-dried samples using a Soxhlet apparatus (Soxhlet system, HT, 1043 Extraction Unit Tecator System), with anhydrous diethyl ether as a solvent for extraction.

***Ash Content:*** The ash content was determined by ignition at 550°C for 6 hours in a muffle furnace (AOAC, 1990).

***Crude fibre:*** The crude fibre was determined using acid and alkaline hydrolysis followed by ashing for 2 hours at 500°C using a muffle furnace. The crude fibre content was calculated as the difference between the sample weight before and after ashing divided by the dry sample weight and then multiplied by 100% (AOAC, 1990).

***Carbohydrate:*** The carbohydrate content was calculated as the difference between 100% and the sum of the percentage of protein, fat, ash and crude fibre.

***Energy Content:*** Energy content was calculated using the Atwater factors 4, 9 and 4 for carbohydrates, fat, and proteins respectively.

***Vitamin Determination:*** Vitamin A content (in retinol equivalent) for these studied plant foods was calculated from the carotenes which were determined using Booth method (Booth, 1957). One retinol equivalent was considered to be equivalent to 6 µg β- carotene or 12 µg other

carotenoids. Vitamin C was determined using titration with 2, 6-dichlorophenol-indophenol method. (AOAC, 1990).

**Mineral Determination:** Potassium and Sodium were determined by flame photometry (Evans Electro Selenium Ltd, Halsted). Total phosphorus was determined colorimetrically through converting to phosphomolybdic acid which was reduced and measured by Spectronic 55 spectrophotometer at 882 nm.

Other mineral elements (the trace elements: Ca, Fe, Mn, Cu) were determined by atomic absorption spectrophotometry after ashing and dissolving in dilute acid.

**Oxalate Analysis:** oxalate was determined using the method described by AOAC (1990) which depended on extraction with m-phosphoric acid and titration with 2, 6-dichlorophenol-indophenol (Takaruri, 1995).

## ***Results and Discussion***

The uses and methods of preparation were obtained (Tukan et al, 1998). Selected examples of these different methods of preparation and uses as described by the interviewees are listed in Table (1). When the recipe was totally new to the researcher, it was tested by tasting it after preparing it, as described by interviewees, in the meal preparation laboratory of the Department of Nutrition and Food Technology. It is clear that the uses and methods of preparation are varied, ranging from eating the plant fresh to cooking and stewing or infusing to have cold or hot drinks. Even jam preparation, and drying and storing for future uses, especially as herbal tea (e.g. chamomile and sage) or cold drink (e.g. liquorice) are among the uses.

Data on proximate analysis and energy content for some of the studied plants is presented in Table 2 (expressed in DMB). As plant foods are mainly leafy vegetables, it is expected that the fat percent is low in most of them. The ash content was of a wide range. On the other hand, these plants are rich in fibre content.

Vitamins A (carotenes) and C for 20 of these plants are presented in Table (3). It is apparent that many of them are rich in carotenes and/or vitamin C. Since some of them, such as mallow, garden rocket and thyme, are of popular use, it is expected that they significantly contribute to meeting the requirement of these important nutrients.

**Table 1: Methods of preparation and consumption of wild edible plants in Jordan.**

<u>Family</u>	<u>Scientific name</u>	<u>English name</u>	<u>Use and mode of consumption</u>
Anacardiaceae	<i>Rhus coriara</i> L.	sumac	spice and seasoning
Araceae	<i>Arum palaestinum</i> Bioss. <i>Eminium spiculatum</i> (Blume) Kuntze	arum eminium	stews stews (dried vegetable)
Chenopodiaceae	<i>Beta vulgaris</i> L.	wild chard	stews; turnover filling; soup ingredient.
Compositae	<i>Centaurea iberica</i> Trev. ex. Sprengel <i>Cichorium punitum</i> Jacq. <i>Gundelia tournefortii</i> L.	Spanish thistle dwarf chicory gundelia	raw without preparation; boiled and pressed. boiled and pressed. stews; sauteed with oil; fried with eggs.
	<i>Lactuca tuberosa</i> Jacq.	wild lettuce, tuberous- lettuce	raw without preparation.
	<i>Matricaria aurea</i> (Loefl.) Schultz Bip.	chamomile	hot drink (fresh or dried).
	<i>Notobasis syriaca</i> (L.) Cass.	Syrian thistle	raw without preparation; stews.
	<i>Scolymus maculatus</i> L.	golden thistle	raw without preparation.
	<i>Scorzonera papposa</i> DC.	viper's grass	raw without preparation.
	<i>Silybum marianum</i> (L.) Gaertner	holy thistle, knap- weed, milk thistle	raw without preparation; roasted seeds (snack); stews.
	<i>Tragopogon coelesyriaca</i> Boiss.	goat's beard	raw without preparation.

Table 1 continued

<b>Family</b>	<b>Scientific name</b>	<b>English name</b>	<b>Use and mode of consumption</b>
<b>Cruciferae</b>	<i>Eruca sativa</i> Miller	garden rocket	raw without preparation; green salad
	<i>Lepidium sativum</i> L.	garden cress, pepper cress	raw without preparation; green salad
	<i>Nasturum officinale</i> R.Br.	water cress	raw without preparation; yogurt salad
	<i>Sinapis alba</i> L.	white mustard	raw without preparation; green salad; yoghurt salad
<b>Ericaceae</b>	<i>Arbutus andrachne</i> L.	oriental strawberry tree	raw fruit
<b>Fragaceae</b>	<i>Quercus coccifera</i> L.	kermes oak, scarlet oak	boiled; baked
	<i>Quercus ithaburensis</i> Decne.	oak	boiled; baked
<b>Geraniaceae</b>	<i>Geranium tuberosum</i> L.	tuberous crane's -bill	raw without preparation
<b>Iridaceae</b>	<i>Crocus aleppicus</i> Baker	crocus	baked and roasted
	<i>Crocus hermonicus</i> Kotschy ex Maw	crocus	baked and roasted
<b>Labiataeae</b>	<i>Calamintha incana</i> (Sm.) Heldr.	grey moench	salad mix (fresh); hot drink (dried); spice
	<i>Mentha longifolia</i> (L.) Hudson	wild mint	raw without preparation; bread ingredient; cold or hot drink; spice and seasoning
	<i>Micromeria nervosa</i> (Desf.) Bentham	benth	hot or cold drink
	<i>Origanum syriacum</i> L. Syn.: <i>Majorana syriaca</i> (L.) Rafin.	thyme, Syrian hyssop	raw without preparation; turnover filling; spice

Table 1 continued

<u>Family</u>	<u>Scientific name</u>	<u>English name</u>	<u>Use and mode of consumption</u>
<b>Labiatae</b>	<i>Salvia fruticosa</i> Miller Syn.: <i>S. triloba</i> L. Fil. <i>Salvia hierosolymitana</i> Boiss.	sage, Lebanon sage clary, judean sage	hot drink stuffed dish (leaves)
<b>Leguminosae</b>	<i>Ceratonia siliqua</i> L. <i>Glycyrrhiza glabra</i> L. <i>Pisum syriacum</i> (Berg.) Lehm. <i>Tetragonolobus palaestinus</i> Boiss. & Blanche <i>Trigonella arabica</i> Delile	carob, locust liquorice wild pea Palesine winged pea wild Arabic fenugreek	cold drink cold drink raw without preparation raw without preparation
<b>Liliaceae</b>	<i>Trigonella stellata</i> Forsskal	star fenugreek	raw without preparation ( fresh); spice (dried) spice (dried)
<b>Malvaceae</b>	<i>Asparagus aphyllus</i> L. <i>Malva neglecta</i> Wallr.	wild asparagus dwarf mallow	fried with eggs sauteed; stewed with oil
<b>Polygonaceae</b>	<i>Rheum palaestinum</i> Feinbr. <i>Rumex crispus</i> L. <i>Rumex cypreus</i> Murb.	Palestinian rhubarb yellow dock, curled dock sorrel	boiled and sweetened raw without preparation sauteed with oil; soup ingredient, turnover filling
<b>Portulacaceae</b>	<i>Portulaca oleraceae</i> L.	common purslane	raw without preparation; green salad; sauteed with oil

