Establishing Food-Based Dietary Guidelines

(with special emphasis on the Near East Region)

Edited by

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Preface

A great interest has been emphasized on the importance of establishing food-based dietary guidelines for promotion of healthy nutrition. However most of the Near East countries have not established any form of food-based dietary guidelines. For this reason the Food and Agriculture Organization in collaboration with International Life Sciences Institute and the Arab Nutrition Society organized the workshop on Establishing Food-Based Dietary Guidelines in Amman, Jordan, during 17 – 20 November, 1998. Various background papers, as well as a case study from Thailand were presented in this workshop.

This publication include most of the papers presented in this workshop, in addition to other technical papers which were written by experts in physical activity and nutrition. It is hope that this document will provide baseline data for concern institutes in the Near East region to establish food-based dietary guidelines.

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FOOD CONSUMPTION PATTERNS IN THE NEAR EAST REGION: PAST AND PRESENT

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Introduction

In this paper the Near East countries are the Arab countries and Cyprus, Malta, Turkey, Iran, Pakistan and Afghanistan. These countries which lie astride the lines of communication with Europe, Africa and East Asia have been subjected to influence, in terms of the dietary patterns, from the West as well as East. The Mediterranean dietary habits are, however, predominant in most of these countries.

The total land area of Near East region is 16.5 million km^2 out of which 75% is desert and about 20% pastures and forests. The remaining 5% is under permanent crops. It should be noted that only 20% of this arable land is irrigated and 80% relies on rainfall. The fluctuation and uneven distribution of rainfall affects food production, and in turn the diet and health, especially of the rural population.

Thus, the two constraints affecting the expansion of food production in the region are lack of arable land and of water resources. In addition, some countries of the region such as Somalia, Sudan and Mauritania, are affected (from time to time) by severe droughts, while certain geographic areas in Tunisia, Morocco and Jordan etc., may also suffer occasionally from droughts, which lead to acute food shortages.

The total population of the Near East region 1997-1998 was 570 million with an annual average growth rate of 2.9%, which is considered to be among the highest growth rates in the world. This means that the population of the region will double with the next 27 years, whereas the population of Europe, in contrast, is expected to double in about 235 years. Consequently, food production and consumption are being affected by high population pressures on limited arable land. This problem is aggravated by a high increase in urbanization, which ranges from 4 to 6% per year. As a result, more and more food producers are becoming food consumers, and the expansion of the cities is mostly at the expense of the limited agricultural land. Moreover, during the last three decades, the region

has experienced massive population movements both within as well as from outside the region. These changes were coupled with large food imports to meet the increasing demands. This contributes to the new dietary patterns and their implication on health.

History of Dietary Patterns and Human Evolution in the Near East

In ancient times great civilizations flourished along the valley of the two great river systems, Euphrates and Tigris in the East, and the Nile in the West.

The first man who inhabited this region might be traced to 20,000 years B.C. The sources of the diet in this early stage were leaves, fruits, berries, roots and nuts, insects and eggs which the first man used to collect from the natural environment. Later he was able to exploit and breed sheep and goats and started his nomadic life in North Africa. He was also able to hunt animals to make use of their skin and flesh.

In the years 8000-9000 B.C. he discovered food grains, especially wheat in Egypt and barley in Iraq and started to settle and practice agriculture. Since food grains were preserved, his food needs were covered all year round. Therefore, he felt more food secure and learnt how to make bread. Through the years, he developed agricultural practices and tools such as the hoe, hydromel and plough, which paved the way for him to increase his food production.

During the same period, he discovered different techniques for food preservation, such as drying, pickling and fermentation. The history of food production and human evolution in the Near East are shown in Table 1.

The ancient civilization was determined by the progress that mankind accomplished in food production and in the discovery of writing and reading (Egypt and Iraq).

Looking at the pharaonic civilization which started 10,000 years B.C., the status and sculptures of ancient Egyptians represented males and females who were not under weight (slim) or over weight (obese). The abundance of a wide variety of foodstuffs, of plants as well as animals, in relation to the relatively small number of people, prove that nutritional disorders were unknown. The diet consisted of cereals, wheat and barley, legumes, especially broad beans, lentils and

chickpeas, while olives and sesame were consumed in the ancient diet. Fruits, especially grapes, dates, etc., were dried or used for fermentation. Breast feeding for 2 years and exposure of young children to sunlight were well known to ancient Egyptians and widely practised.

The Near East region was well known by the inland and sea trade. Caravans from the Arabian Peninsula to the North of Syria, Palestine and South of Yemen were known. Through the trade, newly discovered foods were spread all over the region. Similarly, the wars between countries played an important role in exchanging food and dietary habits.

During the Pharaonic time, life expectancy, was between 70 and 80 years or more. This proved that they had a good knowledge of food, medicine and healthy lifestyles. The diet of the builders of pyramids and temples mainly consisted of wheat, broad beans and vegetable oils, onions and green leaves. This diet was not only used to provide energy but it took a long time to be digested, so the labourers did not feel hungry after a short time. The two biggest enemies of the Near East population in these old times were famine and plague, which killed large numbers of people. Very limited knowledge was reported on malnutrition among the farmers or the pastured communities during this period.

Over the years Persians, Greeks, Romans and Mongols invaded the region. Farmers had to pay heavy taxes and were obliged sometimes to leave the land. This was the period when undernutrition became widely spread in the region.

On the other hand, all the prophets of mankind were in this region. The three known religions: Judsim, Christainity and Islam were born in the Near East. As the Old and New Testaments and the Qoran included basic information on food and nutrition for the well-being of mankind, the people of this region were aware of proper dietary habits and healthy lifestyles.

However, the diet deteriorated at the time of wars, invasions and famines. It is only 400 years ago when the Othmanic empire dominated the region, and introduced 2 classes of population, the nobles, (Pacha) and the mass of the poor.

In modern history, the food dietary guidelines were only introduced in the US 100 years ago, after and during discovery of different nutrients

and their health roles. Health problems related to nutrition deficiencies in specific periods such as in 1916, or 1930 or in 1985 were used as determinants of the food groups. It should be mentioned that the food guide which was used in the thirties in the US is not valid for the present needs any more.

Dietary patterns are important elements of the history and culture of society at all times and in all locations. Proper dietary patterns are necessary for a healthy and productive population and they are an integrated part of its development and the civilization of nations.

Change in the Dietary Patterns of the Near East Countries

There are vast differences in socio-economic, ecological and cultural conditions in the countries of the Near East. This region includes the poorest countries (Somalia, Afghanistan, Sudan) and the richest countries (United Arab Emirates, Qatar) in the World; the overpopulated (Pakistan) and the least populated (Qatar, Malta) and those countries of highest illiteracy rates (Afghanistan, Mauritania) and of the lowest rates (Cyprus, Tunisia). These factors, along with the differences of government policies and Programmemes, significantly affect dietary patterns, nutrition and the health of the population.

In addition to the above, food carries special social and cultural meanings in various communities and also carries psychological significance well beyond consideration of nutritional value or the physiological needs of the population of the Near East.

Economic, environmental, social and cultural, food industries, advertisements and disasters, are all factors which affect the dietary patterns of the population in the Region. In addition, nutritional problems of public health importance and associated with dietary patterns due to the changes in the lifestyles, sedentary life and smoking, etc. They all contribut to the increased prevalence of non-communicable diseases.

It should be noted that food consumption patterns in a given society are a function of food prices and consumers' income. Dietary patterns change as income grows or declines. In fact, there is a positive relation between GNP/capita and food energy derived from animal sources, fats and sugar. However, the low-income groups tend to be conservative in their food choices and often resist changes,

while high-income groups show increased demand on selection of the food varieties, and prefer convenience foods and eating out.

In general, consumer income plays a fundamental role in determining food choices in the countries of the Near East Region. They are influenced by the degree of the economic development of the country, distribution of income, family size, cost of non-food items, employment policies and income-generating activities, as well as the geographic location of the consumer in rural or urban areas.

Another important factor is the amount of rainfall and its distribution which affects food production and, in turn food prices and farm income. These influence the diet and health status, especially among the rural and low income groups:

- Poor environmental sanitation and absence of a clean water supply, affect the health and population, in addition to food contamination and unhygienic practices.

- The excessive use of food additives and pesticides, and in the absence of an efficient food control system, food becomes a source of disease.

- The hot climate in certain countries prevents outdoor physical exercise.

It should be also noted that the level of education, family size, age of marriage, repeated pregnancy, employment of women and health and nutrition awareness are important determinants of the diet and health of community.

- The cultural factors including religion, beliefs and taboos and local traditions are also significant to the health of the child. For example, the spread of bottle-feeding replacing breast-feeding in many parts of the region affects the growth of children for lack of hygiene and proper feeding practices.

- The widespread adoption of street foods for low-income groups and of fast and convenience foods for high-income groups, affects the diet and health of these groups.

- New food habits have emerged in certain countries as a result of labour import.

- Lack of physical activity and nutrition awareness, especially among women has led to obesity, and consequently health related problems.

- The spread of the habit of smoking among a considerable portion of the societies also contributes to the deterioration of health.

- The stress of the new lifestyles specially in urban society has an effect on the prevalence of non-communicable diseases.

- Certain drugs (medicines) encourage/discourage dietary intake and interfere with certain nutrients, especially for the elderly.

- The expansion of food industries and advertisements for certain foods, plays a vital role in changing the dietary patterns in several countries of the Near East. This is exemplified in the widespread consumption of soft drinks and empty calorie foods, as well as dense calorie foods.

- The canning and freezing industries make it possible for the consumer to have access to several food choices all the year round. Similarly the development of the dairy industries has also contributed to increased consumption of dairy products for certain income groups.

- The food industries influence consumption patterns by improving food appearance such as colour, texture, odour and flavour and accordingly the taste. It is noticed that more urban as well as rural consumers are becoming users of processed foods such as biscuits, sweets, soft drinks, snack foods, ice-cream, cakes, pies, etc.

- Food advertisements sometimes concentrate on selling one particular product and prompting negative dietary habits towards another product, such as the replacement of milk by carbonated beverages. On other occasions false claims are introduced in the absence of adequate food control and active Consumer Protection Societies, which mislead the consumer. Food advertisements concentrate on children and adolescents who easily adapt to new food habits.

- On the other hand, certain food industries are also contributing to the improvement of the diet and promote positive dietary habits.

- Some countries of the Near East region face both man-made disasters, especially wars and international conflicts, such as in Iraq, Sudan, Somalia and Afghanistan, and natural disasters such as droughts (Mauritania, Somalia) and floods in Sudan. These disasters have short and long-term implications on dietary patterns and health.

- Food aid has also contributed to the changes of dietary habits, for example in Sudan wheat, which was not previously consumed by the nomadic population, replaced sorghum. Sorghum used to be the traditional stable which was cultivated in the country.

The above mentioned factors which have influenced the Near East populations' dietary patterns have direct implications on the nutrition and health of these populations.

Table 1. History of Evolution of Human Dietary Patterns in the Near East Region

Period	Date	Discovery	Place	Dietary Patterns
Lower Paleolithic	800,000	Domestication of fire	Africa	Picking, fruits, roots, seeds, leaves, insect, eggs and birds.
Middle Paleolithic	-50,000	Practice of hunting and fishing	Africa	Special devices for hunting and fishing less dependent upon plant food and more animal food.
Upper Paleolithic	-21,000	Exploitation of sheep	Egypt, Iraq	Varieties of food (wheat, barley, bread, beans, lentil, chick peas, beer, wine).
	-11,000	Sheep breeding	Maghreb	Cereals (wheat, barley, sorghum) – Bread (sun, oven).
	-9,000	Goat domesticated	Iran	Grain legumes (broad beans, lentils, etc).
	-7,800	Wheat and barley cultivated Oven hot ston	Iran	Fat & Oils (olive oil, sesame, ghee, etc.).
	-7,000	Hoe invented		
	-6,000	Pressing olive oil	Near East	Fruits (grapes, dates, figs, etc.).
		Cherries and cherry wine, brewing beer	Near East	Milk and milk products.
			Turkey	Meat and fish.
Neolithic	-5,000	Large, agriculture community and Nomad	Near East	As above in addition to dried and fermented foods, dairy products (cheese-butter-ghee) honey, eggs, dried foods, salted food.
	-4,500	Viticulture and wine making	Egypt	Goose, duck meat and eggs.
		Dairies cheese and butter	Near East	
	-3,500	Merchant shipping	Mediterranean	
	-3,000	Breeding donkeys	Egypt	
		Hydromel	Egypt	
		Irrigation of cultures	Egypt	
		Horse-drawn plough	Egypt	
		Plough with metal blade	Near East	
	-2,500	Goose and duck domesticated	Egypt	
		Melon cultivated	Sudan	
	-1,200	Technique of frying	Egypt	
Christian era and Islam area invasion (Roman, Mongol, Mamlouk, etc)	10	Expansion of food production, processing and trade	Near East Region	Cereals, legumes, vegetables, fruits, meat, dairy products, meat, fish. Food shortage and famine in some countries, Egypt 1020 during certain period
Colonization, Turk, British, French	1500	Less food production, introduction of cash crops, maize (cotton, sugarcane, etc.)	Near East	Food deficiencies. Pellagra 1840 in Egypt, Syria, Lebanon, etc.
Liberalisation, Revolution, Urbanization and oil era (war, drought).	1950 up to date	Fresh, semi-processed, processed food, increase in food imports	Near East	New food habits, e.g. bottle feeding, street food, convenience food (PCM, micronutrient, obesity, etc.).

METHODOLOGIES FOR DIETARY ASSESSMENT AND ANALYSIS AT NATIONAL, HOUSEHOLD AND INDIVIDUAL LEVELS

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Detailed information about the foods actually eaten in the community is essential both for assessing nutritional status as well as for determining the dietary etiological factors that may be amenable to correction.

The value of Food Consumption Surveys

Food consumption surveys (F.C.S.) are the only source of measurements of variations in the consumption of all foods by source, season, consumer characteristics and different geographical areas. They provide the only basis for measuring the relationship among these variations in food consumption and patterns of nutrient supplies with demographic, socio-economic, cultural, environmental factors and morbidity patterns.

Such measurements are an important component of the database for national nutrition and health planning, public Programmeme administration and food marketing research. The measurement both of variations in food and nutrient consumption and how these relate to major determinants of health throw light on the nature and causation of nutrition problems in a community. Such knowledge is essential for realistic and effective Programmeme planning, administration and evaluation both at particular points in time and as changes occur over time. (Jelliffe, 1966; Jelliffe et al., 1989).

F.C.S. provide the only usable information on consumption of food from home production such as milk and its products, garden or field produce, family poultry and fish caught by family members or bartered. Few, if any, reporting systems for agricultural production measure these foods adequately. It is quite possible that more than half of the food consumed in some developing countries does not enter commercial channels. In Egypt, the Nutrition Institute (N.I.) has acquired considerable knowledge about this particular point in the different food consumption studies (Aly et al, 1981).

Food consumption surveys at both the household and individual levels provide the basis for estimating variations in nutrient supplies for comparison with standards or recommendations for nutrient intake (R.D.A.). Such comparisons are important elements in national nutrition education Programmemes, food-based dietary guidelines (FBDG) and public information Programmemes.

Constraints Limiting the Values of Food Consumption Surveys

Human Problems

In most developing countries, due to cultural constraints related to the privacy and intimacy of the food intake process, it is practically impossible to get reliable food consumption data from respondents unless the dietitian or interviewer has established friendly relations with them. This is stated repeatedly in the F.C.S. manuals and has been documented in one of the longitudinal studies conducted by the N.I. In this study, the rotation of dietitians every 3 months was used as one of the quality control methods. Such rotation, however, could not be applied due to the high rate of refusal, reaching at times 25%. Even those households which accepted the new dietitian did not always give the correct information, as was proven by a double study by 2 dietitians, new and old, on the same household on the same day. Special effort is needed to ensure that diet is typical and unmodified during the survey period, whether to show prosperity or to seek donations.