Table 1 continued

Family	Scientific name	English name	Use and mode of consumption
<b>Primulaceae</b>	<i>Cyclamen persicum</i> Miller	cyclamen	raw without preparation (soft seeds); stuffed (leaves)
<b>Rhamnaceae</b>	<i>Ziziphus lotus</i> (L.) Lam.	ziziphus	raw without preparation; jam
	<i>Ziziphus nummularia</i> (Burm.fil.) Wight.& Walk.-Arn.	ziziphus	raw without preparation; jam
	<i>Crataegus aronia</i> (L.) Bosc. ex DC.	hawthorn	fruit
<b>Rosaceae</b>	<i>Pyrus syriaca</i> Boiss.	wild pear	fruit
	<i>Rubus canescens</i> DC.	bramble	fruit; jam; turnover filling
<b>Umbelliferae</b>	<i>Apium graveolens</i> L.	wild celery	green salad
	<i>Apium nodiflorum</i> (L.) Lag.	dwarf celery	raw without preparation; green salad; turnover filling
	<i>Astoma seselifolium</i> DC.	astoma	raw without preparation; baked
	<i>Coriandrum sativum</i> L.	coriander	raw without preparation (fresh leaves); spice and seasoning (fresh leaves and dried seeds); green salad
	<i>Eryngium creticum</i> Lam.	button snake root	raw without preparation; bread ingredient (fresh leaves) spice and seasoning
	<i>Foeniculum vulgare</i> Miller	common fennel	raw without preparation; soup ingredient; spice and seasoning
	<i>Ridolfia segetum</i> (Guss.) Mori	dill	raw without preparation
<b>Urticaceae</b>	<i>Urtica pilulifera</i> L.	Roman nettle	raw without preparation

Reference: Tukan et al., 1998.

**Table 2 : Proximate Analysis of selected wild edible plants consumed in Jordan (on dry matter basis).**

Food	Moisture	Protein	Fat	Ash	Crude fiber	NFE	Energy
Arum	87.1	48.8	4.1	7.3	9.3	30.5	262.6
Asparagus	88.5	34.3	1.2	15.1	8.7	40.7	310.8
Celery, wild	92.1	27	3.2	18.9	11.2	39.7	295.6
Chard, wild	90.5	29.5	1.6	19.7	10.1	39.1	288.8
Clary, Judean sage	94.4	22.3	1.8	14.8	16.1	45	285.4
Common chry-santhemum	88.0	10.9	-	14.9	8.3	65.5	274.5
Coriander	87	29.6	3.4	20.3	8.5	38.2	301.8
Dwarf celery	90.5	38	4	9.9	7.4	40.7	350.8
Eiminion	74.7	22.8	2.4	21.6	5.1	48.1	305.2
Fennel leaves	87.8	21.7	1.7	10.3	22.1	44.2	286.5
Fenugreek	92.9	23.2	4.3	13.7	11.3	47.5	321.5
Garden Cress	94.5	32.4	3.3	12.4	17.8	34.1	295.7
Golden thistle	94.3	6.8	1	12.7	21.1	58.4	269.8
Gray moench	94.4	39.6	7	20	15.8	17.6	291.8
Gundelia	93.5	25	3.3	13.4	15.4	42.9	301.3
Leek, wild	88.3	7.3	0.8	43.8	9.4	38.7	191.2
Mallow	94.8	20.2	0.6	19.9	15.4	43.9	261.8
Mint, wild	94.4	26	0.5	10.3	17.8	45.4	290.1
Pistacia	91.5	16.2	0.6	25	10.2	48.0	262.2
Sorrel	92.1	14.4	1.8	22.8	10.1	50.9	277.4
Spanish thistle	93.3	15.8	1.4	14.4	19.4	49	271.8
Syrian thistle	94	23	1.5	21.9	15.0	38.6	295.9
Thyme, syrian	78.9	34	0.6	6.5	9.0	49.9	337.4
Wild Mint	94.4	26	0.5	10.3	21.4	41.8	275.7
Wild Pea	91.2	25.7	0.7	3.2	11.3	59.1	345.5
Ziziphus	95.4	6.8	1.4	5.2	8.7	77.9	51.4

Table (4) shows the mineral elements Ca, P, Na, K, Fe, Zn, Cu and Mn in some selected wild plants. Again it is shown that some of the studied plants were high in mineral content. As expected the K content is generally high and the Na content is relatively low.

The contents of Ca, vitamin C and oxalate are presented in Table (5) (Takruri, 1995). The oxalate content was found to be very high in some wild plants such as sorrel, dock, chard, orache and Palestinian rhubarb. The oxalate/Ca molar ratio was calculated in some of the studied plants. The oxalate and oxalate/Ca ratio have important health implications in people who suffer from renal stones.

### ***Obstacles***

Various obstacles were faced while performing research which included:

1. Lack of trained personnel in collection of specimens.
2. Poor experience of personnel in collection of specimens and their sorting out, and in clearing and separating the edible portion.
3. Inaccuracy and contradiction in data given by interviewees about the uses and methods of the preparation of the plants.
4. Unavailability or poor functioning of apparatus.
5. Funding and financial support.

**Table 3 : Vitamin A and vitamin C in some wild edible plants consumed in Jordan.**

Plant	Scientific Name	Arabic Name	Vitamin A ( $\mu\text{g}$ ret. equiv)	Vitamin C (mg)
Arum	<i>Arum Palaesti- num</i> Boiss	لوف	484	209
Asparagus	<i>Asparagus aphyllus</i> L.	عجرم	56	18
Celery , wild	<i>Apium graveolens</i> L.	كرفس بري	-	24
Chard , wild	<i>Beta vulgaris</i> L.	سلق بري	710	18
Clary , JudeanSage	<i>Salvia judiaca</i> Boiss	لسان الثور	908	41.7
Common chrysathemum	<i>Chrysanthemum Coronarium</i>	بسباس، بسوم	8	35.5
Common purslane	<i>Portulaca Oleracea</i>	بقلة	122	50.2
Coriander	<i>Coriandrum sativum</i> L.	كزبرة برية	278	92.5
Cress	<i>Lepidium aucheri</i> Boiss	رشاد	-	130
Cyclamen	<i>Cyclamen persicum</i>	زعماطوط	530	-
Dominica sage	<i>Salvia dominica</i> L.	خوشة، مرو	556	7.1
Dwarf celery	<i>Apium nodiflorum</i> L.	قرة العين	955	70.7
Dwarf chicory	<i>Cichorium pumilum</i> Jacq	علك	333	-
Eminium	<i>Eminium spiculatum</i>	صمغية	607	126.1
Fennel leaves	<i>Foeniculum vulgare</i>	شومر بري	1101	64
Fenugreek	<i>Trigonella foenumgraecum</i>	حلبة برية	906**	52.3**
Garden cress	<i>Lepidium sativum</i> L.	خرشق	1117	205.4
Garden rocket	<i>Eruca sativa</i>	جرجير	1200	163.4
Mallow	<i>Malva spp.</i>	خبيزة	1505	79
Mint , Wild	<i>Mentha longifolia</i>	نعنع بري	117	32.8
Nettle	<i>Urtica pilulifera</i>	قريص	66	49
Oxalis , fiddle dock	<i>Rumex pulcher</i> L.	حميض	341	27.1
Thyme, Syrian hyssop	<i>Origanum syriacum</i>	زعترا	929	-
Wild Lettuce	<i>Mentha longifolia</i>	خس بري	1100	-
Ziziphus	<i>Ziziphus, Lotus</i>	دوم السدر	7.5	152

**Table 4 : Elements in selected wild edible plants consumed in Jordan . ( per 100g edible portion on DMB) .**

Plant	Ca (%)	P (%)	Na (%)	K (%)	Fe (mg)	Zn (mg)	Cu (mg)	Mn (mg)
Asparagus	0.22	0.615	0.06	3.12	25	4.56	1.39	4.35
Chard ,wild	1.22	0.46	1.7	3.54	66	3.39	2.42	6.01
Cociander	0.81	0.35	0.051	4.24	50	3.62	1.11	4.71
Cress	0.88	0.665	0.29	4.29	29.5	5.33	1.03	8.46
Dill	0.92	0.39	0.20	3.37	71	4.04	1.39	3.15
Fennel	1.17	0.32	0.59	3.46	25	1.95	1.19	5.06
Garden rocket	1.55	0.485	0.21	3.39	72	3.39	3.06	6.25
Gundelia	0.68	0.39	0.32	4.52	15	4.5	1.65	1.07
Mint	1.31	0.62	0.14	4.13	41	4.42	2.16	4.45
Spanish thistle	1.32	0.405	0.57	5.72	33	1.53	1.52	—
Water cress	1.84	0.5	0.20	3.11	24	3.7	0.72	3.55
Wild pea ( pods )	0.44	0.094	0.05	1.07	17	2.83	0.56	—

**Table 5 : Ascorbic Acid ( Vit.C ) , Calcium , Oxalate and Ca/Oxalate ratio in some local plants in Jordan .( Per 100g edible portion ) .**