Technical Problems

Examples are:

- Estimation of waste and refuse.
- Alterations of foods both in weight and nutritive value as a result of cooking.
- Use of local domestic units of weight and volume and the need to transfer to standard units of weight such as grams and kilograms.
- Assessment of food eaten away from home.

- The nibbling process (ramraming) practiced by some communities in developing countries, particularly by women and preschoolers staying at home. In a study by N.I. in an Egyptian rural community, using the observation and weighing method, it was shown that food intake is a continuous process for preschoolers rather than regular meals; the majority of the sample ate every 1-2 hours (Moussa & Hegazy, 1988).

Statistical problems

Examples are:

- Combining scientific sampling with practical realities such as the lack of a local census.

- The inaccessibility or hostility of certain households, leading to a high drop out rate in some cases.

Measuring Food Available for Consumption at the National level (Food Balance Sheets)

The most widely used method of assessing the nationally available food supply (food which is available for consumption, but not necessarily consumed) is based on food balance sheets, (FBS). The data are presented on a per capita basis using population estimates, but supplies vary within the country as does or the extent to which individuals within populations vary in food intake. The data can be used to compare the available food supply between countries, and to monitor trends over time. The accuracy of the estimates of available food supplies varies among countries, and systematic errors may occur, which increase as the food system becomes more sophisticated; the limitations of the data should be clearly understood. Attempts to link trends in national food available for consumption data to trends in disease or mortality must be viewed with caution (Gibson, 1990).

FBS are defined as a national account of the annual production of food, changes in stocks, imports and exports, and distribution of food over various uses within the country (FAO, 1980). Once the net food supply has been calculated, it is usually converted to a daily per capita basis

using population estimates for that country. This is expressed in terms of grams per capita of individual food commodities, and energy and nutrient availability per capita.

Measurement of Food Consumption and Dietary Assessment

Food consumption assessment methods produced qualitative or quantitative information from food consumption surveys. The survey data collected at the national, household, or individual levels can be expressed in terms of nutrients and/or foods.

A dietary survey is generally concerned with both the economic consumption which means the value of food entering the home for human consumption, and with physiological consumption or food intake, which refers to the foods actually eaten by the family.

It must be emphasized that predicting health status from dietary data alone is not possible. A number of the existing health data bases appropriate monitoring system. From measures of the usual food intake of a population it is possible to assess the probability that individuals may or may not meet certain nutritional standards. The prevalence of individuals who may have intakes below an established standard (RDA) can be computed.

Assessment of nutritional status should include measurement of individual food intake. However, in developing countries, such as Egypt, this operation often requires measurement of household food intake due to a number of factors, mainly:

- Communal feeding of household members from the same dish.
- Complexity of recipes and great inter-household variability in proportions of ingredients in the same recipe.
- Unavailability of adequate Food Composition Tables (F.C.T) or nutrient data bases for complex dishes or cooked meals.

It is, therefore, advisable to combine both household food consumption measurement with individual food intake assessment in order to obtain a reasonably accurate estimate of individual food intake.

A. Methods Used for Measuring Household Food Consumption

Methods used in developed countries where the literacy rate is high cannot be used in developing countries where illiteracy is the dominant feature of housewives in low income groups. In general, there are four ways of collecting data on household food consumption (Reh, 1967; Hartog and Staveren, 1985; Gibson, 1990).

1. The Household Food-Record Method:

Weighing (or measuring in household units) of the food supplies for the day or the meal in advance is done during daily visits by field investigators or the householder. Foods not eaten by the household (HH) members may or may not be subtracted according to the objective of the study. It should be subtracted to compute HH food consumption at the physiological level, or HH food intake. Sometimes an arbitrary wastage factor of 10% of all edible portions of the foods consumed is applied. This factor is also used for the inventory and the food account methods.

2. The Inventory Method

Acquisitions and changes in food inventory of the household are recorded generally over a period of one week. At the beginning and end of this period an inventory of the household is recorded generally over a period of one week. At the beginning and end of this period an inventory is made of food in the house and all foods brought into the house by any route or used for other purposes than consumption by HH members.

3. The List Recall Method

The interviewer uses a list of major food items in a structured questionnaire to help the respondent recall amount and price or purchase value of all foods used in the HH in a specified period, usually seven days. Quantities may be estimated by weight or household (HH) measures. Food models are sometimes used as memory aids.

4. The Food-account Method

All food purchases and food brought into the HH from other sources during a seven-day period are recorded. This method assumes that there were no significant changes in HH food inventories.

In developed countries telephone surveys, particularly telephone interviews conducted online with a computer, were found to cost 40% - 50% of personal interviews.

In all HH food consumption methods demographic and socio economic information on HHs is collected, enabling data to be presented in terms of income level, family size, region of the country...etc.

Egypt's Experience (as an example of a developing country in the East Region)

Several field studies conducted by N.I. over the past 20 years have shown that the classical weighing methods are generally not very suitable for HH food intake assessment. Recall methods combined with sample weighing are more feasible. A pilot study was conducted by N.I. to test the feasibility of using the Household Food Inventory method in a rural community (Moussa, 1983). Each HH in the sample was studied by both HH food inventory and 24-hour recall with sample weighing. It was concluded that results obtained by HH food inventory could be more efficiently reached by the 24-hour recall with sample weighing method.

B. Methods Used for Individual Food Intake Assessment

Individual dietary surveys are required when data on food intake need to be evaluated against other parameters of nutritional status.

Methods used for measuring food consumption of individuals can be classified into two major groups. The first group, is designed to measure the quantity of the individual foods consumed over a one day period. By increasing the number of measurement days for these methods, quantitative estimates of actual recent intakes, or for longer time periods,

usual intake is particularly critical when relationships between diet and biological parameters are assessed.

The second group of methods includes the dietary history and the food frequency questionnaire. Both obtain retrospective information on the patterns of food use during a longer, less precisely defined time period. Such methods are most frequently used to assess usual intake of foods or specific classes of foods (Young, 1965; FAO, 1980; Neisheim, 1982; Pao and Cypel, 1996). With modification, they can provide data on usual nutrient intakes.

Practically, individual food intake methods may be grouped under 4 main categories:

1. Recall categories.
2. Recording categories.
3. "Short-cut" or qualitative methods.
4. Combinations.

1. Recall of Past Intakes of Individuals

Recall methods aim at eliciting actual past intakes as remembered at an interview or with a questionnaire for completion by respondents. The principal procedures for recalling past intake of individuals are:

a. The 24-hour recall method

The food intake of an individual during the immediately preceding 24 hours or preceding day is ascertained by means of detailed questions. Food intake is usually assessed in terms of household measures. This method estimates the food actually eaten, as recalled from memory. Detailed description of all foods and beverages consumed including cooking methods, and brand names if possible, are recorded by the interviewer. Vitamin and mineral supplement use is also noted.

The interview is not very complicated and is not very time-consuming for either interviewer or respondent. If the procedure is restricted to one interview per respondent, information is limited to the food intake of one

particular day, although day-to-day variation can be high for most people. Therefore, the 24-hour recall is often used combined with another method as will be discussed under 'Combinations'. A single 24-hour recall is most appropriate for assessing average intakes of foods and nutrients for large groups. A 24-hour recall can be repeated during different seasons of the year to estimate the average food intake of individuals over a larger time period i.e. the usual food intake.

b. The dietary history method

It uses several approaches to obtain information from the individual about his average food intake during a certain period of time. During interviews the respondent is asked to provide information on:

- His overall pattern of eating
- Recalling the actual food eaten during the preceding 24-hours.

The respondent is also asked to complete a checklist of foods usually consumed and a cross-check of all foods actually consumed in a 3-day period.

The dietary history method (Burke, 1947; Burke and Pae, 1967) is a technique for estimating usual dietary intake. The technique is based on the assumption that everyone has a constant daily eating pattern. The method was originally developed to measure diets over a period of time for research on human growth and development. The rationale was that clinical signs and laboratory findings may result from long-term food habits; current intake may not reflect usual intake and so may have less value in evaluating nutritional status.

The interview technique to obtain a dietary history requires highly trained interviewers with nutritional background. The data may be collected by the question What do you usually have for breakfast? coupled with: What did you have for breakfast this morning? The amounts are recorded in common household measures. The complete day is covered in this way.

If an individual does not have a constant eating pattern, a dietary history cannot be compiled. The dietary history including a check list of foods and a cross-check of all foods actually consumed in a 3-day period may

be appropriate in the assessment of nutritional status and is not a great burden for the participant. However, skilled interviewers are crucial.

2. Recording of Present Food Intake

The amount of food eaten can be weighed or estimated in terms of household measures.

Table 1. Strengths and weaknesses of 24 hour Recall Methods.

Strengths	Weaknesses
1. Administration time is short.	1. Respondent recall depends on memory.
2. Time period is defined.	2. Portion size is difficult to estimate accurately.
3. Food intake can be quantified.	3. Intakes tend to be underreported compared with other methods.
4. Procedure does not alter dietary patterns.	4. Usual intake of an individual cannot be assessed from one.
5. Interviewer administration allows probing for omitted foods or incomplete information and requires fewer callbacks.	5. Trained Interviewers are required.
6. Response rates are relatively high.	6. Interviewer variability may offset standardized procedures.
7. A single contact is required.	7. Procedures may be more difficult for certain population groups (e.g., young children).
8. Procedure is often used to evaluate dietary intakes of large groups.	
9. Two or more days provide data on intra and interindividual variation in dietary intakes.	
10. Multiple days are necessary to provide reliable data on less frequently eaten foods.	
11. Multiple days may yield a measure of usual intake.	
12. Repeated recalls over a year may provide an estimate of usual intake by an individual.	
13. Respondent does not rely on long-term memory.	
14. Procedure can be administrated by telephone.	
15. Procedure obtains specific details on foods eaten and their methods of preparation.	
16. Procedures can be automated.	

Source: Kohlmeier (1993).

a. The weighing method

It consists of the assessment of the cooked weights of the total meal served, the individual portions and leftovers. The ingredients used in the preparation of mixed dishes should also be weighed in the pre-preparation state so that cooked recipes can be computed for their nutritive value by referring to the raw ingredients and making necessary corrections for cooking effect. This is more accurate than using F.C.T. for cooked recipes.

This method requires varying degrees of supervision depending on the corporation and capacity of the participants.

Educated People

After proper training by the field investigator, they can weigh food items for themselves with a dietary weighing scale provided for them for this purpose. Both 0.5kg and 10kg scales will be needed.

Less educated people

In that case, the actual weighing should be done by the field investigator. Therefore, the dietitian has to spend several hours each day with the housewife or mother, which may cause interference in the home. To what extent this alters the pattern of food intake is difficult to determine.

A compromise must be reached between close supervision with consequent interference with home routine, and very little, perhaps inadequate, supervision so as not to upset the home pattern. In some societies such as in Egypt, this method is not culturally accepted.

b. A record in household measures

It is a list of all foods eaten by an individual during a specified period of time given in household measures or compared in size to food models.

Educated people

This method is less demanding than weighing; they can record food intake themselves. There is less precision in this process but closer cooperation. Supervision by a dietitian at the beginning and end of the period is essential. At the end, a detailed interview is desirable to allow checking of amounts and getting a list of weights of HH measures used, so that food intake can be transferred to amounts in grams. Details overlooked or omitted reduce the accuracy with which HH measures can be converted to weights.

Less educated people

This method is not appropriate, because they cannot record and describe their portions. A dietitian would have to do the work and in that case she might as well weigh the foods.

3. Short-Cut or Qualitative Methods

These methods provide information only on the quality of the diet. With a short form for qualitative classifications of dietary pattern, this method permits rating or grading of items into categories so that extremes can be identified. The questionnaire consists of simple clearly defined questions which can be used by relatively unskilled staff or can be included in questionnaires completed by literate respondents.

Two methods can be represented under this heading

The form contains a list of well-defined groups and the respondent is asked to recall the food groups eaten on the previous day for each of three main meals and snacks.

Food groups are listed in a form and the respondent is asked how frequently she/he consumes each of these food groups with the main food items. Frequency may be stated per day, per week, per month, per season or even per year according to the type of food. This is the Food Frequency Method (Pao and Cypel, 1996).

Table 2. Strength and weakness of food record method

Strengths	Weaknesses
Respondent does not rely on memory.	Generally, respondents must be literate.
Time period is defined.	Respondents must be highly cooperative.
Portions can be measured or weighed to increase accuracy.	Food consumed away from home may be less accurately reported.
For elderly people, records may be more accurate than recalls.	Habitual eating patterns may be influenced or changed by the recording process.
Food intakes are quantified so nutrient contents can be calculated.	Requirement for literate respondents may introduce bias as a result of overrepresentation of more highly educated individuals.
Multiple days may yield a measure of usual intake for a group.	Record keeping increases respondent burden.
Two or more days provide data on intra and interindividual variation in dietary intakes.	Increased respondent burden may adversely affect response rates.
One-day records kept intermittently over the year may provide an estimate of usual intake by an individual.	Self-administered records require more callbacks and editing than interviewer-administrated reports.
Multiple days provide reliable information about less frequently eaten foods.	One-day records provide an inadequate indication of usual intake for groups or individuals.
Procedure can be automated.	Validity of records may decrease as number of days increases.
	Validity of records may be influenced by the level of monitoring.
	Substantial underreporting suspected.

Source: Kohlmeier (1993).

4. Combinations

All methods have their specific advantages and disadvantages. There is no perfect method for all purposes. Investigators should carefully consider what is the most suitable method for their specific objectives. Very often a combination of two methods might provide more comprehensive and accurate information; the shortcomings of one method are counterbalanced by the strengths of another.

Table 3. Strength and weaknesses of food frequency questionnaire

Strengths	Weaknesses
An indication of usual dietary intake may be obtained.	Memory of food patterns in the past is required.
Highly trained interviewers are not required.	Period of recall may be imprecise.
Method can be interviewer administrated or self-administrated.	Quantification of food intake may be imprecise because of poor estimation or recall of food intake.
Administration may be simple and less costly.	Portions or use of standard sizes.
Customary eating patterns are not affected.	Respondent burden is governed by number and complexity of foods listed and quantification procedure.
Individuals may be ranked or classified by food intake.	Recall of past diets may be biased by current diets.
Response rates are high.	Heterogeneity of population influence the reliability of the method.
Respondent burden is usually light.	Suitability is questionable for certain segments of the population who may not consume foods on the list.
Relationship between diet and disease may be examined in epidemiological studies.	Intakes tend to be overestimated compared with some other methods.
Data on the total diet can be obtained or data on selected foods or nutrients.	Specific descriptions of foods are not usually obtained.
Procedure can be administrated by mail.	Validation of the method is difficult.
Procedure can be automated.	

Source: Kohlmeier (1993).

Examples are:

- Weighing record at the household level and 24-hour recall for individuals. This can provide information on food purchases of different categories of HHs, recipes and food intake of groups of individuals.

- Dietary history and current recording provide information of food pattern in the past and a more accurate picture of current food intake.

- Weighing and recall: 24-hour recall and sample weighing can be used for HH as well as individual food intakes. This should be conducted in the homes of participants (commonly used in Egypt).

- HH Food inventory and 24-hour recall with sample weighing. The respondent is asked what was consumed by the household the previous day. Samples are weighed. At the same time food sources are obtained by weight whether purchased, donated, bartered, from home stores or the field. Amounts of foods prepared for HH consumption but not consumed are also obtained and information about different routes of disposal is recorded. (Commonly used in Egypt).

- 24-hour recall and sample weighing with food frequencies for HHs or individuals. This combination will provide rather accurate information on the consumption patterns over a long period, e.g. a year, as well as on current consumption patterns and precise food intake. (Commonly used in Egypt).

Rapid Methods for Collection of Dietary Data

As a basis for documenting and understanding the food intake for developing FBDG, rapid methods of dietary assessment can be very helpful. A rapid assessment procedures survey (RAP) usually involves focus-group interviews with community leaders and selected target groups, to gather information on food beliefs, behaviours and intakes without preconceived ideas. The trained interviewer works with the informant to create a knowledge base with minimal bias. A particular advantage of RAP methods is that they allow a more relevant food usage list to be developed for a community, which may then be used along with other more quantitative methodologies, such as for cross-checking food records or recalls or for developing FFQs. Thus, RAP methods, which are low-cost, may be used as the primary method for collecting data on which to base dietary guidelines or may be used to enhance the validity of more quantitative methods. Another approach to rapid assessment of food intake involves the use of a qualitative 24-hour recall to identify family and individual intakes (WHO, 1996).

New Developments in Measuring food Consumption.

In developed countries, telephone administered surveys, photographs of food items consumed and left overs, as well as use of food recording electronic devices, have been developed.

All these developments aim to reduce respondent burden and hence increase compliance, reduce errors resulting from memory lapses, and in the case of electronic devices, to eliminate the tedious process of coding the food records (Gibson, 1990; Pao and Cypel, 1996).

Selecting the Most Appropriate Dietary Data Collection Method

There is no ideal method for assessing food or nutrient intakes, the choice depending primarily on the objectives of the study. None of the current methods are devoid of systematic errors, or prevent alterations in the food habits of the subjects. Table 4 summarizes the most appropriate methods for assessing food or nutrient intakes in relation to the study objectives.

In general, the more accurate methods are associated with higher costs, greater respondent burden, and lower response rates.

Unfortunately, compromises often have to be made between collection of precise data on usual nutrient intakes of individuals and a high response rate.

Validation and Quality Control Methods

To appraise the validity of a set of dietary data, one considers the relevance of the food consumption responses to the concepts being measured, which are determined by survey objectives.

There is no "true" measure of consumption with which the data derived with various survey methods can be compared. Validity of each method can only be tested against another, for there is no absolute method of dietary assessment; the weighing method has been taken as the nearest to ideal, through the conditions imposed on the subjects may affect their behaviour more than recall techniques. In fact this issue is a very sensitive one to populations and it is not an easy matter to try validity and quality control methods for food intake assessment techniques in the field.

Table 4. Selection of Appropriate Dietary Assessment Methodology in Relation to Study Objectives.

Desired information	Preferred Approach
1. Actual nutrient intake over specified time period (e.g. in a balance study)	1. Chemical analysis of duplicate meals or calculated intake from weighed records
2. Estimate of usual nutrient intake in free-living subjects group average	2. One day intake with large number of subject and adequate representation of days of week
3. Proportion of the population at risk	3. Replicate observations of intake or diet history
4. Individual intake, for correlation or regression analysis	4. Multiple replicate observations on each individual.
5. Group or individual pattern of food use, proportion of population with particular pattern	5. Food frequency questionnaire.
6. Average use of a particular food or food group for a group.	6. Food frequency questionnaire or a one-day intake with large number of subjects and adequate representation of days of the week.

Source: Gibson, 1990.

In one of the dietary assessment studies conducted by N.I. which was continued over a one year longitudinal study, and where accuracy in assessment of energy intake was required for target individuals, several validation and quality control methods have been attempted (Moussa, 1986). Results have shown that some of these methods were feasible while others were impossible to accomplish under the Egyptian rural community conditions. A brief account of these feasible and unfeasible methods might be useful to researchers in other countries of the region.

Methods not feasible in the Egyptian rural community

1. Rotation of dietitians every 3 months

In the study, which continued for 12 months, it was planned that dietitians would be rotated on household every 3 months. This change was not accepted by respondents.

2. Reliability of data given by the respondent

Each household in the sample would be studied twice on the same day by two different dietitians, once during the one-year study. The second dietitian was not accepted by respondents.

3. Observation and weighing by trained village data collectors

The idea was to validate the 24-hour recall with the sample weighing method against weighed food intake of individual targets for the whole day. Due to cultural constraints, N.I. dietitians could not stay in the village homes for the whole waking hours. To overcome this difficulty, middle level educated village girls were trained for the job. However, during implementation, the trained village data collectors could not stay at home the whole waking hours and they resorted to short interval visits every 2-3 hours, and a new method evolved which was short recall with sample weighing.

Validation and quality control methods feasible in the Egyptian rural community

1. Interviewer reliability

Two dietitians study food intake simultaneously, each filling a separate set of forms and weighing food with her own scales. In most cases, there were minimal differences between the forms of the two dietitians.

2. Validation of recall data against weighed data

This method was successfully applied whenever feasible for data of both the household and the individual. The method was developed by dietitians and then refined.

a. Household

On Day 1 of the two study days of food intake by 24-hour recall and sample weighing: if the target female or care-taker was in the process of food preparation, all ingredients of the recipe were weighed and recorded on Form 2 labeled "Weighed During Preparation". On Day 2, recall data was obtained as usual and the information was compared.

b. Individual

On Day 1 of the two study days, if the toddler was eating a meal or a snack, it was weighed and recorded on Form 4 labeled " Weighed During Eating". On Day 2 recall data was obtained as usual from the adult informant. The information was compared.

3. Observation and weighing by trained household members versus short recall and 24-hour recall by dietitians

After analysing results of Observation and Weighing by trained village data collectors, it was realized that to conduct a reasonably accurate Observation and Weighing Method (O), it should be implemented by a well-trained cooperative eligible household member.

The process of selection and training of data collectors from HH members was very tedious and time consuming. However, 15 HHs could be studied by the 3 methods. On Day 1, the trained HH member was observing, weighing and recording food intake of all targets from morning immediately after waking till just before sleep in the evening (O). Also on Day 1, dietitians from N.I. studied food intake of the same targets by two hourly visits using short recall with sample weighing (SR). On Day 2, dietitians from N.I. studied food intake of the same targets by 24-hour recall and sample weighing (R). Energy intake per day (kcal) for each target was compared, obtained by the three methods, and evaluated statistically.

4. Short recall versus 24-hour recall by dietitians

A random sample of 50 HHs was selected to compare energy intake of targets as assessed by both (R) and (SR). HHs who refused to participate were substituted by randomly selected HHs.

5. Interviewer and respondent reliability by continuous analysis of means and variances of energy intake

It is thought that this method is most reliable and most applicable.

Sample Size, Duration of Survey and Field Schedule

Results of several studies have shown that accurate estimation of individual intake of energy and nutrients cannot be obtained by a single dietary record or dietary history. In every group, individual energy intake may be twice as high on one day than on another. Day-to-day variations between energy and nutrient intake of an individual can be as large as variation between individuals. Some investigators have calculated from their data the number of recalls needed to estimate an individual's diet with 95% probability of being within 20% of the mean intake of that person. To fulfil this criterion for 90% of the population, the number of recalls needed ranged from 9 for total energy to 45 for cholesterol (Balogh et al., 1971).

Results of several studies also show that accurate data on individual food intake can be obtained in long surveys. Usually this is not feasible because it is time consuming, too costly and very often it is difficult to motivate the participants for such an effort.

The purpose of consumption studies in epidemiology is rather to identify or characterize groups of individuals by their intake. Adequate sample size and number of records per subject depends on the required precision of the assessment of nutrient intake and thus on the intra and inter-individual variation in nutrient intake of the group. So, a pilot study is essential if no data on these sources of variation exist in the literature. An example of this is the pilot study carried out in one of the longitudinal studies conducted by N.I. in the Egyptian rural community. Forty HHs with 4 individual targets in each were studied for their daily energy intake for 3 single days, at 3-day intervals, over a 10-day period. The aim was to estimate intra and inter-individual variation in order to determine the number of data intake of each individual in the sample (Moussa, 1983).

Based on the results of the pilot study, it was decided to study a sample of 100 target individuals on two consecutive days in each month for 12 months. In order to have a full picture of daily, weekly, monthly and seasonal variations, study days covered beginning and planned with the assistance of a statistican and the sampling technique should be described carefully.

Analyses of Food Intake Data

Conversion of Food Data to Uniform Terms of Weight

The heterogenous information on food intake obtained in the field must be converted into uniform terms of weight (grams) to be ready for computation of nutritive value.

Figures for converting these heterogenous data to uniform weight units are obtained from pooled information on units, volumes, weights, prices, household measures and refuse which the staff have obtained in the field.

Conversion of Amounts of Foods into Nutrients

Known amounts of foods can be transferred to known amounts of nutrients and energy. This can be achieved by the use of:

1. Food composition tables (F.C.T.) preferably local or at least regional. Nutrients data banks or computer-stored nutrient databases are FCT transferred to, and maintained on, a computer.

2. Chemical analysis of duplicate composite food samples. However, this is very expensive, effort and time consuming, thus it is used almost only in limited metabolic research e.g. nitrogen balance or bio-availability of certain nutrients or to validate the nutrient, data base or F.C.T.

In each dietary survey Nutrient Data Base should be prepared from local F.C.T supported by regional F.C.T. and chemical analysis of samples of food items not available in the F.C.T.

For large scale surveys this process of conversion of foods consumed into nutrients should be computerized. Amounts of coded food items consumed are entered together with the coded nutrient data base and a Programmeme is developed. A food code usually consists of 6 digits; 2 denoting the food item and 2 denoting the state of food or method of its preparation.

It is important to note that food composition values generally indicate the total amount of the constituents in the food, rather than the amount absorbed. This is because the bioavailability of most nutrients in individual food items has not been assessed. Hence intakes of most nutrients, calculated from FCT, present the maximum available to the body and consequently when nutrient intake data are evaluated, the potential bioavailability of the nutrients from the diets must always be considered.

Determining Nutritive Value of Complex Dishes

In the Middle East Region there is a wide variation in the composition of recipes. Even within one country, e.g. Egypt, the variation can be very large for each single complex dish. Amounts and kinds of ingredients composing a complex dish vary greatly from one local area to the other and even from one household to the other according to several factors e.g., food availability in the area, social and economic conditions of the household.

Therefore, it seems unjustified to use F.C.T. for cooked recipes for the region or even for a large country such as Egypt. It is more appropriate to use nutrient data base for raw food items constituting a recipe and do the necessary corrections for changes in weight or nutritive value of foods which occur during preparation or cooking. Also computerized Programmes, where ingredients of complex dishes are entered and nutritive value is computed, after adjusting for the necessary change due to cooking, are practical and useful.

Analysis of Food Intake Data By Individual Foods, Food Groups, Meal Patterns And Eating Practices

Food intake data may be analysed in many ways other than by conversion to nutrients. The possibilities for analysis by individual foods, food groups, meal patterns and various eating practices are unlimited. The kind of analysis selected will depend on the questions of interest and the data available. Usually this type of analysis is useful when considering developing or monitoring food-based dietary guidelines (FBDG) (WHO, 1996).

Approach for Adjusting Household Food Intake

In case a household food intake study is done without assessment of individual food intake, some adjustments must be made so that food intake of different households in the study can be compared. There are different approaches and in each study a certain approach should be selected according objectives and resources of the study.

Household BMR: using the FAO/WHO/UNU BMR equations, a BMR for each individual will be computed and then added to give the household BMR.

Household Energy Need: the FAO/WHO/UNU energy requirement will be estimated for each individual in the household according to age, sex and body weight assuming a moderate activity. All will be added to give the household energy need.

Consumer Unit: in this approach classes of individuals are expressed as a proportion of a reference adult man (e.g. infant = 0.25; adult units are then added for the household.

Per caput: In this approach household food intake is simply divided by number of individuals to get per caput food intake. However, this approach lacks accuracy. Help of statistician is needed.

Important Indicators of Quantitative and Qualitative Dietary Adequacy

After computations of energy and nutrient content of a 24-hour diet of an individual, the following indicators of dietary adequacy can be developed:

1. Percentage contribution of energy and nutrient intake to recommended Dietary Allowances (%RDA) or nutrient adequacy ratio (NAR) or index of nutritional quality (INQ). The FAO/WHO RDA should be adapted to each country in the region based on previous information. E.g. on quality of protein, bioavailability of iron and source of vitamin A.

2. Protein energy ratio (P.E.R) both for total and animal protein.

3. Fat energy ratio (F.E.R) both for total and animal fat.

4. Percentage contribution of energy derived from animal sources to total energy intake.

5. Amino acid score.

6. Net dietary protein calorie percent (NDp Cal%).

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USE AND STATUS OF FOOD COMPOSITION TABLES AND DATA-BASED INTHE NEAR EAST REGION

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Introdction

Several activities were carried out during the past 30 years in the Near East Region to establish food composition data. Lebanon may be the first country that succeeded in preparing food composition tables for use in the Middle East. There were some activities in Egypt, Pakistan, Iran and Sudan to prepare national food composition tables; however, none of these countries have established a comprehensive food composition data-base.

Objectives and needs for food composition data-bases in the Near East

1. To be used in determination of nutrient intakes for dieteic and public health Programmemes in the Region.

2. To be used in epidemiologic studies, especially those on diet-related diseases.

3. To be used in formulation of nutrition and health education Programmemes, e.g. dietary guidelines and recommned dietary allowances.

4. To support food labelling and food regulations.

Some reasons for changes or additions to food composition tables

1. Although there are some food composition tables available in theNear East Region, these tables need to be revised and updated. The main reasons for carrying out these changes are:

2. Change in unprocessed food e.g. new fruits; new cultivars or breeds of fruit, vegetables and animals; different cuts of meat; changes resulting from new farming practices or country of origin.

3. Processing new or re-formulated beverages, cereal products, confectionery, dairy products, desserts, fats, infant foods, meat products, sauces, soups, etc.

4. Availability of wide varieties of mixed dishes, both local and for immigrants, as well as changes in cooking methods for preparing these dishes.

5. Addition of new nutirents or nutrient fractions not previously inculded in the processed foods.

Benefits of Regional Collaboration

1. The need for regional collaboration is highly recommended. Such collaboration has several benefits:

2. Cost and time effectiveness and sharing of resources (expertise, knowledge, labour, and facilities).

3. Possiblilites for avoiding duplication.

4. Opportunity for countries to complement their national food composition data.

5. Facilitate food trade adherence to international trade guidelines and requirements.

6. Strengthen the scientific capactities of nutrition and food science departments and laboratories in the region.

7. Provide information needed for public healht and agriculture food policy decisions.

Obstacles and Solutions to Regional Collaboration in Compiling Food Composition Data

Obstacle: Food analysis and the development of food composition data bases is not a governement priority in the countries of the region.

Solution: FAO, WHO and UNU should help governments to recongize the importance of supporting the development of reliable national food composition data bases.

Obstacle: Lack of coordination of food analytical activities and the development of reliable national food composition data bases.

Solution: Establish a regional centre to coordinate the variety of initiativies required. Such a cenre would be expected to:

1. Assemble all useful food composition data availble for the region on both indigenous and imported foods in a form that makes them freely available electronically to all users.

2. Coordiante the activities of such regional committees or task forces as may be establihsed.

3. Arrange for the covening of periodic regional meetings.

4. Constitute an advisory group consisting of a representative from each of the participating countries and others as may be deemed necessary.

Food Composition Tables Used in the Near East Region

A few food composition tables are used in the Near East Region. They are as follows:

1. Azar, M. et al (1998): Food Composition Tables of Iran. National Nutrition and Food Technology Research Institute, Iran.

2. FAO (1982): Food Composition Tables for the Near East. FAO, food and nutrition paper No. 26, Rome.

3. Gopalan, C., Rama Sastri, B. V. and Balasubramanian, S. C. (1981): Nutritive Value of Indian Foods. National Institute of Nutrition, Hyderabad.

4. Holland, B. et al, (1992): McCance and Widdowson's the Composition of Foods. 5th revised edition. The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Food, London.

5. Hussain, T. (1985): Food Composition Tables for Pakistan. NWFP Agriculture Univerisity, Peshawar, Pakistan.

6. Musaiger, A. O. and Al-Dallal, Z. S. (1985): Food Composition Tables for Use in Bahrain. Ministry of Health, Bahrain.

7. Nutrition Institute (1990): Food Composition Tables for Egypt. Ministry of Health, Cairo.

8. Pellet, P. L. and Shadarevain, S. (1970): Food Composition Tables for Use in the Middle East. Amercian University of Beirut, Lebanon.

Users and Use of Food Composition Data

The main users of the food composition tables in the Near East Region are:

1. Dieticians and nutritionists.
2. Reseach scientists.
3. Food analysts.
4. Caterers.
5. Food manufacturers, distributors and retailers.
6. Legislators.
7. Health and agricutlture policy makers.
8. Educators.
9. Media and the public.
10. Food comsuption surveys and interpretation of food balance sheets.