Plant	Arabic name	Ascorbic acid (mg)	Calcium (mg)	Oxalic acid (mg)	Oxalic /Ca (mol.ratio)
Sorrel	الحميصة	11.7	176	1297	3.3
Fiddle dock	الحميض البري	27.0	26	485	8.3
Yellow dock	الحميض البستاني	30.2	28	650	11.1
Water cress	الخويرة	149	184	49	0.12
Cyclamen	الزعمطوط	32.0	94	45	0.31
Spinach, winter	السبانخ الشتوي	47.0	80	634	3.52
Spinach, summer	السبانخ الصيفي	60.0	108	809	3.33
Chard	السلق	34.0	100	781	3.48
Wild Chard	السلق البري	18.1	122	852	3.1
Palastenian rhubarb	العطرفان	6.8	15	1487	43.4
Dwarf celery		71.0	105	12	0.05
Button snake root	قوة العين القرصنة	25.0	262	62	0.11
Orache	القطف	24.5	120	698	2.6
Wild celery	الكرفس البري	5.3	70	19	0.12

**Ref. Takruri ( 1995 ) .**

## *Conclusions*

1. The data collected on traditional foods and local plants is thought to be very useful and important since a wide variety of such foods and plants are used in the diet of the people of Jordan and other M.E. countries.
2. The food composition values should be incorporated in food composition tables of Jordan and the Middle East to be prepared later.
3. Team work is needed in the study of local and wild food plants as it is a tedious job and requires cooperation and coordination among people of different disciplines.
4. The use of computer programmes to store the data is important.
5. Continuation of the study is important to do most of the work and analyze the vitamins and some other minerals, fibres, amino acids and organic acids.
6. Work should be done on analysis of fast and convenience foods as well as on the manner of data tabulation and recipe standardization.

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# ACTIVITIES OF ESTABLISHING FOOD COMPOSITION DATA IN THE SUDAN

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## ***Introduction***

The Sudan, the largest country in Africa and the Near East, has a diversity of climate, vegetation, wildlife, livestock and people. Extending from the Sahara Desert in the north to close to the Equator in the south, its vegetation spans the whole gamut of flora from wispy grasses to thick equatorial jungles. Temperatures run from 2°C to nearly 50°C during the year. Rains range from naught in the north to 800 mm in the south, where it rains eight months per year.

The political and geographical location of the Sudan has given it a rather unique character that has been observed by many authors and administrators from early times. Werner Munzinger Pasha, a Swiss adventurer and governor of Eastern Sudan and Eritrea during the 1970s, on behalf of the Khedive Ismail of Egypt, once wrote that the Sudan "*held the key to inner Africa*" and that it would become, in time, "*the little America of Africa*" (Cox, 1952). Today the country is more like the New World in the diversity of its culture and the origins of its people. However, unlike most countries, the Sudan was once the cradle of some of the most ancient kingdoms, not only in Africa or the Nile Valley, but in the whole wide world. The ancient kingdoms of Meroe, Kerma and Kush have been mentioned in the writings of the classic authors of Greece and Rome and have been mentioned in the Bible.

Today the Sudan is surrounded by a great number of countries: Egypt, Libya, Chad, Central Africa, Zaire, Uganda, Kenya, Ethiopia, Eritrea, and across the Red Sea, Saudi Arabia. Naturally, a great many of its inhabitants claim origin in one or other of these countries. The melange of cultures in the country is also furthered by settlers from as far as West Africa, who originally came on their way to or from Mecca. So, people of different creed and race man the Sudan.

The foods of a country are the making of the natural climate and the human culture. That is why we expect the Sudan to be extremely rich in its foodstuff. This was been acknowledged very early by a number of writers. The Arab traveler Al-Istakhri, wrote in 957 that the people of

Bilad El Sudan (including present day Sudan) had foods of fruits, plants and others which were not known in the land of Islam (Mus'ad, 1972). Herodotus (430 BC) wrote in his book the *Histories* about the legendary *Table of the Sun* in the outskirts of the town of Meroe, two millennia before the present; a table replenished with food each night by royal magistrates for all people to help themselves. This must be taken as a symbol of abundance in the Sudan of that time as well as of the present Sudan.

Today all major cereals of the world are grown in some suitable locality in the Sudan. Sorghum, millet, corn, wheat, barley and a little rice are all produced in the country. However, the staple of the land is sorghum (*Sorghum bicolor*) followed by millet in the west and wheat in the north and in all cities and towns. All kinds of vegetables are used for sauce and salad in addition to a number of indigenous fermented leaves, meats, milks, etc., that are mostly products of sub-Saharan Africa (Dirar, 1993).

All this gives us an idea of the diversity of food materials to be found in the country as to be expected of the biological diversity of the food sources as well as the history of the country and the culture of its people. It also gives us an idea of the colossal body of work needed to analyse all these foods in order to take the country from the legendary *Table of the Sun* to the scientific Table of Food Composition.

## ***Establishing Food Composition Data***

### ***Source of Food Composition Data***

Any discussion of food composition data in Sudan ignoring the pioneering role of the National Chemical Laboratories of the Ministry of Health is deemed to be erroneous. To this day, these laboratories of eminent history constitute the major source of food composition data of any official character.

In 1902 a wealthy British anthropologist, Mr. Henry Welcome, came to the Sudan only four years after the colonization of the country by Great Britain. He established the Welcome Research laboratories in 1903 on part of the premises of Gordon Memorial College (The University of Khartoum today) and its first report which appeared in 1904 had the results of the analyses of some foodstuffs of the Sudan. That date, therefore, can be taken as the beginning of food analysis in the Sudan. The many reports that followed the first one all had more food composition data.

Through its evolution the establishment had a number of changes in name. In 1911 it was given the name Welcome Tropical Research Laboratories and since its first appearance it has been completely independent, although symbolically affiliated with the Director of Education.

In 1939 the chemical laboratories were officially transferred to the Sudan Medical Service and given the name Welcome Chemical Laboratories. Today, the laboratories are named the National Chemical Laboratories and are found in the capital Khartoum. They continue to carry out food analyses and the results are either published in local periodicals or given in annual reports.

In 1938 the Faculty of Agriculture of the University of Khartoum was established and its Chemistry Department has concerned itself with food analysis since early times. The results of research carried out by its staff and graduate students are published in local and international scientific journals or are available in theses and dissertations. This research is carried out by the section of Biochemistry and Food Science (today an independent Department of Food Science and Technology).

In the year 1965, the Food Research Centre was established with the help of the FAO. This became another source where knowledge of food composition is generated. Here, the data are kept in the annual reports or published in scientific journals.

Although the above three institutions form the major source of food composition data, there are a number of other agencies which generate some data of the same kind. The various faculties of the University of Khartoum do have some data on food composition and so do the various departments of the Faculty of Agriculture.

In 1969, the Ministry of Commerce established its first Quality Control Laboratories with the help of the UNIDO. Three laboratories were established in Khartoum, Port Sudan and Obeid. The idea behind this was prompted by problems and complaints of international buyers of Sudanese export commodities where the problems were mostly of the kind of quality standards and the breach of these standards agreed to in contracts. The laboratories basically concerned themselves with analysing food samples for the attributes involved in the contract. The starting commodities were the oil seeds for export and then later other commodities were checked. In 1972, the laboratories also began to test samples for the presence of the mycotoxin. No attempt was ever made by

these laboratories to find out the complete composition of a food sample with the purpose of compiling food composition data.

In 1994 the Quality Control Laboratories became part of the newly-established Sudanese Standards and Metrology Organization (SSMO) which encompasses all quality control and standards in the country including those of foods. The laboratories now, in addition to export commodities, work on import materials and on local foods and food commerce. Still no complete food analysis is performed by these laboratories.

### ***Sampling and Priorities of Selection of Foods***

Logically, the selection of the food to be analysed is based on the importance of that food in the nutrition and diet of the greater majority of the populace. Therefore, we find all researchers, whether at the Chemical Laboratories, the Faculty of Agriculture or the Food Research Centre, give priority to such foodstuffs as dura (Sorghum), various vegetables, legumes, milk, white cheese, Zabadi, meat, fruit and even some wild fruits, in descending order of importance.

Sorghum, which has many varieties in Sudan, the country being considered a possible origin of this African cereal (Doggett, 1988; Martin, 1970; Evelyn, 1951), has received a fair number of analyses since early times.