Recommendations for Establishing Food Composition Data for the Arab Gulf (GULFOODS)

A. Proposal for Darafting 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 Programmeme).

A.2.3 Sampling and methods of Analysis

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

A.2.4 Nutrients included (Minimum)

General

- Proxmiate composition (water, protein, fat, ash, crude, fiber, CHO and Energy).
- Minerals (Ca, P, Fe).
- Vitamins (Retinol, B1, B2, Niacin, Vit C).

For Composite dishes

- Depends on data avaible.

A.3. Presentation of Data

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).

2. For the general information two tables will be used; the first for proximate composition and the second for minerals and vitamins.

3. The source of information will be shown for each food item.

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.
- 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: 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).

Suggested Centers for the Gulf

1. Food and Nutrition Department/ King Saud University – S. Arabia.
2. Food and Enviromental Laboratory – Dubai Municipality – U.A.E.
3. Centeral Laboratories – Ministry of Health – Doha – Qatar.
4. Food Biotechnology Department – Kuwait Institute of Scientific Reseach – Kuwait.

Action Needed to establihsh Food Composition Data in the Near East

A. National Centres and Resource People

Cyprus: State General Laboratory, MOH-Food Composition Section.

Egypt: Nutrition Department, National Research Center, Cairo.

Iran: National Nutrition and Food Technology Research Institute, Shaheed Behhesti University, Tehran.

Jordan: Department of Food and Nutrition, University of Jordan.

Lebanon: Department of Food Technology and Nutrition, Amercian University of Beirut.

Pakistan: Deparmtent of Agriculture and Chemistry.

Sudan: Faculty of Agriculture, University of Khartoum.

B. Sampling of Foods

1. Protocol to be decided by each country depending on resources.

2. All relevant documentation should be provided.

C. Standardization Method for Recipes

1. Each country to survey commonly consumed foods, including common recipes. It is important to share the methodology of survey.

2. Priorities for foods need to decided nationally (raw vs. cooked) by national steering committee.

D. Methods of Analysis

1. Documentation of method is necessary.

2. Share experience in method of analysis among countries.

3. Identify centres of excellence and have analysis done there, or for checking the results.

4. Improve the equipment in the food analysis be seeking funds from various resources.

E. Terminology and Names of Foods

1. Scientific, local and English names should be used.

2. Determination of classification should be deicded at later stage.

F. Quality Assurance of Analysis Method

1. Centre laboratory collaborative studies are necessary, within countries and the region.

2. Co-ordination with GULFOODS project is necessary.

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, to be released by GULFOODS Secretariat at the Bahrain Center for Studies and Research.

5. Countries other than arab Gulf countries agree to participate in this Newsletter.

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

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Appendix (1). 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
Bahrian	+	Proximate Ca, P, Fe, VitA, B_1, B_2, Niacin, VitC	+++	Ready Made Foods
Kuwait	- Composite Dishes	- Proximate, Minerals (most) Vitamins (most) Amino Acid Cholesterol + FA	+++	Ready Made Foods
S. Arabia	- Composite Dishes	- Proximate, Minerals (most) Vitamins (most) Amino Acid Cholesterol + FA	+++	- Raw Foods
Qatar	- Composite Dishes	Proximate Minerals	+ +	- Most Foods
U.A.E.	-	-	-	- Most Foods
Oman	- Composite Dishes	Proximate Minerals Cholesterol + FA	+ +	- Ready Made Foods - Raw Foods.

Appendix (2). 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 Measurement)	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
National Food Composition Tables	No	E	1995	KACST	Bahrain 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.

ENERGY BALANCE AND PHYSICAL ACTIVITY

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Introduction

It is needless to stress the important role of physical activity and exercise in preventing disease and premature death, and in maintaining a high quality of life. Based on the results of several investigations published in the United States, it has been estimated that between 9 and 16% of deaths can be attributed to a sedentary lifestyle (International Life Science Institute, 1998). Unfortunately, no comparable data are published for Arabs, but there is no reason to expect that the Arabian, situation differs from that of the United States, if not being substantially higher.

According to the Surgeon General Report, (1996), there is a strong link between physical activity and numerous health improvements. Most significantly, regular physical activity greatly decreases the risk of dying from coronary heart disease, the leading cause of death in the world. Physical activity also reduces the risk of developing diabetes, hypertension and colon cancer, and helps to unbalance the energy balance equation and produces a negative energy balance which results in weight loss.

The energy balance concept of weight control is relatively simple. Body weights remain constant when caloric intake equals caloric expenditure. Any imbalance in caloric output or caloric input will result in a change in body weight. If the caloric input is greater, a positive caloric balance exists, and the individual gains weight. On the other hand, that individual loses weight if the caloric output exceeds the caloric input, a condition of negative caloric balance.

According to Donelly (1997) and Katch & McArdle, (1983), there are three ways to unbalance the energy equation and lose weight: (1) decrease caloric intake below daily caloric requirements, (2) increase caloric expenditure through physical exercise and maintain regular food

intake, (3) combine methods (1) and (2) by reducing daily food intake and increasing daily energy expenditure.

The purpose of this review article is to shed light on the role of physical activity and exercise in maintaining and losing body weight. In addition, recommendations for types of physical activity Programmes for weight and fat losses will be presented.

Physical Activity and Metabolic Rate

Metabolic rate is defined as the rate at which energy is produced by an organism. It is usually measured by heart production (direct calorimetry) or by oxygen consumption (indirect calorimetry), seeing that both reflect the rate at which biochmical processes occur in living things. Resulting metabolic rate (RMR) is the energy expended to maintain body function at rest. According to Woo et al (1985), it is measured when a subject is resting in a thermoneutral environment at least 8 to 12 hours after food intake or physical activity.

For most people, the vast majority of daily energy expenditure, about 90%, is accounted for by the RMR, which includes the basal rate (BMR), while only about 10% of the daily calories are expended in light exercise, such as walking or climbing stairs. In typical sedentary individuals, these forms of light activity are not part of a planned exercise Programme, but are rather simply activities involved in their normal lifestyle. So these activities are considered to be part of the RMR.

Many studies have convincingly demonstrated that fat-free mass (FFM) or lean body mass (LBM) is the correlate of RMR (Ravussion et al, 1992; Tremblay et al, 1986; and Schutz et al, 1984). Williams (1995) stated that decreasing body fat and increasing LBM may increase the resulting energy expenditure. This effect could be due to the increased physical activity levels of muscle tissue compared to fat tissue. Some investigators have suggested that regular physical exercise has the potential to elevate the RMR over and above the gain associated with the increase in FFM (Bouchard, et al, 1993). Furthermore, Baher et al, (1987) have shown that one bout of exercise is sufficient to produce a significant increase in postexercise PMR. This result is concordant with the fact that RMR is significantly decreased in trained individuals when they suspend their physical exercise training regimen for several days (Herring et al, 1992). These findings tend to suggest that the increased

RMR observed in trained individuals is primarily the result of repeated effects of physical training.

RMR probably increases with high intensity physical activity because of the elevation of resting metabolism that follows exercise (Schure and Titon, 1977). It has been estimated that following high-intensity exercise, the RMR may remain elevated for several hours and use a total of 20 to 50 Calories more than would be used at rest (Williams, 1995).

In the context of a weight-reducing Programme, the increase in RMR is most likely to be small in relation to the effects of energy expenditure during physical exercise. However, researchers have demonstrated that the degree of energy expenditure postexercise is linearly related exercise intensity up to about 80% VO2 max (about 95% maximal heart rate) and then it rises faster as exercise intensity increases, 12.5-35 kcal after moderate exercise, and as high as 180 kcal after strenuous exhaustive exercise. Baher et al (1992), concluded that the postexercise energy expenditure as a result of light and moderate exercise is unlikely to have any real effect on energy balance or weight loss.

So it is unlikely that overweight or obese individuals, especially if they have been sedentary, will be able to tolerate the intensity and duration of physical exercise necessary to achieve energy expenditure high enough to influence weight loss. However, persons who participate in large amounts of daily energy expenditure over time may help regulate bodyweight.

Physical Activity and Daily Energy Expenditure

The benefits of physical exercise go beyond negative energy balance and added fitness. Physical activity lowers risk of heart disease, stroke, high blood pressure, and diabetes. In addition, overweight individuals can boost their self-control, self-confidence, and well-being, as well as reducing stress and depression.

Millions of people seem to believe that regular physical exercise is a useful means to control bodyweight and body fat content. Bouchard et al (1993), reported that about 60% of adults stated that they exercise for the purpose of maintaining body weight at the desired level. A considerable amount of knowledge from the world of sports substantiates the contention that regular physical activity may be

protective against weight gain and unfavorable changes in body composition. Thus, weight gain and increase in body fat are commonly seen in those who do not participate in physical activity regularly. Mayer (1960), an international authority on weight control, has concluded that physical inactivity was the most important factor responsible for the prevalance of obesity and overweight in western societies.

The total energy expenditure is the sum of BMR, thermic effect of food (TEF), and thermic effect of exercise (TEE). It has been indicated that BMR accounts for 60-70% of the total energy expenditure, TEF represents 5-10%, while TEE explains 15-30% (Williams, 1995). However, these values may vary tremendously, particularly TEE, which may range from 0% in the total sedentary individual to 50% or more in the ultraendurance athletes.

The TEE represents the increase in metabolism brought about by moderate or strenuous physical activity. Thus, elevating the TEE is considered the most effective means to increase daily energy expenditure and should be a major component of a weight control Programme (Williams, 1995).

The major function of physical activity in a weight co trol Programme is simply to increase the level of energy expenditure and help unbalance the energy balances equation so that negative energy balance would be generated. It has been indicated that while the average individual may expend only about 60-70 calories per hour during rest, this value may exceed 1,000 calories per hour during a sustained high level physical activity such as rapid walking, running or swimming. Athletes, for example, participating in endurance events, such as the Tour de France and ultramarathon have been reported to consume between 6,000 and 13,000 calories per day (Williams, 1995).

In addition to the direct effect of increased energy expenditure during physical activity, physical activity has been shown to facilitate the mobilization of fat cells to supply energy to the working muscle. Hence, body fat stores are reduced. Several studies have indicated that an important feature of the negative energy balance generated by regular physical activity rather than by dieting or drug treatment is that the body mass loss is generally associated with a greater preservation of fat-free mass and greater loss of adipose tissue mass (Ballor & Kessey 1991; Depres et al,1991). In addition, physical activity may also stimulate the

development of muscle tissue and thus increase lean body mass. Since muscle tissue is more active metabolically than fat tissue, these changes in body composition may actually favor an increase in the RMR in the long run.

Moreover, physical activity programmes have been described by dietitians, nutritionists and exercise physiologists as a useful means of weight loss in both overweight and obese individuals. This advice is consistent with recent recommendations by the National Institutes of Health (1992) and National Academy of Sciences, (1995). According to Bouchard et al, (1993) the rationale for recommending regular physical activity to lose weight is that the caloric expenditure associated with regular physical activity has the potential to unbalance the energy balance equation and generate a negative energy balance state. However, a misconception has developed over the role physical activity can play in the energy expenditure of overweight and obese persons. They believe that physical activity produced. loss over a period of the weight control and expect a slow but gradual weight loss over a period of several months and years. This misconception is overwhelming and discouraging to the overweight. In other words, there is no reason why one should expect the weight he gained over a period of several years to be taken off rapidly, say within a few weeks of physical activity Programme.

The truth is that body weight and body fat losses with regular exercise Programmes are generally small (Ballor & Kessey, 1991). However, there is no doubt that regular exercise, whatever its intensity, contributes to energy expenditure. Moreover, physical activity is the only way which energy expenditure can be increased voluntarily, and has the potential to normalize body weight and body composition in a large number of cases, if it is sustained for years (Bouchard et al, 1993). The problem is actually the adherence and motivation to remain active for a long period of time. It has been indicated that overweight and obese individuals tend to decrease appreciably their regular participation after a few months (Dishman, 1982). Buskrik (1993), stated that adherence to remaining active can be well maintained for a few weeks to 6 months and after that the drop-outs may increase linearly. Thus, there is need to develop methods for motivating overweight and obese individuals to start and continue a physical activity Programme for several years and ideally, for a lifetime.

Type of Physical Activity and Energy Expenditure

Through the media and advertisements, people are constantly bombarded with new ideas and products that are claimed to help them lose weight. Weight training with sophisticated equipment, Slimnastics exercise, aerobic dancing, special exercise devices such as belts, shakers, rollers and other mechanically driven instruments are a few of the approaches often advertised as the best means to lose body fat fast. The truth is that you do not need any special instrument or any specially designed Programme.

The best type of physical activity Programme for losing body fat must inevitably involve a reasonable high level of energy expenditure. According to the American College of Sports Medicine, (1991) (ACSM) recommendations, an increase of energy expenditure by 200-300 calories per day would be a desirable outcome from such a Programme and would result in substantial weight loss.

In general, activities that use the large muscle groups of the body and are performed continuously expend the greatest amount of calories. Intensity and duration probably are two key determinants of total energy expenditure. Over the years, recommendations have been made regarding the intensity and duration of exercise to moderate-intensity exercise of long duration (ACSM, 1993). An intensity of about 50-60% of VO2 max (65-75% maximal heart rate), 5 times and more per week, for about one hour per session (e.g., walking), may represent the most appropriate form of physical activity Programme to be recommended for weight and fat losses (Table 1). High intensity physical activity does not appear to provide any major contributions in terms of weight loss.

Table 1. Recommendations for weight loss and cardiorespiratory fitness

Mode of exercise

1. Utilize large muscle groups.
2. Can be maintained continuously.
3. Must be aerobic in nature.

Intensity of exercise

1. 65-70% of maximal HR.
2. 50-60% VO2 max.

Duration of exercise

1. 20-60 minutes of continuous aerobic exercise.
2. Moderate intensity with long duration.

Frequency of exercise

1. 3-5 days per week or longer.

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CARBOHYDRATE, BEHAVIOUR AND HEALTH

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Carbohydrate is the single most important source of food energy in the world, making up 40% to 80% of total food energy, depending on the cultural and economic status of the people. Carbohydrate includes, polyhydroxy aldehydes, ketones, alcohols, acids, their simple derivatives and their polymers having linkages of the acetal type. These are classified according to their degree of polymerization and may be divided into three principal groups, namely sugars, oligosaccharides and polysaccharides (Table 1).

Each of these three groups may be subdivided. Sugars may be monosaccharides, disaccharides, or polyols (sugar alcohols). Oligosaccharides include malto-oligosaccharides, principally those occurring from the hydrolysis of starch, and other oligosaccharides such as alpha-galactosides (raffinose, stachyose, etc) and fructo-oligosaccharides. Polysaccharides are divided into starch (alpha-glucans) and non-starch polysaccarides (NSP), of which the major components are the polysaccharides of the plant cell wall such as cellulose, hemicellulose, and pectin.

The ingestion of all forms of dietary carbohydrate confers benefit to human behaviour and health. It is an essential component of healthy diets. It provides energy and is an important regulator of the nervous system, of behaviours, and of metabolism. Carbohydrate foods bring with them a wide array of essential nutrients and metabolically active substances important to the maintenance of health and prevention of disease.

Carbohydrate and the Nervous System

During digestion and absorption, dietary carbohydrate produces glucose, which is essential to the normal functioning of the nervous

system (LiETS and Anderson, 1987). The nervous system depends on glucose as its major energy source. From the ingestion and metabolism of carbohydrate, the nervous system receives information that may influence brain neurotransmitter synthesis and function, and activate neuroregulatory process.

Table 1. The major dietary carbohydrates.

Class	Subgroup	Components
Sugar (1-2) #	Monosaccharides	Glucose, Galactose, Fructose
	Disaccharides	Sucrose, Lactose, Trehalose
	Polyols	Sorbitol, Mannitol
Oligosaccharides (3-9)#	Malto-oligosaccharides	Maltodextrins
	Other oligosaccharides	Raffinose, Stachyose, Fructo-oligosacchaides
Polysaccharides (>9)#	Starch	Amylose, Amylopectin, Modified Starches
	Non-Starch Polysaccharides	Cellulose, Hemicellulose, Pectins, Hydocolloids

Degree of Polymerization

Carbohydrate ingestion has a positive effect on several human behaviours, including appetite, sleep, activity, mood and cognition and physical performance. Studies of carbohydrate and behaviour show that its effects are often subtle and hard to measure, but overall the conclusion is that its effect on behaviour is significant. Following is a review of the mechanisms by which carbohydrate affects the nervous system and behaviours.

Carbohydrate as Energy Substrate

The brain has a very high metabolic activity relative to most other body organs. Although it comprises only 2% of adult body weight, it receives 15% of cardiac output and accounts for 20-30% of whole body resting

metabolic rate. In a premature infant, up to 60% of the whole body resting metabolic rate may be due to the metabolic activity of the brain (Sokoloff, 1977). The respiratory quotient of the brain is 0.79, and since its glycogen store is only 0.1% of its weight, the brain depends on a continuous supply of oxygen and glucose to meet its high energy demands. The metabolic energy derived from glucose oxidation provides power for the brain's unceasing electrical activity, of which the main function is excitation and conduction.

In human infants, rates of cerebral energy metabolism and blood flow are associated during brain development, with the highest rates occurring during the period of active brain growth. In five-week-old infants, cerebral glucose utilization is already at 71-93% of adult levels in most brain regions. Adult levels of cerebral glucose utilization are reached by two years of age. They continue to increase, however, until the child is three or four years old and are maintained until about nine years, at which time they begin to decline, returning to adult by 20 years of age. The high levels of brain energy metabolism in the first decade are due to the brain's basal energy needs as well as the biosynthetic requirements for the active maturational processes. The child's cognitive development is related to changes in blood flow in the different brain regions (Nehling, 1997).

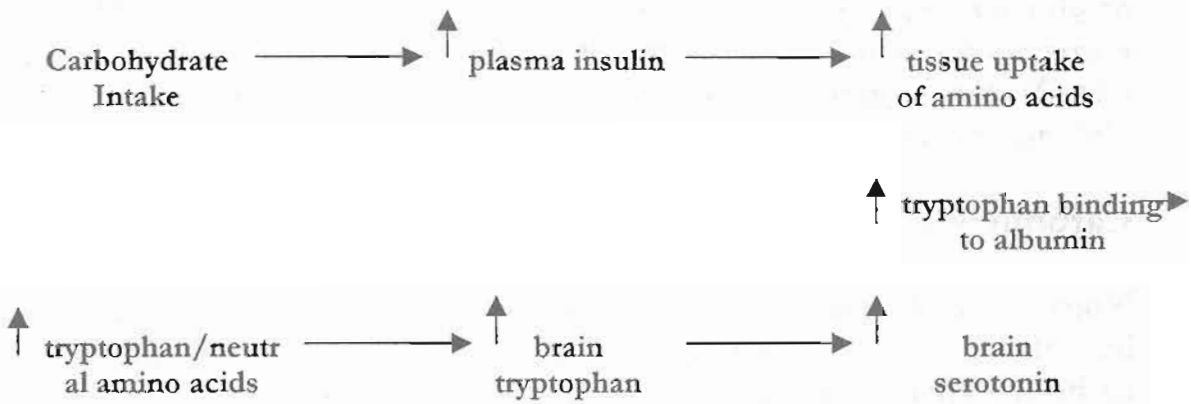
Blood glucose in the normal individual may fluctuate over a relatively wide range without evidence of neurological consequences, because cerebral energy metabolism is not affected. When plasma arterial concentration falls from a normal level of 6-7 mmol/L to about 2.5-3 mmol/L, cerebral glucose content decreases in a directly proportional manner to whole blood glucose concentration; however cerebral energy metabolism remains the same. Below 2.5 mmol/L, glucose transport into the brain is diminished to a point where brain glucose no longer saturates hexokinase; it becomes rate-limiting and insufficient to support brain energy metabolism (Nehling, 1997).

Under normal conditions, physiological and endocrine factors control blood glucose within narrow ranges in the normal individual, both after a meal and in the absence of food, ensuring that the brain has available an excess of this critical nutrient. The availability of blood glucose may be modified, however, by endocrine disturbances (eg. diabetes) or with aging, when fluctuations in dietary carbohydrate intake and blood glucose levels affect the availability of glucose as an energy substrate.

Carbohydrate and Brain Neurochemistry

In the early 1970s, it was shown that carbohydrate consumption by rats resulted in an increase in the synthesis of the brain neurotransmitter 5-hydroxy-tryptamine, or serotonin (Frensstrom and Faller, 1978). This observation provided a physiological mechanism linking carbohydrate consumption to behaviour serotonin is a neurotransmitter known to regulate many behaviours, including appetite, sleep and mood.

The effect of carbohydrate consumption on brain serotonin is explained primarily by the digestion of carbohydrate to glucose and the resulting release of insulin summarised below:



In animal species such as the rat and probably man, the transport Km of the blood-brain-barrier carrier system is approximately equal to the plasma amino acid concentration. Thus, competition among plasma amino acids is the primary determinant of the relative rate of uptake of each amino acid (Pardridge, 1983). For this reason, a relative increase in transport of tryptophan into the brain will occur only if its concentration in plasma has increased relative to its competitors. Conversely, if there is a large increase in the concentration of other large neutral amino acids, as occurs when protein is consumed, the increase in plasma tryptophan is relatively small and the brain uptake of tryptophan decreases.

Carbohydrate consumption increases brain synthesis of serotonin, because it provides an increased brain uptake of tryptophan. Under usual brain concentrations of tryptophan, the enzyme converting tryptophan to serotonin is not fully saturated by the substrate. With diet-induced shifts in the availability of tryptophan, synthesis of serotonin is affected.

Carbohydrate and the Sympathetic Nervous System

The effect of carbohydrate on the brain is also reflected in the sympathetic nervous system (SNS). This system regulates many vegetative processes, including blood flow, blood pressure, activity of visceral smooth muscle and glands, and metabolic reactions. Regulation is achieved via body tissues and its communication at these sites through the release of norepinephrine (NE), which exerts physiological and metabolical effects.

Of the three macronutrients, carbohydrate appears to have the strongest influence on SNS activity. Plasma NE levels increase following a meal of glucose but not after a meal of protein or fat (Welle et al, 1981). In humans, about one-third of the observed rise in resting metabolic rate (RMR) during glucose infusion can be accounted for by an increase in SNS activity (Rarussin and Bogardns, 1982).

Carbohydrate, Behaviour and Performance

Normal meals have definite effects on mood and performance in humans. The composition of a meal, for example, protein or carbohydrate content, influences these behaviours (Young, 1993). These effects have usually been attributed to altered serotonin function, because protein and carbohydrate have been found to affect brain serotonin in rats (Wurtman and Wurtman, 1992). Although it is difficult to prove whether serotonin accounts for the acute effects of these two macronutrients in humans (Young, 1993), the effects of carbohydrate consumption on behaviour are clear. They can be illustrated by examining its effect on appetite, sleep, mood and cognition, hyperactivity and physical performance.

Appetite Control

Carbohydrate foods, including those containing simple sugars, are easily recognised by the body as a source of calories and their ingestion leads to decreased appetite (Anderson, 1995; Hill and Prentice, 1995). In general, carbohydrates are more satiating than fats, but less so than protein (Blundell et al, 1994).

Carbohydrates in the form of glucose, fructose, sucrose (table sugar), maltodextrins and starch, when given to humans in preloads or meals, suppress later food intake in amounts roughly equivalent to their energy value (Anderson, 1995; Blundell et al, 1994). Sugars in the amount of at least 50g (about the quantity in one and one-half soft drinks) given from 20 to 60 minutes before a meal, produce a detectable decrease in meal-time intake. The monosaccharide fructose, however, is more effective than glucose in reducing meal-time intake and the desire to eat, when given as the only source of carbohydrate (Rodin et al, 1988). However, when consumed with other carbohydrate, no differences are seen between the different sugar treatments (Stewart et al, 1997). In meals eaten 30 minutes after preloads of cereal with either fructose or surcose added, almost perfect compensation for the preload calories was seen when compared with a no-breakfast (water) preload.

In children, it is clear that both the energy content and sweetness of sugars decrease subsequent food (energy) intake and selection of sweet foods, respectively (Black and Anderson, 1994).

Sleep

Studies in adult humans have indicated that more sleep occurs following a carbohydrate feeding, compared with water. In adult males, a liquid carbohydrate lunch has been reported to provide a longer postprandial sleeping time than no lunch (Zammit et al, 1995). Carbohydrate drinks taken before bed time by older adults enhance sleep duration and quality (Southwell et al, 1972).

In infants, consumption of carbohydrate alone can cause sleep. Based on the serotonin hypothesis, one study provided a 10% glucose feed containing added tryptophan (the serotonin precursor) and reported that newborns entered active and quiet sleep earlier than when receiving a balanced formula (Yogman and Zeisel, 1983). Less dramatic results were obtained in a more recent study in which a 6.7% lactose solution was fed (Oberlander et al, 1992). The failure of the lactose treatment to produce the effects observed when a 10% glucose solution with tryptophan was fed could be expected (Yogman and Zeisel, 1983). Lactose, composed of glucose and galactose, would stimulate much less tryptophan uptake by the brain than the glucose plus tryptophan mixture.

Mood and Cognition

Over the past two decades, there has been considerable effort made to define the effect of short-term nutritional intake on mood and cognition (Zammit et al, 1995; Kanarek, 1997; Kurzer, 1997). It is clear that food intake affects mood, but it is less clear whether carbohydrate is the key component.

Breakfast intake is generally associated with an improvement in cognitive performance later in the morning. In contrast, lunch intake is associated with an impairment of mid-afternoon performance on mental tasks and more negative reports of mood. Intake of nutrients late in the afternoon appears to have a positive effect on subsequent performance on tasks involving sustained attention of memory (Kanarek, 1997). Carbohydrates may play a role in these responses.

The hypothesis that carbohydrate consumption will alter mood because of its presumed effect on brain serotonin has driven much of the research on the relationship between diet carbohydrate and mood. Evidence in support of the hypothesis has been gained from studies of both tryptophan supplementation and tryptophan depletion. Tryptophan supplementation has been used to treat many neuropsychiatric disorders, with variable success (Sandyk, 1992). In normal subjects, supplementation results in a decrease in appetite, an increase in lethargy and sleepiness (Hrboticky et al, 1985). Tryptophan depletion, obtained by feeding subjects an amino acid mixture free of tryptophan, has consistently resulted in a lowering of mood in normal and depressed subjects (Young, 1993). However, most studies, usually conducted at lunchtime, show either no specific effect of carbohydrate or no difference between high and low carbohydrate meals. Generally, mood alterations occur in early afternoon regardless of type of meal. Usually observed is a reduction in vigour, anger and depression scores (Kurzer, 1997; Christensen and Reding, 1993).

In contrast to the inconsistent effect of carbohydrate on mood in healthy experimental subjects, there is strong evidence that individuals make use of carbohydrate to counteract negative mood states (Christensen, 1993). Because a serotonin deficit enhances negative mood states, the drive to consume carbohydrate to correct negative mood status is assumed to be linked to a reduction in serotonin synthesis. Although this link is not

proven, it appears that carbohydrate intake is consumed as a self-administered mood regulator in:

- Tobacco withdrawal symptoms (Bowen et al, 1991).
- Alcohol withdrawal (Rosenfield and Stevenson, 1988).
- Seasonal affective disorders (Krauchi and Wirz-Justice, 1992).
- Obesity (Wurtman and Wurtman, 1992).
- Premenstrual syndrome (Sayegh et al, 1995).

Consumption of carbohydrate has been shown to enhance cognitive function. The beneficial effect of carbohydrate is best shown after acute treatment with glucose drinks. The influence of glucose-containing drinks on cognitive function has been extensively examined in healthy adults. Acute doses of glucose improve cognitive performance in several situations, in comparison to a saccharin-or aspartame-containing palcebo drink (Rogers and Schiff, 1995). In general, the beneficial effects occur within one hour. Some have suggested that the effects may vary with task complexity (Benton, 1990; Holmes et al, 1986) and may be restricted to declarative memory (Craft et al, 1994). Declarative memory is defined as memory that is accessible to conscious awareness; a memory that can be declared or stated (Pinell, 1993). This memory includes episodic memory (specific time and place events) and semantic memory (facts and general information) and is the memory expressed in tests of recall or recognition.

The strongest effect of glucose on memory may be in population with pre-existing memory deficits or vulnerabilities to memory disorders (Azari, 1991). Pronounced improvements in memory occur after glucose drinks are consumed by early subjects (Allen et al, 1996; Gonder-Frederick et al, 1987; Manning et al, 1990; Parsons and Gold, 1992) and by those who are cognitively impaired (Manning et al, 1992). Abundant animal research, showing that glucose attenuates memory impairments caused by drugs other than amnesic agents, supports this notion (Ahlers et al, 1993; Messier et al, 1990; Ragozzino and Gold, 1992; Stone et al, 1988; Stone et al, 1991).

Hyperactivity

A persistent myth about sugar is that it causes hyperactivity in children. The association arises in the minds of parents who have observed that their children are excited at parties, and other celebrations, when sweet

foods are served. Teachers have similar subjective opinions based on the classroom activity of some of their students, perhaps because they would like to have a simple explanation of children's behaviour. As well, a number of poorly designed studies in early literature have given some credence to this myth.

Numerous studies investigating the hypothesis that there is a relationship between sugar intake and children's behaviour have been reported in the peer-reviewed literature of the past 15 years. As summarised by White and Wolraich (1995) results from 14 published studies, representing 16 controlled challenge studies and over 400 subjects, do not support the hypothesis that refined sugar affects hyperactivity, attention span, or cognitive performance in children. To the contrary, a small but statistically significant decrease in motor activity has been observed in some children whose parents believed that they became hyperactive after consuming added sugar and in children whose behaviour had not been considered hyperactive after consuming sugar (Behar et al, 1984; Saravis et al, 1990).

Physical Performance

There is one aspect of human performance that clearly benefits from carbohydrate intake, and that is physical performance. At rest and during low intensity exercise, fat metabolism is the main provider of energy for resting metabolic processes and muscle contraction. However, at higher exercise intensities, the metabolism of carbohydrate reserves, such as blood glucose and liver and muscle glycogen, are the main providers of fuel for muscle when these substrate reach critically low amounts or are decreased, primarily because of reduced availability of substrate for the nervous system (Sherman, 1995).

The optimization of carbohydrate availability to enhance performance has received much interest in the field of sports nutrition, and perspectives have changed greatly in the past fifty years. The timing and frequency of carbohydrate intake at various stages are important determines optimizing fuel availability to maximise performance (Hawley and Bruke, 1997). Pre-exercise carbohydrate feedings are used to optimize substrate availability, whereas post-exercise carbohydrate ingestion promote the re-synthesis of muscle and liver glycogen. Feedings during exercise, based on readily digested carbohydrates or sugars, provide a readily available source of exogenous fuel as stores

deplete. Recognition of this essential role of carbohydrate has led to a marked change in advice over the past forty-five years to athletes performing prolonged exercise (Hawley and Burke, 1997). Forty-five years ago, long distance runners were advised to consume only water after every 5 km past 15 km. Now it is suggested that both water and carbohydrate may be appropriate every 3 km.

Carbohydrates and Maintenance of Health

Carbohydrate provides the majority of energy sources, in the diet of most people. Carbohydrate-containing foods not only provide substrate for energy production, but also carry with them many important nutrients and phytochemicals. They are important in the maintenance of glycemic homeostasis and gastrointestinal integrity and function. High carbohydrate diets (55% or more of energy) are associated with reduced chronic disease, especially obesity and its co-morbid conditions.