Most commonly, the samples to be analyzed are bought from the market, obtained from government agencies or, in the case of processed foods, the samples were collected from groceries, the homes or the factories. The Chemical Laboratory's reports state that "*The importance of the variation of the type of food consumed, cooking habits, the eating habits and the availability of food in different parts of Sudan*" is given great consideration in selecting which food to analyze. The reports also stipulate that "*samples were collected from the actual food consumed, from markets or from houses. In cases where more than one variety or place of growing or method of cooking are available, each is analyzed separately, and either written as one item in the Tables (see below) or as separate items, depending on the variation in nutrient content*".

A special group of foods, the traditional fermented foods, which received international attention in recent decades, have been given special attention by researchers at the Faculty of Agriculture and the Food Research Centre, especially by microbiologists. Some work in this area has been carried out by the Department of Food Science and Technology of the relatively young University of Gezira at Wadi Medani.

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Microbiological work in this area has always been accompanied by chemical analyses. The basis of selection of the food here is the importance of the food in the diet of, especially, the rural communities, and the peculiarity of the food fermentation process (Dirar, 1993).

### *Methods of Analysis*

The methods of analysis used at the Chemical Laboratories, the Faculty of Agriculture and the Food Research Centre and elsewhere in the Sudan are practically the same, and these are the methods accepted in the international literature. However, researchers may differ in some fine detail or even the method of choice or the laboratory equipment used, depending on the availability of materials, chemical reagents and the type of food sample.

The primary references used by researchers in Sudan in the chemical analysis of foods and as guide to quality control are the following:

1. Official Methods of Analysis of the Association of Official Analytical Chemists, USA.
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In general, one can say that in the majority of cases the nutrients analyzed for are the macronutrients of the usual proximate analysis in addition to three important minerals among the micronutrients and these are calcium, iron and phosphorus. The methods used in each case are briefly summarized below.

- i. **Moisture:** Samples are dried at 105°C to constant weight in an air oven. Loss in weight is the moisture content.
- ii. **Protein:** Total nitrogen is determined by the Macro-Kjeldahl method and crude protein is calculated by multiplying total nitrogen by a conversion factor, such as 6.25.

- iii. **Fat and Oil:** The Soxhlet extraction method is used but other methods are sometimes used.
- iv. **Crude fibre:** The defatted sample is digested with alkali and the residue filtered, dried and weighed, then ignited and reweighed. The difference in the two weights represents the weight of the crude fibre in the sample.
- v. **Ash:** This is determined by weighing the residue after burning away all the organic matter at 550-600°C.
- vi. **Carbohydrates:** These are determined by difference after subtracting other ingredients such as moisture, crude protein, crude fibre, fat and ash from 100%.
- vii. **Food energy:** This is determined by multiplying the carbohydrate, protein and fat content by a specific factor to get the kilocalories per 100 gm of sample.
- viii. **Calcium:** By precipitation of calcium from ash solution as the oxalate, dissolving the precipitate in sulphuric acid and titrating with potassium permanganate solution.
- ix. **Iron:** By the aa-dipyridyl colorimetric method on the ash solution of the sample.
- x. **Phosphorus:** By the phosphomolybdate colorimetric method on the ash solution of the sample.

### ***Compilation and Presentation of Food Composition Data***

As mentioned above, the First Report of the Wellcome Research Laboratories published in 1904 contained the first data on food composition. The Second Report (1906) carried a number of tabulations of food composition and all the early work on food composition was presented in a more comprehensive manner in the Third Report (1908).

To be sure, the first genuine compilation of food composition data in the Sudan is the one presented as an "***Appendix to the Report of the Government Analyst, 1947***", entitled "***Analysis of Sudan Foodstuffs***". The table was introduced by short notes by A. J. Henry, then the Government Analyst. This document forms Appendix I attached to this paper.

The table lists analyses carried out at the laboratories during the 45 years preceding its appearance, and although Mr. Welcome mentioned that 103 analyses were listed, a close perusal shows only 100 analyses. The foodstuffs were analyzed for proximate composition plus the minerals calcium and phosphorous as well as for the calories. The items listed include sorghums, pulses, oil seeds, vegetables, millet, wild fruits, dates, rice, teff, milk and meat. The format of the table gives the constituents of each food item in one line as a percentage while the calorific value is given (by calculation) as kilo-calories per 100 g. Items are not grouped.

The next table of food composition data to appear is an unpublished one prepared by Bahieldin Ibrahim El-Magboul in 1971 at the National Chemical Laboratories, Ministry of Health. The format of the table is like that of the 1947 one, only the 107 items included were in classes according to commodity: cereals (40), root crops and vegetables (10), pulses (20), oil seeds (7) and meat and meat products (30). The title of the table was "*Table of Representative values of Foods Used in Sudan*".

The National Chemical Laboratories spurred up its food analysis activities in 1969 and by 1975 the Food Department of the Laboratories launched a project specifically aimed at preparing comprehensive food composition tables for the first time in Sudan.

This effort led in 1977 to the appearance of an unbound list of foods by the title "*Sudan Food Composition Tables, vol I*". It is prefaced by Abdel Hamid Ibrahim, senior consultant for chemical analysis and director of the National Chemical Laboratories. The Tables were edited by Joseph Zaki Boutros.

The great demand for copies of that edition of the Tables from various organizations, both local and international and by individuals, forced those who compiled the Tables to issue a new edition with more complete data and more items. Thus "*Sudan Food Composition Tables, second edition*" appeared in 1986 and was published by UNICEF in a neatly bound form. This document forms Appendix II of this paper. The Tables were also edited by Joseph Zaki Boutros, deputy senior consultant for chemical analysis and head of the Food Department. Now 12 years later the Laboratories are not able to update these Tables which remain to date the only official compilation of food composition data in the Sudan.

The Table comprises 160 food items, grouped in the following major categories:

- i. Cereals, pulses, seeds, nuts and tubers (17 items).
- ii. Flour and cereal products (21).

- iii. Vegetables (30).
- iv. Fruits (22).
- v. Beverages (9).
- vi. Jams, marmalades and confectionery (15).
- vii. Milk, milk products and eggs (10).
- viii. Meat (3).
- ix. Oils and fats (5).
- x. Cooked foods (28).

The foods were analyzed for their proximate composition and the minerals: calcium, phosphorus and iron. All are expressed in gram per 100g of food. Only edible proteins of the foodstuffs were analyzed. The format is similar to that of the 1947 Table, where the constituents of each food are printed in one line but each category of foods begins with a new page.

An event which made a landmark along the road of activities to establish food composition data in the Sudan, is the one-day workshop entitled "*Workshop on the Compilation of Food Composition table for Sudan*" which was held on the 18<sup>th</sup> of September of 1995. The workshop was co-sponsored by FAO, WHO and the Government of Sudan and was successfully attended by most of those concerned with the subject matter of the meeting and all United Nations agencies as well as the national and international NGOs in Khartoum.

The set objective of the workshop was to review existing food composition data from different laboratories in Khartoum in order to compile that data under one cover and thus produce a more comprehensive food composition table for Sudan.

In this workshop new tables were presented. Abdullahi H. El-Tinay and Abdel Azim A. Nour presented a paper by the title "*Food Composition Data Generated by the Department of Biochemistry and Soil Science*", Faculty of Agriculture, University of Khartoum. The paper gave a table encompassing food composition of 41 food items and the authors called attention to the fact that the table also contained data reported by Professor A. J. Henry and D. H. Grindley. Professor Henry's paper alluded to here was presented at the 1953 annual conference of the Philosophical Society of the Sudan in Khartoum. The paper entitled "Sudan Food Values" can be found in the society's proceedings: "*Food and Society in the Sudan, 1955*".

Abdul Hamid R. Ahmed and Bahieldin I. Magboul of the Food Research Centre presented a paper at the workshop with the title "*Towards compiling a Sudanese food composition table*". The paper gave three

tables of composition of foods. Table 1 (62 items) is concerned, like all tables mentioned above, with the general chemical composition of foods (per 100g) and gave proximate composition and the minerals Fe, P and Ca and some other minerals. The remaining two tables are absolutely new to the traditional approach. Table 2 gave the amino acid composition (in grams per 16g nitrogen) of the protein of 20 foodstuffs. Twelve amino acids were determined: tyrosine, valine, tryptophane, leucine, isoleucine, lysine, phenylalanine, methionine, histhionine, histidine, threonine, cystine and arginine. Table 3 gave the fatty acid composition of 12 food items. Seven fatty acids were determined.

The proceedings of the workshop have been presented in: "*Report on the National Workshop on the Compilation of Food Composition Table for Sudan in Accordance with National plan of Action for Nutrition ICN*" prepared by Professor Abdel Gadir Hassan Khattab, the man really behind the whole workshop (Appendix III).