Glycemia

Carbohydrates in food are digested to provide primarily glucose in the bloodstream. The effects of food on blood glucose can be compared by means of the glycemic index. Glycemic index (GI) is defined as the incremental area portion of a test food expressed as a percent of the response curve of a 50g carbohydrate portion of a test food expressed as a percent of the response to the same amount of carbohydrate from a standard food taken by the same subject. Using the GI makes it possible to select carbohydrate foods that have the most beneficial effect on metabolism. In general, low GI foods are preferred over high GI foods. The GI of some selected foods is given in Table 2.

It is clear from Table 2 that the GI is affected by the composition of the carbohydrate, and by the presence of factor protein in the food. The glycemic response to common foods such as rice, whole-meal bread, potatoes, and many breakfast cereals is equal to or higher than the glycemic response to equivalent amounts of sucrose. This is because the starch in these foods as legumes, dairy products, and food high in fat is lower than that of sucrose, because they contain components that slow the digestion and absorption of their carbohydrate. The GI of sucrose is only 83% of the GI of the standard, which is white bread. Sucrose's lower glycemic response is explained by the effect of its components,

glucose and fructose. Glucose alone has a GI of 138% relative to white bread, whereas the GI of fructose is only 26% (Wolever, 1990).

Table 2. Glycemic index of selected foods

Food	Index (%)
Bread, white	100
Bread, whole meal	100
Rice, brown	81
Rice, pol., boiled 10-25 min.	81
Ice cream	69
Milk	45
Yoghurt	52
Sucrose	83
Fructose	26
Glucose	138
Beans, baked (canned)	70
Beans, soya (canned)	22
Peas, chick (canned)	60
Potato, new white boiled	80
Potato, mashed	98
Cornflakes	121
Puffed Rice	132
All Bran	74
Potato chips	74

Because sugars create a lower insulin demand than do many starchy foods, there is no metabolic basis for the myth that sugars cause hypoglycemia (Wolever and Brand, 1995). Experimental studies have shown, as well, caloric sweeteners do not cause hypoglycemia.

Obesity

In North America, obesity has been described as an epidemic. In the United States, prevalence of overweight is currently at a high of one-third of the adult population (based on body mass index of > 27.8 for men and > 27.3 for women) (Kuczmarski et al, 1994), and one-fifth of the children. For adults, the increase in prevalence was almost 8% (from 25.4% to 33.3%) between surveys conducted in 1976-80 and 1988-91. For children 12-19 years, the increase in prevalence was 5% (from 15% to 20% for

males and from 17% to 22% for females). Severe obesity, defined as a BMI of 30 km/m^2 or higher, is found in approximately 22% of American adults (Albu et al, 1997).

The main dietary factor contributing to obesity in North America has been judged to be its fat consumption and the resulting high energy-density of foods (Prentice and Poppitt, 1996). Some studies show that the energy intake compensation is less precise at meals that follow the consumption of a preload high in fat, compared with one high in carbohydrate (Hill and Peters, 1996). Many high-fat foods such as ice cream and chocolate contain sugar, which might suggest that sugar consumed in this combination is a factor encouraging excess fat intake (Hill and Prentice, 1995). However, sugar-fat combinations alone are not likely to be the cause of excessive energy consumption. Furthermore, the role of fat per se is uncertain. Dietary surveys have shown that fat consumption has been decreasing gradually in the US during the past 15 years, yet the incidence of obesity continues to increase (Stephen and Wald, 1990). So not only does sugar not appear to be the culprit, but fat intake alone is not likely to be the sole explanation for obesity.

Nevertheless, epidemiological studies show an inverse relationship between carbohydrate intake, including sugars and obesity (Hill and Perntice, 1995), and a direct relationship between fat intake and obesity (Prentice and Poppitt, 1996). For example, a study of 11,626 Scottish men and women aged 25-64 years reported the lowest prevalence of obesity in those consuming the highest total carbohydrate, total sugar, and added (extrinsic) sugars. The highest prevalence of obesity was among those with the highest consumption of fat relative to added sugar (Bolton-Smith and Woodward, 1994). Furthermore, there is no relationship between the amount of sugar available in the food supply of a nation and the incidence of obesity in its population (Ottley et al, 1994).

Given the complex aetiology of obesity, it is far too simplisitic to attribute its origin to the composition of a particular food or of the food supply. Reviews of the literature have led to the conclusion that the prevalence of paediatric overweight is due to the dramatic decrease in physical activity (Dietz, 1996, Schlicket et al, 1994). Fewer than 40% of high school students engage in vigorous physical activity more than three times per week (Heath et al, 1994).

The lower prevalence of obesity in Canada (14%) than that in the United States (22%) has been attributed to the higher activity levels of Canadians, even though the food supply is similar. Therefore, in the presence of an abundant and palatable food supply, the most effective strategy in the prevention of obesity may be high-volume, low-intensity (prolonged endurance) exercise (Bochard et al, 1993).

Excess body fat (obesity) arises very simply from the energy imbalance caused by eating too many calories and using too few of them. The sociological factors accounting for this problem vary from country to country and the understanding of these should be the basis of Programmemes and food-based dietary guidance aimed at the prevention of obesity.

Diabetes

One consequence of obesity is an increased risk of diabetes mellitus. The symptoms are caused by insulin deficiency that results either from decreased insulin production or from a diminished effect of insulin at the cellular level. The most prevalent form of diabetes is non-insulin-dependant diabetes mellitus (NIDDM). It starts most often in adulthood and is associated with obesity.

The major disease-management objectives for NIDDM focus on weight control through energy-reduced diets and increased physical activity. In the 1970s and 1980s, the diabetes associations of many countries began to recommend that fat in the diet should be reduced and the energy replaced by carbohydrate (Wolever and Brand, 1995). The recent FAO/WHO report on carbohydrate in nutrition suggests that consuming a wide variety of carbohydrate foods is now acceptable, and that 60% to 70% of total energy should be derived from a mix of monosaturated fats and carbohydrate (FAO/WHO, 1998). Diabetics should consume high-carbohydrate foods, emphasising fruits, vegetables and whole grains. These foods are recommended because of their slow release of glucose, which reduces the metabolic demands on insulin.

There has been a wide belief that simple sugars should be avoided in the dietary management of diabetes. However, there is no scientific evidence for this belief. Sugars are not more rapidly digested and absorbed than other starches (ADA, 1997). Thus, sugar in moderation is

also now accepted as a component of diets for diabetics, because it has a low GI (Table 2). Sugars have not been directly implicated in the aetiology of diabetes, and recommendations allow intakes of sucrose and other added sugars, providing that: (a) They are not consumed in excess of the total energy allowance; (b) The nutrient-dense foods and non-starch polysaccharide (NSP)-rich foods are not displaced; (c) They are consumed as part of a mixed meal.(CDA, 1992).

Hyperlipidemia and Cardiovascular Disease

Dietary advice for people with coronary heart disease is to reduce the intake of fat and increase the intake of carbohydrate-rich foods, rich in NSP, especially cereals, vegetables and fruits. Certain NSPs, such as beta-glucans, have been shown to have a serum cholesterol-lowering effect when consumed in naturally-occurring foods, in enriched forms, or in dietary supplements (FAO/WHO, 1998).

Hyperlipidemia is the elevation of blood lipids and is believed to be an aetiologic factor in the process of atherosclerosis. There is no evidence that sucrose plays a role in the aetiology of coronary heart disease; however, it has been recognised for years that large amounts of dietary sugars, about two to three times the average consumption, can raise blood lipids.

The potential effect of sucrose consumption on blood lipids is explained partly by fructose's unique metabolic pathway in the liver. There is evidence that it is a better substrate than glucose for lipid synthesis. Therefore, it should not be a surprise to find an elevation of blood triacylglycerol concentrations in some subjects who are given excessive quantities of either fructose or sucrose. However, in studies in which amounts of sugars typical of the Western diet were provided, such responses were not observed, except in some carbohydrate-sensitive individuals (Frayn and Kingman, 1995). There is no evidence that this occurs when the increase in carbohydrate is due to increased consumption of vegetables, fruits and appropriately processed cereals (FAO/WHO, 1998).

Dental Caries

Caries prevalence has decreased markedly during the past 20 years in developed countries despite consistently high sugar consumption (Konigand Navia, 1995). The reason is that tooth decay is influenced by many factors in addition to diet, including oral hygiene procedures, fluoride delivery, bacterial components of plaque, the amount and composition of saliva, type of preventive and restorative care and immunological response of the individual. The consumption of sugar and other fermentable carbohydrates, in the absence of fluoridated water, toothpaste and attention to oral hygiene, does increase the incidence of dental caries. However, it is recommended that when such circumstances exist, the most effective approach is to improve oral hygiene and to use fluoride dentifrices. Dietary restrictions have not proven as effective (Konig and Navia, 1995; Glinsman et al, 1986).

Food Guides

Dietary advice must be transmitted to the public in the form of food-based dietary guidance in order to have an effect on the health status of the population. Food Guides play this role in many countries.

The major nutrition education tool used in many countries is the national Food Guide. Both Canada and the US have developed new Food Guides that incorporate their national dietary guidelines. In the past, the Food Guides concentrated on expressing a dietary pattern that would provide the individual with the essential nutrients in recommended amounts. The new Food Guides are a departure from the past as they recommend a dietary pattern that would not only meet the requirements for essential nutrients, but would also lead to a diet higher in carbohydrate and lower in fat than currently consumed. Both the Canadian and American Food Guides are centred around food groups and both have a new category of foods, one that includes sugars, fats and oils.

The Canadian Food Guide (Health and Welfare Canada, 1992) incorporates the four food groups in a rainbow design. Meat and alternatives are arranged along the small, inner arc. Next come the milk products, then vegetables and fruits, and finally grain products along the large, outer arc. The design gives the visual cue that the greatest quantity of food should be selected from the grains group. A category of

"Other Foods" is identified as not part of any food group, and includes foods that are mostly fats and oils, mostly sugar, high fat or high salt snack foods, beverages, herbs spices and condiments. It is acknowledge that "These foods can be used in making meals and snacks and are often eaten with foods from the four food groups", but it is recommended that they be consumed in moderation. Instructions on using the Food Guide include advice on reducing fat, but no mention is made of reducing sugar.

The US Food Guide (United States Department of Agriculture, 1992) is in the form of a pyramid, showing five food groups, with the grain group at the base. The vegetable group and the fruit group share the next level of the pyramid and on top of these are the milk and meat groups, sharing equally the next level in the pyramid. The visual impression is that one should consume less of those foods higher up the pyramid. At the very top is the category of fats, oils and sweets. The consumer is advised that "These foods supply calories, but little or no vitamins and minerals".

Thus, both the Canadian and American Food Guides are designed to help the individual select carbohydrate food as the foundation for a healthy diet. Food selection based on the Food Guides will provide 55% of the energy, of greater, from carbohydrate. Explicit in the Guides is also a recognition of the role of all forms of carbohydrates, including the sugars, oligosaccharides and polysaccharides and that food carbohydrates are more than an energy source. Foods containing carbohydrate brings with them a wide array of nutrients and other metabolically and physiologically active components, such as fibre and phytoestrogens, which are beneficial to health. As well, the carbohydrate sweeteners are important not only for their contribution to hedonic value, but for their role in food preparation, such as bread making and preservation. As 10-12% of dietary energy, added sugars provide an important contribution to the benefit of carbohydrate consumption. Although the role of sugars in the diet and their effect on health has been controversial in the past, all recent evaluations (Anderson, 1997; Schneeman, 1995) have concluded that current consumption levels in the developed countries are consistent with healthy diets. With the exception of dental caries, sugars do not have any specific role in the aetiology of chronic disease.

The recent FAO/WHO report recommends that in choosing carbohydrate foods, both glycemic index and food composition be

considered. It will be some time before complete knowledge of the GI of foods is available, although considerable information has been derived (Wolever, 1990). In the meantime recognition of the determinants of GI can help in perspective the metabolic, physiological and behavioural effects of consuming food carbohydrates.

Conclusion

Carbohydrate consumption has beneficial effects on human behaviour including appetite, sleep, mood, cognition and physical performance. The optimum intake of at least 55% of total energy from a variety of carbohydrate sources is associated with the maintenance of health and avoidance of chronic disease.

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DIETARY FAT AND CHRONIC DISEASES

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Introduction

Dietary fat intakes are implicated in the aetiology of many of the major diseases responsible for mortality in developed countries. Thus several components of dietary guidelines issued in these countries concern advice on the amount and type of fat that should be eaten (Table 1). In general populations are advised to reduce the total amount of fat consumed from an average intake of approximately 40% of total energy intakes to 30-35% (DHSS, 1991; NCEP, 1988). Advice on the type of fat to eat is given in terms of the three major classes of fatty acids. Saturated fatty acids (SFA) should not exceed 10% of average energy intakes, polyunsaturated fatty acids (PUFA) should contribute up to – but not exceed – a further 10% of energy intake, while monounsaturated fatty acids (MUFA) should represent the major type of fat eaten (10-15% of energy intake on average). In some countries, for example the UK and Ireland, more detailed advice is given where it is recommended that intakes of trans unsaturated fatty acids, which are estimated to contribute an average of 2% of energy in the UK, should not increase further, and that PUFA of the n-3 series should be increased.

The rationale for these recommendations is mainly based on what is known about the relationship between diet and cardiovascular disease where an extensive field of research focuses on fat intakes in particular. Diets which provide a high proportion of energy intake as fat contribute to the development of obesity, especially in cases where physical activity levels are low. Obesity and low physical activity levels are, in turn, major risk factors for Non-Insulin-Dependent Diabetes Mellitus (NIDDM). Both obesity and NIDDM promote the development of cardiovascular disease. In contrast to cardiovascular disease relatively little is known about the relationship between dietary fat and cancer. Nonetheless current dietary guidelines on fat intakes reflect what is understood about the prevention of cancer.

Table 1. Dietary guidelines of fat intakes.

Fat	UK Population	US NCEP1	US NCEP2
Total fat (%)	</=33	<30	<30
SFA (%)	</=10	<10	<7
MUFA (%)	--	10-15	10-15
PUFA (%)	<10 (n6+n3)	<10	<10
Trans (%)	</=2		
Cholesterol (mg/day)	245	<300	<200

Obesity and NIDDM

Spiraling increases in the prevalence of obesity have been reported in Britain and the US over the past decade. A recent review (Prentice and Jebb, 1995) outlines how, in Britain, average fat intakes have been significantly increasing and physical activity levels have been significantly decreasing in the years when obesity prevalence was growing dramatically. Other experimental work supports the hypothesis that the interaction between a high fat diet and low physical activity levels may be a significant factor in the phenomenal increases in obesity prevalence observed in developed countries over recent years (Astrup et al, 1994).

Strong support for the fattening effects of a high fat consumption is evident in the recent report from the Scottish Heart Study which included over 11.000 men and women (Bolton-Smith and Woodward, 1994). This study found that the leanest adults used carbohydrates (including sugar) as a dietary energy source rather than fat while the opposite was true for the most obese adults; the leanest adults had the lowest intake of fat and the highest intake of carbohydrates (including sugars), while the most obese adults consumed the highest amount of fat and had the lowest intakes of carbohydrates. Many dietary studies have found that low fat intakes are usually associated with high sugar intakes

and vice-versa. In fact this is often referred to as the fat-sugar see-saw. The inverse relationship between dietary intakes of fat and sugar suggest that recommendations which advise populations to reduce fat and sugar intakes simultaneously may be unrealistic.

The recent surge in incidence of NIDDM mirrors the trends in obesity discussed above and reflects the strong association of obesity and NIDDM. A recent report from the Centre for Diseases Control in Atlanta (Table 2) outlines the importance of obesity prevention (which emphasizes a reduction in fat intakes) and increased physical activity to counteract the atherogenic lipid profile associated with NIDDM, and is discussed in the section on PUFAn-3.

Table 2. US diabetes cases at record level.

1980-1994:	+33% increase in blacks +11% increase in whites
Risk factors:	Older age, race Ethnicity, family history Obesity and physical inactivity

Cardiovascular Disease

Dietary fat mediates its effects on cardiovascular disease through atherogenic and thrombogenic factors. Atherosclerosis is a long-term process beginning in teenage years. In general, the atherogenicity of dietary fat intakes can be assessed in terms of blood lipid concentrations which are an important focus for primary prevention Programmemes. Thrombosis is less well understood and although it is likely to be involved in the development of atherosclerosis, it is a much more acute process (Pearson et al, 1997). Anti-thrombogenic factors can, therefore, be much more effective in reducing the risk of acute events in cases where atherosclerosis is established, for example, middle-aged men in populations where cardiovascular disease is prevalent, or in secondary prevention (in patients with established cardiovascular disease). The latter was demonstrated clearly in the Diet and Reinfarction Trial where men (n2033) post myocardial infarction, who were randomised to receive the anti-thrombogenic diet therapy of PUFAn-3 (oily fish), were found

after two years to have experienced a significant reduction in mortality compared with the group receiving anti-atherogenic intervention (Burr et al, 1989) (Table 3).

Table 3. Effects of different dietary interventions on death and Ischaemic Heart Disease (IHD) event in men (n2033) post myocardial infarction.

Dietary advice	*RR* of death*	*RR of IHD event*
Fat	0.97	0.91
Fish	0.71**	0.84
Fibre	1.27	1.23

*RR-relative risk **p<0.05

The effects of the very strict NCEP Step 2 (Table 1) on the plasma lipoprotein profiles in 72 men and 48 women were recently reported from a meta-analysis of five previously published studies (Schaefer et al, 1997) and discussed in an editorial review (Krauss, 1997). There was a large variability found in the blood lipid response to this diet and this was found to be mainly due to genetic influences in men and age in both sexes. The environmental factors were as well controlled as possible in that all food and drink was provided during the study, body weight was stabilized, alcohol and vitamin supplements were excluded, subjects on lipid lowering medication, and those with disorders likely to affect results, were excluded. Age and genetic factors were able to explain 48% of the variance in Low density lipoprotein (LDL) response in men while age explained a corresponding 13% of the variance in women.

The authors conclude that baseline LDL cholesterol concentrations, as a marker of genetic background, are the primary determinant of LDL response to an NCEP Step 2 diet in men. However, the decline in LDL cholesterol may be overestimated by predictive equations based on changing the dietary fat composition in men with low LDL cholesterol concentrations and may be underestimated in those with elevated levels. The determinants of variability of LDL response in women are less clear but age appears to play a role.

Individual Fatty Acids Vs. Major Classes of Fatty Acids

Considering that dietary guidelines on the type of fat which should be eaten are issued in terms of the three major classes of fatty acids – SFA, MUFA and PUFA – the highly variable effects that individual fatty acids (even those within the same class) have on blood lipid concentrations may seem surprising. The changing emphasis from the major fatty acid classes to individual fatty acids is described very well by Kris-Etherton and Yu (1997). The variable effects of individual SFA, MUFA and PUFA on total blood cholesterol, LDL cholesterol and high density lipoprotein (HDL) cholesterol may be due to the potency of myristic acid at raising blood cholesterol levels which can be compared with the neutrality of stearic acid.

Considering unsaturated fatty acids: although oleic acid (MUFA) has a neutral or mildly hypocholesterolaemic effect compared with the more potent hypocholesterolaemic effects of linoleic acid (PUFAn-6), nonetheless the beneficial effects of oleic acid on HDL cholesterol levels are likely to be clinically significant.

Trans Fatty Acids

A trans fatty acid occurs when the isomeric configuration of the hydrogen carbons at a double bond position are changed from the normal cis configuration – where both atoms are on the same side of the carbon chain – to the trans configuration where the atoms occur on different sides of the carbon chain. In the normal cis configuration there is a 'kink' in the molecule which does not allow the fatty acids to fit closely together – thus resulting in greater fluidity – and the fat will be lipid at room temperatures. The trans configuration results in straighter molecules which like SFA fit closely together and are solid at room temperature.

There are different dietary sources of trans fatty acids (Table 4). Some occur naturally in dairy foods and meat due to the hydrogenation of palmitoleic and linoleic acid in the rumen of cattle by bacteria. This hydrogenation occurs at temperatures of 37^0C in the presence of hydrochloric acid. The types of trans fatty acids produced from animal sources have been part of the human diet for generations.

Table 4. Relative risk of coronary heart disease (CHD) in 69,181 women relative to trans fatty acid intake.

	Quintiles of trans fatty acid intake				
	1	2	3	4	5
Total trans isomers	1.0	1.23	1.11	1.36	1.67*
Vegetable sources	1.0	1.43	1.11	1.39	1.78*
Animal sources	1.0	0.76	0.69	0.55	0.59

*$p<0.05$

Early this century the process of hydrogenating vegetable and marine oils to manufacture hard fats which are useful for the production of margarines, cakes and biscuits was started. This introduced a new range of trans fatty acids into human diet. These vegetables and marine sources of trans fatty acids are produced by passing hydrogen gas over the oils at very high temperatures in the presence of a catalyst. The hydrogenation of double bonds occurs more randomly and there is also a tendency for positional isomerisation to occur (where the double bond migrates up or down the carbon chain). The variety of different isomers, both trans and positional, produced by this process is manifold. In the case of the highly unsaturated marine oils the majority of fatty acid isomers produced by hydrogenation remain unidentified.

Total dietary intakes of trans fatty acids have been declining in recent years particularly those of vegetable and marine origin. Currently average intakes of total trans fatty acids are estimated to contribute 2% of energy in the UK diet[1] and 2.6% of energy in the US diet. In the Gulf region intake of trans fatty acids is likely to be low and vegetable and marine sources of trans fatty acids would not be an issue for those following the traditional diet of the area.

A large prospective study of coronary heart disease risk among women reported that the relative risk of developing heart disease was increased by 67% for women having the highest, compared to those having the lowest, intakes of total trans fatty acids. From food intake data this American study was able to determine that this risk was associated specifically with trans fatty acids from vegetable sources only (where the risk increase was 78%) and that there was no increased risk associated with the consumption of trans fatty acids from animal sources (Willett et al, 1993).

Another study provides further evidence of the negative effects of trans fatty acids where high dietary intake (9% of energy intakes) of elaidic acid (t18:1) was found to significantly elevate lipoprotein (a) (Lp(a)). Lp(a) is a lipoprotein that is associated with atherosclerosis and thrombosis and blood concentrations were previously understood to be wholly determined genetically. However, the high intakes of elaidic acid (t18:1) used in the experimental diets (9% of dietary energy) are unlikely to occur in the diet under normal circumstances (Aro et al, 1997).

PUFAn-3

Oily fish is the main dietary source of PUFAn-3 fatty acid eicosapentaenoic acid (EPA;20:5) and docosahexaenoic acid (DHA;22:6). How ingestion of these fatty acids can invoke an anti-thrombogenic response is described by Simopoulos (1991). Dietary intakes of PUFAn-3 inhibit the production of PUFAn-6 (arachidonic acid: AA;20:4) from linoleic acid. EPA replaces AA in phospholipid membranes and competes with AA for enzymes to produce a different series of eicosanoids in plarelets and endothelial cells which have an anti-aggregatory effect. In addition EPA competes with AA and produces leukptrienes series 5 instead of the leuktrienes series 4 produced by AA. The balance in favour of leukptrienes series 5 has anti-inflammatory effects which may be significant for the management of chronic inflammatory disease such as arthritis and inflammatory bowel disease. Recently it has been postulated that leukoptrienes series 5 may be protective against cancer (Kohlmieir and Mendrz, 1997).

The balance between PUFAn-3 and PUFAn-6 have, therefore, important implications for health. It is a matter of concern that the dramatic changes in human fat intakes, which have occurred over the last 100 years or so, have resulted in a much higher ratio of PUFAn-6: PUFAn-3 (Simopoulos, 1991). Considering the effects of PUFAn-3 this may be significant in relation to cardiovascular disease and cancer.

PUFAn-3, Hypertriacylglyceridaemia and NIDDM

Dietary intakes of PUFAn-3 have potent triacylglyceride (TAG) lowering effects and variable effects on LDL and HDL concentrations. With increasing dietary increments of EPA and DHA there is a corresponding

decrease in blood concentrations of total TAG and the main TAG carrying very low density lipoprotein (VLDL) (Kris-Etherton et al, 1988). This has clinical relevance for subjects at risk of hypertriglyceridaemia such as obese patients, patients with NIDDM and post-menopausal women for whom the combination of hypertriacyglyceridaemia with low HDL concentrations represents an atherogenic profile.

A recent post-prandial study of post-menopausal, non-diabetic women (n10) examined their response to the recommended low fat (25%) high carbohydrate (60%) NCEP step 2 diet compared with a high fat (45%) low carbohydrate diet (40%) (Jeppesen et al, 1997). These workers found that the low fat, high-carbohydrate diet yielded a more atherogenic response in blood lipid concentrations. Furthermore this study also found that the low fat, high carbohydrate diet had a more adverse effect on post-prandial insulin concentration (Jeppesen et al, 1997). These findings question the wisdom of advising post-menopausal women to adopt very low fat diets. It also has implications for subjects with abnormal glucose control who tend to develop hypertriacyglyceridaemia.

A recent report from a large multi-centre study, which included over 400 male and female patients with NIDDM, suggests that PUFAn-3 given as a small daily dose of EPA and DHA (equivalent to a potion of oily fish) can be effective at ameliorating hypertriacylglyceridaemia without adversely affecting glycaemic control (Sitori et al, 1997). The TAG-lowering response was more significant in diabetics whose HDL levels were initially low. Previous studies have yielded inconsistent findings about the effects of PUFAn-3 on glycaemic control.

This recent study involved a 6 month follow-up period and the protocol did not allow any change in oral hypoglycaemic agents. The authors conclude from their findings that a moderate dose of PUFAn-3 can provide a suitable option for the management of patients with hypertriacylglyceridaemia including those who have abnormal glucose control (Sitori et al, 1997).

Dietary Fat and Cancer

Investigating the relationship between dietary fat intakes and cancer is inherently difficult due to methodological problems. This review will outline the direction of current research on the role of dietary fat in relation to the cancers affecting the colon and the breast.

The association between meat intakes and incidence of colon cancer is apparent in international comparisons using data on per capita meat consumption[18]. However, there are many other differences between these countries besides their meat consumption pattern which may equally define their risk of colon cancer. Greeks, for example, enjoy high intakes of meat but have a low risk of developing colon cancer. Within high risk countries a high fat intake and a low consumption of fruit and vegetables are positively associated with risk of colon cancer which may be important risk factors associated with a high fat intake (Bingham, 1997).

International cross-country comparisons show a similar positive association between fat intakes and the incidence of breast cancer. However this has not been shown in prospective studies: "in large prospective epidemiological studies, little evidence has been seen to support any major positive association between dietary fat and risk of breast cancer over the range of 15-45% or more of energy from fat" (Willett, 1997). However recent studies indicate that individual fatty acids, rather than the total amount of fat or the major classes of fatty acids, may provide the key to how fat intakes may be associated with an increased risk of breast cancer (Kohlmieir and Mendez, 1997). There is no evidence to link intakes of saturated fatty acids as a class with breast cancer. While there is no evidence of a protective effect of MUFA per se, there have been a number of studies suggesting a protective effect of olive oil (higher socio-economic status of high olive oil consumers). Animal studies suggest that PUFAn-6 may have a carcinogenic effect while PUFAn-3 may be protective due to the production of leukotrienes series 5. Finally, the Euramic study, which included adipose tissue biopsies found an increase in breast cancer risk associated with the greatest stores of trans fatty acids.

Conclusion

A reduction in fat intakes combined with an increase in physical activity levels is recommended to reduce the increasing prevalence of obesity. While increased physical activity is known to be directly effective in reducing insulin resistance, a reduction in the prevalence of obesity will have a 'knock-on lowering effect on NIDDM incidence.

A moderate reduction in fat intakes diets combined with an increase in PUFAn-3 may reduce cardiovascular risk in subjects with hypertriacyglyceridaemia (patients who are obese or have NIDDM, and post-menopausal women). Intakes of individual fatty acids rather than of the major classes of fatty acids may be more critical in determining risk of cardiovascular disease. Intakes of individual fatty acids may explain the relationship between dietary fat and cancer.

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MICRONUTRIENTS, VITAMINS, MINERALS AND BIOLOGICALLY ACTIVE NON - NUTRIENTS AND HEALTH

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Introduction

The wider roles of various micronutrients and biologically active non-nutrients in health and nutrition are being appreciated as newer knowledge is now available in this context. Vitamins and minerals are very diverse in function, being essential for normal growth and development, utilization of the macronutrients , maintenance of adequate defenses against infectious diseases and many other metabolic and physiological functions. They are also known to be important in prevention of infectious and chronic diseases. Vital anti-oxidant properties have been ascribed to micro-nutrients such as vitamins A and C and zinc , which are profoundly beneficial during various stages of the life span. Diets deficient in vitamins and essential minerals can therefore have serious metabolic and physiological consequences.

In recent years, food based dietary guidelines (FBDGs) have been developed and are being suitably tested and used as effective and practical means of assisting people to achieve appropriate nutritional goals, in various Asian countries. The thrust of the FBDGs is mainly to help individuals make correct food choices with an emphasis on varying dietary patterns and benefits of nutritionally balanced diets. The multiple roles of foods with respect to their overall nutritional contribution have been conveyed in the FBDGs, but lesser focus has been given to foods in terms of their contribution of micronutrients and biologically active non-nutrients to the diet. Their inclusion in diets, through a wide variety of available food sources of both plant and animal origin, actual amounts to be taken as foods either alone or in combination with other foods /items, and the actual minimum amounts to be regularly taken, need to be outlined. The present FBDGs provide clear messages for daily inclusion of a variety of foods from the food

groups, but alongside, there is a need to examine the requirements and intake of dietary micronutrients and non-nutrient, biologically active compounds.

This paper will highlight the current knowledge about micronutrients most relevant for dietary guidance and will also discuss non-nutrient, biologically-active compounds commonly found in foods such as anti-oxidants, flavonoids, phenols, etc. that may have an important effect on health and reduce the risk of diet-related chronic disease.

Meeting dietary micronutrient requirements

Deficiency of a single micronutrient seldom occurs in isolation, but exists in the context of dietary inadequacies, deprivation and multiple micronutrient deficiencies. In the South East Asia region, the micronutrient deficiencies of concern are vitamin A, iron, folic acid, zinc and to a lesser extent calcium, riboflavin and ascorbic acid (Florentino, 1996). The persistence of these problems is mainly due to qualitatively and quantitatively faulty diets. The problem of iron deficiency anemia (IDA) is widespread throughout the region arising from poor bio-availability of iron and related nutrients in diets that are monotonous, lacking in dietary variety. Iodine deficiency is prevalent to varying extents in the region and zinc deficiency is also not uncommon.

a) Food sources and quantities

Micronutrients are widely present in a common variety of foods and meeting their requirements in the daily diet calls for wise food selection. Figure 1 shows the groups of micronutrient food sources, which can be recommended for inclusion through the FBDGs.

Micronutrients such as vitamin A, iron and folic acid are present in dark green leafy vegetables (DGLVs), while yellow-orange vegetables (YOV) and fruits furnish vitamins A and C in substantial amounts. Flesh foods such as meat and its products including liver, provide good quality iron present in haem form which is a well absorbed source. These foods also provide vitamin A as a valuable preformed source. Certain sea foods (shell fish) are excellent sources of zinc and calcium, and most fish varieties additionally provide essential fatty acids (alpha linolenic acid) which exert a beneficial role in the prevention of degenerative diseases.

These fatty acids are also found in small amounts in a variety of dark green leafy vegetables, seeds, walnut and some beans, which when taken in adequate amounts can provide the requirements of alpha linolenic acid in vegetarian diet.

A daily intake of at least a bunch of DGLV and / or YOV as one serving of DGLV or YOV preparation or in salad form, and one yellow-orange fruit or sour fruit of citrus variety, should be recommended in the FBDGs so as to provide the package of vital micronutrients and other essential nutrients for the day.