With respect to the special group of fermented foods a number of food analysis data on individual foods can be found in Hamid A. Dirar's book: "*The Indigenous Fermented Foods of the Sudan*".

## ***Conclusions***

It can be concluded from the preceding discussion that efforts and activities to establish food composition data in Sudan have been continuous for almost the whole of the twentieth century. In fact when the Wellcome Research Laboratories were established in 1903 there was only one other analytical laboratory in Africa and that was in South Africa.

As shown, during this period a number of food composition tables have been compiled, the most valuable of which is the 1986 version of *Sudan Food Composition Tables* issued by the National Chemical Laboratories of the Ministry of Health.

There are a number of other laboratories which are engaged in the generation of data on food composition and a sincere effort is being made to bring all those laboratories and individuals concerned to the point of compiling their data together in a comprehensive table of composition.

It can also be concluded that the analyses of the foods dealt with are not complete because there is a clear deficiency and gap in the knowledge concerning amino acids, vitamins, fatty acids and mineral content.

Besides, the present table contains only 160 food items while there still remains a great number of foods both in urban and rural areas that need analysis.

### ***Recommendations***

The 1995 workshop came up with the following recommendations:

1. All data available be compiled in one up-to-date food composition table for Sudan. The data should be arranged according to food commodity group.
2. Gaps in analysis, especially in the areas of vitamins, fatty acids, amino acids and micronutrients, should be bridged. In this respect a special priority should be given to vitamin A, iron and iodine.
3. Indigenous food plants in local diets should be included in the endeavour.
4. Closer coordination and cooperation should be established between concerned laboratories and to design project proposals with the title: ***“Development of Food Composition Tables for Sudan”***.
5. An M. Sc. Degree programme in Analytical Chemistry should be established by the University of Khartoum to provide qualified food analysts.
6. All laboratories need to be rehabilitated and new laboratories need to be constructed.

In addition to the above recommendations, one can add:

7. Taking into consideration the historic role of the National Chemical Laboratories, it is recommended that a well-equipped unit concerned only with the continuous and detailed analysis of foods and the updating of the Tables at regular intervals be established.
8. A laboratory equipment maintenance unit should be established in the country to see to it that all equipment works properly. The WHO has provided The Chemical Laboratories with important equipment such as atomic absorption spectrophotometer, high performance liquid chromatograph (HPLC), UV/visible spectrophotometer and gas liquid chromatograph. But not all this equipment works

properly all the time. Sustained maintenance must somehow be ensured.

9. A computer has been provided by WHO to the Laboratories for saving data but training of personnel is needed to make full use of this apparatus in recipe formulation and various statistical analyses.
10. The problem of chemical reagents is chronic in Sudan and it is not always easy to secure chemicals that have not expired when needed. It is recommended that national chemical stores be established to help laboratories to work properly.

***The above recommendations are for the country level. For the regional level the following recommendations may be made:***

11. More contacts and meetings should be encouraged between the agencies and researchers in the different countries who are working in the field of food composition so they can exchange their experiences.
12. A unified manual of methods of analysis should be published so that the same methods are followed in all Near East countries. This is important in the light of the progress of trade between these countries.
13. This in turn would necessitate the unified training programme of analytical chemists.
14. A combined food composition table for the Near East countries should be published and continuously updated.
15. A joint committee for food composition and food legislation should be formed for the Near East countries.
16. A network and an association of food analytical chemists should be established for the region.

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# FOOD COMPOSITION ACTIVITIES IN PAKISTAN

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## ***Introduction***

Pakistan has a population of 140 million. Its land area is 80 million hectares, out of which 32 million is suitable for agriculture. Presently 21 million hectare is cultivable. It is an agriculture based society with 70 percent of the population living in rural areas and directly dependent on agriculture. The small scale farming and highly inequitable form of land tenure, along with high population growth in Pakistan, has adversely affected the ability of farmers to produce sufficient food for the population. The food balance sheet showed an increase of caloric availability from 2100-2300 in 1990 to 2400-2450 in 1993.

Because of rapid population growth and other factors the food produced is at a much lower rate and the deficit is covered through imports. Main foods produced are wheat, maize, rice, sugar, legumes, fish, fruit and vegetables. Foods exported are rice, fish, fruit and vegetables, while foods imported are wheat, legumes, edible oil and tea.

## ***Significance of Food Composition Data***

Food is a basic need for all human beings and the right to adequate food has been recognized as a human right. Everyone requires access to food which is culturally acceptable and sufficiently balanced and safe to satisfy the nutritional requirements.

Food composition data are required to ensure food supplies adequate for the needs of population, to meet the consumer demands for information and formulate health and dietary recommendation. In addition these data are also critical for promoting trade and for establishing regulation and standards for food. It is therefore important that the national food composition programme be developed and strengthened in a manner that ensures adequate and accurate data while encouraging resource cooperation and regional collaboration. Food composition data of comparable quality can be shared among countries, which in turn greatly assists cross border trade and allows for more use of resources. The

FAO/UNU meeting on food composition work in Tunisia in March 1994 emphasized the need for better access to reliable representative data and the need for a network of institutions collaborating on food composition activities at national, regional and international level.

In order to generate, compile and disseminate accurate food composition data, INFOOD (International Food Data System) has established 8-9 regional food data systems through out the world.

### ***Development of Food Composition Tables for Pakistan***

In 1983-84 the Health and Nutrition section of the Planning and Development division, government of Pakistan, selected the Faculty of Nutrition Sciences, NWFP Agricultural University, Peshawar to develop food composition tables for Pakistan on the pattern of USDA/FAO Food Composition tables. I worked as Principal Investigator for the task.

### ***Need***

1. In any assessment of the nutritional status of the population, one of the prerequisites for an effective survey is reliable data on food consumption and nutrient intake of the food consumed. The need for such data for Pakistan has been emphasized repeatedly by the Nutrition Section of the Planning Division, government of Pakistan.
2. Recommended dietary allowances for various ages, sexes and groups of Pakistanis were established in 1980. These allowances are only meaningful when information on nutrient content of the diet is known.
3. The food composition data would help in planning a balanced diet for an individual or a group of the population e.g. preschool and school children and pregnant and lactating women.
4. It would also help provide nutritional knowledge of local, regional and national food and diet.

### ***Objectives***

1. To collect and compile all available data on food composition in Pakistan.

2. To arrange for filling the gaps through new data production.
3. To survey the food produced, available and consumed in the whole country.
4. To analyse these foods for nutrient content, proximate composition and a few vitamins and minerals; some foods would also be analysed for amino acid composition.
5. To present the results in a tabular form in the manual to be named Food Composition Tables for Pakistan.

### ***Methodology***

1. From literature review and personal contact with researchers and labs in various universities in the country, available data on food composition was obtained which was found to be quite limited.
2. The variation of results obtained at different laboratories was checked.
3. Most food items produced and consumed in the country were collected.
4. 210 samples of food were analysed for their proximate composition, 3 minerals (Ca, P, Fe) and 5 vitamins (B1, B2, Niacin, B-Carotene and vit. C), while 87 samples were analysed for their amino acid content.
5. The proximate composition of food samples were determined by A. O. A. C methods. The protein values were calculated from kjeldhal nitrogen values using the conversion factors for different foods.
6. Food energy values were determined by an adiabatic bomb calorimeter, while mineral elements and vitamins were determined by calorimetric, flourimetric and chemical methods.
7. All amino acids except tryptophan were determined by an amino acid analyser while tryptophan was analysed by enzymatic method.

## ***Compilation of Data***

The analysed food items were classified as follows:

1. 1 Cereal and Cereal products, 2 Legumes, 3 Vegetables, 4 Roots and tubers, 5 Condiments, 6 Fruits, 7 Nuts and dry fruits, 8 Dairy products, 9 Meat and meat products, 10 Fish, 11 Eggs, 12 Fat and oil, 13 Sugar and sweets.
2. Proximate principles were expressed in grams while Ca, P, Fe, B<sub>1</sub>, B<sub>2</sub>, Niacin and vit. C were expressed in mg/100 g. The B carotene content were shown as mcg/100 g of edible portion of food. Food energy values were expressed in terms of K.Cal/100 g of edible portion, while amino acid content was expressed as mg/g of nitrogen.
3. Food items were listed alphabetically in English with Urdu and Scientific names. The food composition data was arranged in a tabular form as Food Composition Tables for Pakistan.

## ***Publication***

The food composition table for Pakistan was first published in 1985 and because of the increase demand it was reprinted in 1990.

## ***Users of Food Composition Tables for Pakistan***

We have identified the following users of Food Composition tables for Pakistan :

1. Research scientists at the research institutes in Pakistan.
2. Dietetics and community medicine departments of medical colleges and teaching hospitals.
3. Food and Nutrition Departments in Agricultural Universities and Home Economic colleges.
4. Health, Nutrition, and Agriculture experts in the Planning and Development division, government of Pakistan.
5. Food industries.

6. Individuals concerned with their diet.

### ***Constraints***

1. Obtaining representative samples of food items from all over Pakistan.
2. Manpower, expertise, sophisticated instruments like kjeltec, fibertec, HPLC, atomic absorption Spectrophotometer and Freeze dryer, which are now available to us, were not available in 1985.
3. Development of food composition data is not a government priority, so little funds are available for generating food composition data. Therefore we have not so far updated the present food composition table for Pakistan.

### ***Plan for Future***

1. We are interested in checking all previous analytical results with the latest equipment.
2. Analyse local diets, consumed in all the four provinces, Northern areas and Azad Jammu & Kashmir.
3. Include more food items for additional mineral and vitamin content.
4. Analyse important food items for fatty acid composition, cholesterol, dietary fibre and vitamin A content.
5. Analyse additional foods for amino acid content.
6. Revise and update the food composition tables for Pakistan.
7. To establish links with SAARCFOODS and INFOODS.

## *Recommendations*

### *Country level*

1. Identify a central lab in each country where analyses of food items produced and consumed are carried out on regular basis. This lab should collaborate with other labs in the country.
2. Equip the central lab with advanced instruments like Atomic absorption spectrophotometer, amino acid analyser, HPLC, Freeze dryer, bomb calorimeter, and protein, fat and fibre analyser.
3. Obtain training of personnel in analytical and sampling methods, data coding and handling systems of identified materials.
4. The central lab should share information and get guidance from INFOOD and the recommendations of FAO/UNU.
5. Each country should have a national food composition committee concerned with food analysis and food composition data with head of the central lab as convener of the committee.

### *Regional level*

1. A regional coordinating secretariat should be established in a region. The organizer of the first workshop on food composition data systems should be appointed as Regional Coordinator.
2. The central lab of each country of a region, be designated as National Food composition center, which will collaborate with the regional center.
3. An executive committee be constituted with a representative from each country of the region, which shall be chaired by the representative of the host country. The committee should hold a meeting once every two years.
4. The Executive committee shall coordinate work on collection, compilation, evaluation and dissemination of the food composition data, and establish linkages with INFOOD and UNU.

# ESTABLISHING FOOD COMPOSITION DATA OF IRAN

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## ***Introduction***

Iran has long experience in establishing food composition data. Several reports have been published concerning determination of nutrients in local foods. One of these important reports is the National Food Composition Tables. This national report has broad applications in the country such as:

- Determination of the nutritional status and food and nutritional planning at national level.
- Food planning for families and institutional food services such as educational centers, hospitals and armed forces.
- Health and agricultural planning in the country.
- Food industries and marketing.

The work was published in two languages, Farsi and English. Unfortunately in Iran, the nutrients for cooked dishes were computed from tables of foreign countries or Iranian raw food composition tables. Therefore, the figures obtained were not relevant. Recently, a research project on composition of Iranian cooked dishes was established. The work will be published in both Farsi and English.

## ***Activities of Establishing Food Composition Data***

The data of food composition are based on direct standard methods and divided into four categories:

- 1- Composition data on raw foods.
- 2- Composition data on rural foods.
- 3- Composition data on cooked foods.

4- Composition data on traditional food and fermented foods.

### ***Composition Data on Raw Foods***

This section was divided into the following:

- 1- Cereal and grain products.
- 2- Sugar and sugar products.
- 3- Fruits.
- 4- Vegetables.
- 5- Pulses.
- 6- Nuts and dried fruits.
- 7- Meats and egg.
- 8- Milk and milk products.

### ***Preparing the Sample***

The food stuffs were purchased from the market and were transported to the laboratory. The edible portions were used in accordance to customary method. Then the sample, was weighed and homogenized.

### ***Moisture***

The moisture content represents the amount of free water and volatile substances that are lost in drying process under specified conditions of analysis. It was determined using different methods according to nature of samples. For example for cereals, air oven-drying at 130°C for one hour was used and for sugar products, vacuum drying at 70°C to constant weight was used.

### ***Protein***

Since the nitrogen content of different proteins is approximately 16%, the protein conversion factor used is 6.25. This value has been used in converting nitrogen to protein expect for some foods. Nitrogen was determined by macro Kjeldahl technique.

### ***Fat***

This includes true fats and various petroleum ether soluble substances such as fatty acids, lecithin and plant pigments. Oven dried material was extracted in Soxhlet apparatus using petroleum-ether (B. P. 40 – 60°C). Other techniques such as the Greber, acid hydrolysis (Werner – Schmid method), or alkali hydrolysis (Rose – Gottlieb method) were also used.

### *Fibre*

The crude fibre content is an index of the amount of indigestible matter, or roughage in a food stuff. It is made of cellulose, lignin, pentosans and a little nitrogenous matter. The crude fibre content is obtained by digesting the defatted sample with boiling dilute acid to hydrolyze the carbohydrates and proteins in the sample, then digesting with boiling dilute alkali to saponify any fatty materials under standardized conditions, during which most minerals are dissolved by the two digestions. The residue consisting mainly of fibre and a little mineral matter is filtered, dried and weighed, then it is ignited and reweighed. The difference in the two weights represents the weight of the crude fibre present in the sample.

### *Ash and Minerals*

As refers to title mineral residue after ignition of the sample at 550°C from which followed by appropriate dilution and determination of calcium by a volumetric methods and iron by colorimetric method in using O-phenanthroline as reagent. Sodium and potassium were determined using Flame Photometer and phosphorus by standard ammonium molybdate, using volumetric method.

### *Vitamins*

Vitamins A of plant foods was computed from the amount of beta carotene (Column Chromatography method) on the basis that 0.6 mcg. One beta carotene is equivalent to 1 I.U. of vitamin A. The value for retinol was obtained by multiplying I.U. vitamin A by the factor 0.3, since one I.U. is equivalent to 0.3 mcg retinol.

Vitamins B<sub>1</sub>, B<sub>2</sub> and PP were determined according to Hoffman La Roche method. Thiamin was estimated by thiochrome procedure and Riboflavin by transformation to lumiflavin. Niacin was determined photometrically using procaine method. Vitamin C was determined by dichlorophenol indophenol. For sample containing larger amount of sugar, thin layer chromatography method was used.

### *Energy*

The food energy values were calculated according to the method developed by Atwater in which quantities of protein, fat and carbohydrates were respectively multiplied by the factor 4,9 and 4.

## ***Carbohydrates***

Carbohydrates were calculated by difference between the sum of the other major ingredients namely moisture, protein, fat, fibre and ash.

## ***Rural Food Composition Data***

The raw and processed foods were obtained from households in rural areas in 24 provinces of Iran and were sent to laboratory for analysis. The name of rural villages were taken from the Census Data Centre of Iran and a systematic random sampling method was used. Detail information on method of preparation were recorded.

## ***Cooked Food Composition Data***

This part consists of cooked dishes. A survey to obtain the most common dishes, method of preparation and ingredients was carried out in households and restaurants.

Serving portion may be the portion commonly available in the restaurant or an estimated amount of dishes that may be consumed in one meal. Because of the wide variation in sizes and shapes of dishes, the measures reported were approximate.

## ***Traditional Food and Traditional Fermented Food Composition Data***

Recent studies have shown that the traditional foods and fermented traditional foods can improve the nutritional status of many families and even reduce the deficiencies of vitamins and protein. Data on traditional foods were obtained from a national survey. Community health workers in which were the rural and urban health centres were trained to interview housewives selected at random, under supervision of local nutritionists.

The amount and percentages of ingredients in each food as well as the physical characteristics were determined. After weighing each food, it was homogenized by a mixer and stored in a refrigerator at -20°C.

## ***Compiling and Presentation of Data***

About 590 food stuffs were analyzed and divided into 4 categories as follows:

- Raw Food Composition Data	240 foods
- Rural Food Composition Data	230 foods
- Cooked Food Composition Data	64 foods
- Traditional Food & Traditional Fermented Food Data	56 foods

## ***Future Activities***

- Review the composition of raw foods and include more foods.
- Include more information on processed foods such as canned vegetables and fruits.
- Include more data on cooked foods, particularly food consumed in different geographical areas.
- Include data on composition of traditional foods in provinces that not included in the survey such as Sistan, Baluchestan, Hormozgan and other provinces.
- Use of computer programme for computing the composition of foods.

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# ACTIVITIES TO ESTABLISH FOOD COMPOSITION DATA IN CYPRUS

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## ***Introduction***

There was a lack of Food Composition tables especially of Foodstuffs produced traditionally and locally in Cyprus. After a preliminary work done on food composition of various foodstuffs at the State General Laboratory it was decided to expand the work to include calorific values, proximates, fatty acids, cholesterol amino acids, vitamins and trace elements of some food locally consumed in Cyprus.

The first edition of the preliminary food composition tables was released in 1994. This edition includes dairy, meat, cereals and fish products, which have been analysed for moisture, fat, protein, ash, total dietary fiber, carbohydrates, sugars, sucrose, glucose, fructose, maltose, fatty acid profile, saturates, mono-saturates, poly saturates, O-fatty acids, cholesterol, sodium, potassium, phosphorous, vitamin C and amino acids.

## ***Activities of establishing food composition data***

### ***Sources of food composition data***

The main source of food composition data is the direct method of compiling tables. All the values are the results of analysis carried out at our Laboratory of State Laboratory.

### ***Sampling of Food***

Sampling was focused on specific foods or groups of foods, especially of locally produced foods. The samples were selected by the health inspectors of the Ministry of Health and are representative of origin of production. As Cyprus is a small island there is a limited amount of sources of food production so it is relatively easy to have a representative sampling.

### ***Priorities of Selection of Food***

The decision on the priority of food groups for inclusion in Food Composition Data was related to public health problems such as heart diseases and cancer.

For dairy products we analysed proximates, cholesterol content, fatty acids, phosphorous, potassium and sodium. For cereals and cereal products we analysed proximates, and dietary fibre. For meat and meat products we analysed proximates, cholesterol, fatty acids, sodium, potassium. For fish proximates, fatty acids including  $\Omega_3$  and  $\Omega_6$ . For eggs we analysed proximates, cholesterol, vitamin E and  $\Omega_3$ ,  $\Omega_6$  fatty acids.

### ***Methods of analysis***

For the determination of the previously mentioned parameters official validated methods have been used.

### ***Quality Assurance***

To ensure the reliability of analytical results we proceed to the implementation of Quality Assurance Programme. For Intralaboratory studies we have standard Operating Procedures (SOP) and use spiked and Control samples as well as Standard Reference Materials.

The Interlaboratory Quality Assurance programmes we participated in with successful results, are collaborative studies for the following parameters: Moisture, fat, protein, ash, chloride, calcium, zinc, sodium, potassium and fatty acids, saturates, mono-unsaturates, poly-unsaturates, fatty acids profile.

### ***Format, modes of expression, nomenclature of foods***

The format, the mode of expression and nomenclature of foods were given in the 2<sup>nd</sup> preliminary edition of food composition tables.

### ***Conclusion***

The main difficulties that we face as an analytical laboratory is the lack of personnel. Many analytical data for the food products produced in

Cyprus differ from the analytical data of respective food products from other countries due to the different ingredients, or the method of preparation.

### ***Future activities***

Expand the existing tables with other foods which are not included and proceed to vitamins A (retinol), B<sub>2</sub>, B<sub>6</sub> and D and Se.

***Examined Food and determined Parameters in 1<sup>st</sup> Edition***

<b>Food Category</b>	<b>Products</b>	<b>Parameters</b>
Dairy Product	Halloumi Fresh Anari Dry Anari Fetta	Moisture, Fat, Proteins, Ash, Carbohydrates, Sodium Chloride, Cholesterol, Saturates, Monounsaturates, Calorific value
Meat Products	Frankfurters Sausages	Moisture, Fat, Proteins, Ash, Carbohydrates, Sodium Chloride, Saturates, Monounsaturates, Polyunsaturates, Phosphorous, Potassium, Sodium, Calorific value
Cereals, Products and Pastries	Diet Spaghetti Diet Rusks Trahanas Pourgouri Olive pie Cheese pie	Moisture, Fat, Protein, Ash, Total Dietary, Fibre, Calorific value
Fish	Different kinds of fish of the Cyprus sea area e.g. Scorpaena Scrofa Epinephelus Guaza Sparus Auratus Pagrus-pagrus	Moisture, Fat, Protein, Ash, W. Fatty Acids, Calorific value.

*Second Edition of the Preliminary Food Composition Tables*

<b>Food Category</b>	<b>Products</b>	<b>Parameters</b>
Dairy Products	Halloumi	Moisture, Fat, Proteins,
	Halloumi Slim*	Ash, Carbohydrates,
	Halloumi Light*	Sodium Chloride,
	Fresh Anari	Cholesterol, Saturates,
	Dry Anari	Monounsaturates,
	Fetta	Sodium Potassium,
	Flaouna Cheese*	Phosphorus**
	Cows Yogurt*	Calorific value
	Cows Yogurt Strained*	
	<b>Cows Skim. Yogurt Strain*</b>	
	Sheep & Goats Yogurt*	
	Cows Butter*	
	Butter Ghee*	
	Sunflower Margarine* (with added milk fat or animal fat)	
Meat products	Salami	Moisture, Fat, Proteins,
	Smoked Ham	Ash, Carbohydrates,
	Smoked Sausage (tradit.)	Sodium Chloride,
	Frankfurt. Type	Cholesterol**,
	Sausages	Saturates,
	Smoked Lountza	Monounsaturates,
	Mourtatella, Eggs	Polyunsaturates, Sodium Potassium, Calorific Value
Cereals, Products, Pastries and Fruits	Diet Spaghetti	Moisture, Fat, Protein,
	Diet Rusks	Ash, Total Dietary,
	Trahanas	Fibre, Vitamin C**,
	Pourgouri	Trace Elements**,
	Olive Pie	Calorific value
	Cheese Pie	
Fish	Prickly Pear*	
	Scorpaena Scrofa	Moisture, Fat, Protein,
	Epinephelus Guaza	Ash, W. Fatty Acids,
	Sparus Auratus	Calorific value
	Pagrus-Pagrus	
	Trigla Spt*	
Onchrorhynchus Mykiss		

\* New food in the 2<sup>nd</sup> edition.

\*\* New parameter in the 2<sup>nd</sup> edition.

## **RECOMMENDATIONS**

### ***Group 1: Recommendations for establishing food composition data for the Arab Gulf (GULFOODS)***

#### ***A. Proposal for Drafting Food Composition Tables for use in the Arab Gulf Countries***

##### ***A. 1. Title***

Food Composition Tables for Use in the Arab Gulf Countries

##### ***A.2. Introduction***

The introduction should include the following information:

###### ***A.2.1. Objectives and Justification***

- A.2.2. Source of data:***
- Unpublished reports
  - Published books and articles
  - Direct chemical analysis
  - Others (e.g. computer programme)

###### ***A.2.3. Sampling and methods of Analysis***

- General
- By each country
- By kind of foods e.g.
  - Composite dishes
  - Ready-to-eat foods
  - Raw foods
  - Other foods

###### ***A.2.4. Nutrients included (Minimum)***

###### **General**

- Proximate composition (water, protein, fat, ash, crude fiber, CHO and Energy)
- Minerals (Ca, P, Fe)
- Vitamins (Retinol, B<sub>1</sub>, B<sub>2</sub>,Niacin, Vit C)

###### **For Composite dishes**

- Depends on data available

### ***A.3. Presentation of Data***

- A.3.1. Data should be presented in two languages; English and the local language (in case of the Arab Gulf countries – the language should be Arabic)
- A.3.2. For the general information two tables will be used the first for proximate composition and the second for minerals and vitamins) – see appendices 1 &2.
- A.3.3. The source of information will be shown for each food item.
- A.3.4. The data will be presented under the following sections:

#### ***Section one: Composition of Foods***

- Cereal and cereal products
- Bread and bread products
- Fruits
- Vegetables
- Nuts and seeds
- Milk & dairy products
- Legumes
- Meat and poultry products
- Fish and sea products
- Fats and oil
- Herbs
- Spices and condiments
- Beverage
- Miscellaneous

#### ***Section two: Composite dishes (Local names & common names)***

- Bahrain
- Kuwait
- Qatar
- S. Arabia
- Oman
- U.A.E.

**Section three: Ready-to-eat foods (should be defined clearly)**

- Bahrain
- Kuwait
- Qatar
- S. Arabia
- Oman
- U.A.E.

**Section Four: Fast foods**

***Appendices:***

Appendix 1: Cholesterol and fatty acid composition of foods and dishes.

Appendix 2: Amino acid composition of foods and dishes.

Appendix 3: Index of scientific names of foods.

Appendix 4: Recipes (methods and ingredients by country).

***B. Suggested centers for the Gulf:***

- B.1. Food and Nutrition Department / King Saud University – S. Arabia.
- B.2. Food and Environmental Laboratory – Dubai Municipality – U.A.E.
- B.3. Central Laboratories – Ministry of Health – Doha – Qatar.
- B.4. Food Biotechnology Department – Kuwait Institute for Scientific Research – Kuwait.

***C. Executive Committee for the GULFOODS***

It was agreed on the following names as members of Executive Committee for the GULFOODS:

- C.1. Dr. A. O. Musaiger, Bahrain Centre for Studies and Research, Bahrain (Coordinator, GULFOODS).
- C.2. Dr. M. Al-Kanhal, King Saud University, S. Arabia.
- C.3. Dr. M. Ali, Food and Environmental Laboratory, Dubai, United Arab Emirates.
- C.4. Mr. J. Al-Jedah, Central Laboratories, Ministry of Health, Qatar.
- C.5. Ms. B. Dashti, Biotechnology Department, Kuwait Institute for Scientific Research, Kuwait.

## D. Drafting the Food Composition Tables for the Gulf

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<i>Activities</i>	<i>Action By</i>	<i>Starting Date</i>
Reviewing the Proposal of GULFOODS Tables	GULFOODS Secretariat and Members	June 1998
Preparing First Draft of GULFOODS Tables	GULFOODS Secretariat	Nov-Dec. 1998
Reviewing the First Draft	GULFOODS Members (meeting in Bahrain)	Jan-Feb. 1999
Publishing the First Edition of GULFOODS Tables	GULFOODS Secretariat	March-April 1999
Establishing Computer Programme for GULFOODS	GULFOODS Secretariat	May-Sept. 1999
Reviewing the Computer Programme for the GULFOODS	GULFOODS Secretariat (meeting in Bahrain)	Oct. 1999
Producing the Programme	GULFOODS Secretariat	Nov- Dec. 1999

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## ***Group 2: Actions Needed to Establish Food Composition Data in the Near East***

### ***A. National Centers and Resource People***

- Sudan:*** Faculty of Agriculture, University of Khartoum.  
***Prof. Abdul Ghadir Hassan Khattab***
- Jordan:*** Department of Food and Nutrition, University of Jordan  
***Prof. H. Takruri***
- Lebanon:*** Department of Food Technology and Nutrition,  
American University of Beirut  
***Prof. N. Baba***
- Pakistan:*** Department of Agriculture and Chemistry  
***Prof. T. Hussain: for N. E. Liaison***
- Cyprus:*** State General Laboratory, MOH-Food Composition  
Section  
***Dr. N. Argyrides***
- Iran:*** National Nutrition Food Technology Research Institute,  
Shaheed Beheshti University, Tehran  
***Prof. M. Azar***

\* For other countries in the region not presented (Egypt and Turkey) centres and resource people are to be identified.

### ***B. Sampling of Foods***

- Protocol to be decided by each country depending on resources.
- All relevant documentation should be provided.

### ***C. Standardization Method for Recipes***

- Each country to survey commonly consumed foods, include common recipes. It is important to share the methodology of survey.
- Priorities for foods need to be decided nationally (raw vs. cooked), by national steering committee.

#### ***D. Methods of Analysis***

- Documentation of method is necessary.
- Share of experience in method of analysis among countries.
- Identify centres of excellence and have analysis done there or for checking the results.
- Improve the equipment in the food analysis by seeking funds from various resources.

#### ***E. Terminology and Names of Foods***

- Scientific, local and English names should be used.
- Determination of classification should be decided at later stage.

#### ***F. Quality Assurance of Analysis Method***

- Centre laboratory collaborative studies are necessary, within countries and the region.
- Co-ordination with GULFOODS project is necessary.

#### ***Other Recommendations***

1. Co-ordinator in each country should seek funds from public and private sectors to promote the activities to establish food composition data.
2. More emphasis should be put on analysis of traditional foods in each country.
3. Food contaminants and additives should not be included in the food composition tables.
4. Establishing a newsletter for GULFOODS and to be released by GULFOODS Secretariat at the Bahrain Centre for Studies and Research. Countries other than Arab Gulf countries agreed to participate in this Newsletter.

5. It is important to establish a co-ordination office for other Middle East countries such as Lebanon, Egypt, Jordan, Syria and Palestine.

## Appendix (1)

### LIST OF PARTICIPANTS

#### WORKSHOP ON FOOD COMPOSITION IN THE NEAR EAST

BAHRAIN, 14 – 16 JUNE, 1998

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## Appendix (2)

### WORKSHOP ON ESTABLISHING FOOD COMPOSITION DATA FOR THE NEAR EAST REGION

#### PROGRAMME

Manama, Bahrain, 14-16 June, 1998

#### Sunday, June 14, 1998

8:00 – 9:00      **Registration**

9:00 – 9:30      **Opening**

9:30 – 10:00     Coffee Break

#### **First Session (10:00 – 12:00): Background Papers** **Chairman: H. Dirar (University of Khartoum/Sudan)**

10:00 – 10:30     Objectives and Needs for Food Composition Data  
**V. Menza (FAO/RNE, Cairo)**

10:30 – 11:00     Food Composition Activities in the Near East Region  
**S. Miladi (FAO/RNE, Cairo)**

11:00 – 11:30     GULFOODS Activities  
**A. Musaiger (BCSR/Bahrain)**

11:30 – 12:00     INFOODS Network Activities  
**B. Burlingame (INFOODS/New Zealand)**

12:00 – 12:15     Coffee Break

#### **Second Session (12:15 – 14:15): Technical Papers** **Chairman: N. Baba (AUB/Lebanon)**

12:15 – 12:45     The Important of Micronutrients in Food Composition Data  
**K. Nagy (F. Hoffman – La Roche/Switzerland)**

- 12:45 – 13:15 Setting Priorities for Selection of Food Items and Nutrients  
**Ivy Barclay (SAC/Scotland)**
- 13:15 – 13:45 Standardization of Recipes for Food Composition Data  
**A. Musaiger (BCSR/Bahrain)**
- 13:45 – 14:15 Computer Programmes for Food Composition Data  
**A. Burlingame (INFOODS/New Zealand)**
- 14:15 – 17:00 Lunch Break
- 17:00 – 20:00 Social Programme

**Monday, June 15, 1998**

**Third Session (8:30 – 10:30): Establishing Food Composition  
Data in the Arab Gulf Countries**

**Chairman: T. Hussain (NWFP Agr. Univ./Pakistan)**

- 8:30 – 9:00 ***Bahrain***  
*A. Musaiger (BCSR/Bahrain)*
- 9:00 – 9:30 ***Kuwait***  
*B. Dashti (KISR/Kuwait)*
- 9:30 – 10:00 ***S. Arabia***  
*M. Al-Kanhal (KSU/S. Arabia)*
- 10:00 - 10:30 ***Qatar***  
*J. Al-Jedah (MOH/Qatar)*
- 10:30 – 11:00 ***U.A.E. (Dubai)***  
*M. Ahmed (Food & Environmental Laboratory/UAE)*
- 11:00 – 11:15 ***Coffee Break***

**Fourth Session (11:15 – 14:15): Establishing Food Composition Data in the  
Near East Countries**

**Chairman: M. Al-Kanhal (KSU/S. Arabia)**

- 11:15 – 11:45 ***Lebanon***  
*N. Baba (AUB/Lebanon)*

11:45 – 12:15	<b>Jordan</b> <i>H. Takruri (Jordan University/Jordan)</i>
12:15 – 12:45	<b>Iran</b> <i>M. Azar (NNFIRI/Iran)</i>
12:45 – 13:15	<b>Cyprus</b> <i>R. Argyrides (State General Laboratory/Cyprus)</i>
13:15 – 13:45	<b>Pakistan</b> <i>T. Hussain (NWFP Agr. Univ./Pakistan)</i>
13:45 – 14:15	<b>Sudan</b> <i>H. Dirar (University of Khartoum/Sudan)</i>
14:15 – 17:00	<b>Lunch Break</b>
17:00 – 20:00	<b>Social Programme</b>

**Tuesday, June 16, 1998**

**Fifth Session (8:00 – 11:00): Working Groups**

**Chairman: A. Musaiger (BCSR/Bahrain)**

**Group A:** Reviewing the proposal for establishing food composition tables for the Arab Gulf.

**Group B:** Activities and mechanism for establishing food composition data in the Near East.

**Sixth Session (11:00 – 12:00): Conclusion and Recommendations**

**Chairman: S. Miladi (FAO/RNE, Cairo)**

- Presentation of the Reports of Working Groups.
- Conclusions and Recommendations.