Figure 1. Foods and their 'package contribution' of micronutrients

Food source/group	Major micronutrients furnished
1. Meat, fortified dairy products, liver and organ meats, egg yolk, sea food and fish liver oils	Vitamin A (as retinol), riboflavin, vitamin K, vitamin B12, zinc, iodine and iron (exception of milk being a poor source of iron)
2. DGLVs	Vitamin A as beta-carotene, iron, folic acid, vitamin C, vitamin B6, vitamin K, vitamin K, riboflavin, calcium and phosphorus
3. YOVs, red coloured vegetables	Vitamin A as beta-carotene, vitamin C in certain cases, folic acid, non-provitamin A carotenoids,valuable non-nutrient components
4. Whole grain cereals, millets and enriched breads, nuts, seeds and dry beans	Thiamin, riboflavin, niacin, iron, calcium, chromium
5. Organ and lean meats, fish, shell fish, pulses and legumes, brewer's yeast	Vitamin B12, riboflavin, zinc

Good food sources of iodine (seaweed and seafood) are highly perishable, culture specific and are often expensive. Iodized salt is the commonest micro-nutrient fortified food which should be suggested for daily inclusion in the diet for habitual cooking. Prevention and control of iodine deficiency thus entails the mandatory use of iodised salt in the daily diet.

On the whole, a greater extent of elaboration on dietary diversity, food and food group selection, and appropriate food combinations with specific emphasis on micronutrient rich food quantities are additional essential elements that need to be incorporated in the FBDGs.

b) Dietary variety and diversity

In view of the widespread presence of several essential micronutrients in common foods and food groups, it seems justifiable to recommend a variety of foods to incorporate a diverse food selection. The appropriate and proportionate food combination of staple grains, flesh foods and vegetables along with a regular intake of fruits should be emphasized. FBDGs should precisely indicate a variety of micronutrient sources in order to provide the wide spectrum of nutritional benefits from similar foods or food groups. Guidance for appropriate food selection can then help to meet recommended standards for dietary requirements.

In addition to dietary variety and diversity, there is need to suggest a regular and frequent intake of these foods daily or every other day, depending on the habitual dietary pattern and practices and micronutrient requirements. There will also be a need to indicate minimal daily amounts of fat usage in the diet, which is essential for absorption and utilization of beta-carotene. Fats and oils may also serve as good sources of vitamin E, and meat, milk, pulses and legumes are valuable sources of protein. This combined intake of foods will serve to enhance beta-carotene utilization. Often, monotonous cereal-based diets contain a preponderance of foods that inhibit micronutrient utilization such as iron. The absorption of iron from such diets can sometimes be very low (as low as 3-4%) (NIN, ICMR, 1974 &1975) and can be improved only through dietary variety, diverse food selection and correct food combinations.

c) Bioavailability of micronutrients

Bioavailability of micronutrients in the diet can be affected, especially with reference to micro nutrients like iron. It is very difficult to obtain enough iron even from a variety of plant foods, since they have the inherent presence of natural inhibitors such as phytates, oxalates, polyphenols and tannins. Due consideration should be given to the inclusion of *enhancers and appropriate food combinations in the daily diet through the FBDGs* so that iron absorption can be improved. A diversified diet containing generous quantities of meat, fish, poultry and foods rich in ascorbic acid will have high bioavailabilty and its intake should be promoted through the FBDGs.

Taking a vitamin C rich fruit or a sour or citrus variety fruit as part of a meal or alongside should be emphasized, as vitamin C is known to enhance iron absorption in meals. In certain developing Asian countries where the meat intake is low, ascorbic acid is the single most important factor of iron absorption. Addition of a vitamin C rich food to a meal i.e. in the form of fresh and raw vegetables or fruits [e.g. 100 g of cabbage or 200 g amaranth or one serving of cabbage salad/amaranth stir fried preparation, one fruit such as an orange/lemon or a slice of guava] will help to double the absorption. Similarly, typical inclusion of tamarind, gooseberries, tomatoes, lemon, (sour fruits) in most Asian food combinations or meals seems valuable in improving iron absorption, and should be encouraged through the FBDGs.

Certain food substances inhibit iron absorption, especially when the food source of iron is in non-haem form (those available from plant sources) and should be avoided or restricted in use. Examples of such foods are tea, coffee, egg yolk, soy protein products, nuts, legumes and bran (McGuire,1993).

In several Asian countries such as India, tea is commonly taken by a large majority of people as a habitual practice. Drinking of tea, especially strong tea with or shortly after a meal has a marked inhibitory effect on iron absorption. Soy protein can also impair iron absorption especially when it is used a meat substitute. However because of the intrinsically high content of iron in soy protein products, the net effect of their addition to a meal is to increase rather than decrease the total amount of iron absorbed. Though phytates, which are present in wheat and other cereals, markedly reduce iron absorption, the inhibitory effect can be

counteracted with ascorbic acid. Similarly polyphenolds in nuts and legumes inhibit iron absorption and this can be mitigated by adding an ascorbic acid food to the meal. A typical Thai meal for example, composed of rice, vegetables and spices will yield 0.16 mg of absorbed iron, but this will more than double to 0.40 mg with the addition of some fish. A Latin American diet providing 0.17 mg of iron from a meal consisting of maize, rice and black beans would provide an absorption increase of 0.41 to 0.58mg, if vitamin C through 125 g of cauliflower (one serving quantity) is added (NIN,ICMR,1975;INACG,1981; WHO 1989).

Substitution of food sources of highly available zinc such as milk, meat and fish by vegetable sources of protein rich in phytic acid can interfere with zinc absorption. Zinc absorption is found to vary from 10-30% and is dependent on interactions with other nutrients such as phytates and fibres (WHO/FAO, 1996). Zinc in human milk is also well absorbed and it seems essential to encourage the practice of exclusive breast feeding through the FBDGs especially in the first three months of life.

By and large, suitable food combinations such as enriched cereal-pulse preparations with DGLV and a citrus fruit should be encouraged as part of the daily meals, through the FBDGs. Several such food combinations need to be planned and precisely suggested in the context of a varied and diverse diet /meal pattern suited to individual country applications and practices. FBDGs can thus help to improve the bioavailabilty of micronutrients in diets through use of certain foods. Fruits offer the greatest potential, being high in ascorbic acid and citric acid. For example, papaya emerged as the strongest enhancer of iron absorption followed by guava, orange and zizphyus (INACG ,1981).

Dietary habits are likely to play an important role in this regard, and should be taken into account while making recommendations through the FBDGs. Populations should be persuaded to add these foods (enhancers) to cereal based diets and consume fruits and vegetables at all meal times, which can have a positive effect on micronutrient availability.

d) Dietary nutrient density

The nutrient densities of diets depend on an adequate consumption of energy especially for adults and adolescents. For example, if the energy intake of the diets of adolescents or adults is less than 2000 kcal per day,

it is unlikely that their mineral and vitamin requirements will be met. The recommendations of intake of micronutrient-rich foods should be relative to mean energy requirement for a given age and gender group. Precise indications for consumption of DGLVs , YOVs and fruits along with specified food quantities of cereals, pulses, other staples , energy-rich root vegetables, fat and sugars should be given in the FBDGs.

A diverse diet using a variety of micronutrient foods in combination with staples is shown to enhance the micronutrient density and bioavailability in the diet. Diets using white rice/corn-tortilla along with pulses/beans and YOV and DGLV are found to have a higher micronutrient density and should be encouraged in planning dietary patterns and meals. The main purpose of using micronutrient density is to evaluate the adequacy of diets at the household level, where most members eat a common family diet.

e) Cooking practices and food processing

Strengthening of beneficial and traditional cooking practices and common household processing methods should be reflected in the FBDGs. Apart from the fact that cooking is required to ensure digestibility and safety of food taken every day, it also involves mixing of foods or perhaps more commonly adding food items to the main food being cooked, which may alter the nutritive value of the main food but is usually intended to make the food, dish or meal taste better (Latham, 1997).

Cooking practices

Stewing (using onions, tomatoes, and small pieces of meat), cutting vegetables into larger pieces and cooking for shorter periods, avoidance of repeated washing of grains/millets, cooking in minimal or just enough quantities of water, steaming, stir frying and roasting are some of the desirable cooking practices which contribute to micronutrient retention, and should be clearly recommended for daily use through the FBDGs

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Approximately 50-80% of vitamin C originally present in food can be lost during cooking. Moreover, the vitamin C content of food that is cooked and left standing decreases considerably and reheating reduces it still further. The consumption of fruits and vegetables in raw form overcomes

this problem, and should be emphasized in the FBDGs. The risk of gastrointestinal infection from intake of raw vegetables, especially if not properly washed, however, should not be ignored, and FBDGs need to stress this point.

Household food processing

Germination and malting of grains have been used successfully to prepare a variety of weaning foods, snacks and food mixes which can be regularly taken in the daily diet, especially by vulnerable groups. Germination of some cereals and legumes for 24-48 hours is associated with the appearance of 10-70 mg of ascorbic acid per 100g, an 8-25% reduction in tannin concentration, and a 25-35% decrease in phytic acid concentration. The bioavailability of iron from such germinated grains, as determined *in vitro*, increases almost 2- fold. Malting of millets has shown a 5 to 10 fold improvement in iron bioavailbilty (WHO, 1989).

Fermentation of foods is known to increase the absorption of non-haem iron, and may be encouraged in dietaries. A wide variety of traditional fermented foods is consumed in the Asian region and this could be promoted to advantage to enhance the micronutrient quality of meals. Such foods provide micronutrients in easily assimilable form, are often culture specific, introduce dietary variety, reduce the bulk of cereal based diets and should be encouraged through the FBDGs.

f) Condiments, spices and salt

These are necessary accessory food items used to flavour meals and improve the palatability in most Asian diets. Since they are usually used in small amounts, their contribution to micronutrient intake is limited, but their judicious inclusion in the diet should be encouraged through FBDGs.

Condiments like chillies and coriander provide some beta carotene and vitamin C and can 'add on' to the dietary micronutrient intake when used in the preparation of sauces, adjuncts, relishes, preserves and pickles indigenous to the Asian region. Some spices (turmeric) contain a high level of tannin, which may interfere with iron absorption.

Spices also contain several pharmalogically active substances like choline, biogenic amines, etc. Some of them, like asafoetida and garlic, have an antibacterial property and inhibit putrifying bacteria (Gopalan et al, 1993). Their intake can be encouraged through FBDGs.

Intake of iodised salt, no more than 2 teaspoons /day, is to be emphasized as an essential dietary practice. Restricted or limited use of salt may also be indicated in FBDGs specifically in view of the adverse effects of excess intake over time or in specific health conditions.

Consideration of biological anti-oxidants in dietary requirements and FBDGs

It is well established that free radicals, especially superoxide and other reactive oxygen species such as hydrogen peroxide are continuously produced in vivo. (Halliwell and Gutteridge, 1989). Superoxide in particular is produced by leakage from the electron transport chains within the mitochondria and microsomal systems or formed by activated phagocytes to combat infection by microorganisms or foreign substances. To cope with this, aerobic tissues contain endogenously-produced anti-oxidant enzymes, viz superoxide dismutase, glutathione peroxidase, catalase, etc, and several exogenously-acquired, radical-scavenging substances such as vitamins E and C and the carotenoids. The protective role of tissue integrity is also to be considered in the context of redox imbalance and antioxidant requirement.

A variety of fruits and vegetables provide the much needed antioxidants through micronutrient and non-nutrient food components that can confer protective qualities to the diet and human system.

a) Protective nutrient intake

Regular and increased intake of foods which provide these antioxidants and protective components should be considered in view of the mounting evidence of their beneficial nutritional effects and protection against cancers. The concept of protective nutrient intake refers to an amount greater than the recommended nutrient intake (RNI) that may be protective. For example, intake of vitamin C with a meal to promote iron absorption or folic acid to lower the risk of neural tube defects is suggested and amounts to be consumed within a meal should be clearly

indicated. Citrus fruits are known for their high vitamin C content, which as an antioxidant may protect cell membranes and DNA from oxidative damage. Vitamin C may further help prevent cancer via its ability to scavenge and reduce nitrite, thereby reducing substrate for the formation of nitrosamines (National Research Council Committee on Diet and Health, 1989). Citrus fruit also contain coumarins (found in some vegetables) which is shown to increase the activity of glutathione transferase, a detoxification enzyme.

Green leafy vegetables contain lutein, a carotenoid and xanthophyll pigment that has no vitamin A activity, but as an antioxidant may protect against cancer via its ability to block damage by free radicals. Green leafy vegetables are a rich source of folic acid, a deficiency of which may lead to chromosomal damage at sites thought to be relevant to specific cancers (MacGregor et al, 1990). Orange vegetables such as carrots, sweet potatoes, winter squash and pumpkin are relatively rich sources of beta-carotene, as are fruits, including papaya, mango and cantaloupe. Beta carotene, like other carotenoids, is an antioxidant; through this function it may protect against free radical damage. Orange vegetables contain alpha-carotene, which is an antioxidant and a vitamin A precursor and which may inhibit cell proliferation. Tomatoes are rich in lycopene, another antioxidant carotenoid.

Vegetables also contribute vitamin E to the diet. Although the major sources are vegetables and margarine, vitamin E, as an antioxidant, protects polyunsaturated fatty acids from oxidation and also keeps selenium in a reduced state, thus facilitating the antioxidant capacity of selenium. Flavonoids present in vegetables and fruit (also present in tea and wine) are polyphenolic antioxidants, and defend the cells against the ump-mediated effect of certain carcinogens (Phang et al 1993)

b) Non-nutrient food components

Several compounds of interest have been investigated as anti-nutrients, including phytates, anti-trypsin and other enzyme inhibitors, tannins, phenolic compounds and lecithins. These non-nutrient components are likely to gain increasing nutritional significance and will constitute an important rationale for FBDGs. When diets are marginally adequate nutritionally, these anti-nutritional factors may have implications causing nutritional and health concern. By contrast, in diets which are nutritionally adequate, these compounds are likely to exert beneficial health effects. (WHO/FAO, 1996).

Many of the non pro-vitamin A carotenoids appear to have significant biological activity in humans. For example, lycopene, abundantly present in tomatoes and water melons, does not have vitamin A activity but is a powerful trapper of singlet oxygen (Goodwin, 1986). Other carotenoids lacking in pro-vitamin A activity are readily absorbed from the diet and distributed to tissues. Lutein and zeaxanthin for instance are selectively concentrated in the retina, and their dietary intake may be correlated with a reduced risk of age-related macular degeneration (AMD). Some carotenoids and plant derived polyphenols also possess anti-oxidant activity and reduce oxidative stress, which may be the basis for their association with reduced risk of some forms of cancer and coronary heart disease (Hertog et al, 1995).

The types of vegetables or fruit that appear to be most protective against cancer are raw vegetables, followed by allium vegetables, carrots, green vegetables, cruciferous vegetables and tomatoes. Substances present in vegetables and fruit include dithiolthiones, isothiocyanates, indole-3-carbinol, allium compounds, isoflavones, protease inhibitors, saponins, phytosterols, inositol hexaphosphate, vitamin C, lutein, folic acid, beta carotene, lycopene, selenium, vitamin E, flavonoids and dietary fiber (Steinmetz et al. 1996).

Promoting, through FBDGs, the consumption of carotenoid-rich foods such as red and yellow-orange vegetables, and in particular DGLVs, in quantities of over three or more servings per day, appears to decrease the risk of developing degenerative diseases in addition to the primary benefits of providing micronutrients in the diet. A well planned, balanced diet maintains the exogenous antioxidants at or near optimal levels so as to reduce the risk of tissue damage. All fruits and vegetables which include the green leafy, yellow, orange and red coloured variety, are good sources of many anti-oxidants, and their regular and increased intake should be supported through the FBDGs, (Figure 2).

Figure 4. Suggestions for increasing vegetable and fruit intake

- Try one new fruit or vegetable each week
- Double normal serving sizes for vegetables
- Have all-vegetable based meals
- Eat fruit as a snack
- Drink fruit juice instead of soft drinks
- Add vegetables to favourite entrees
- Eat vegetarian meals more often
- Eat more international dishes (e.g. Italian pasta, Moroccan stew, oriental stir frys, Indian vegetable curries, Vegetable-based Thai preparations, sprouted and green salad, Greek vegetable moussaka, Provencale ratatouille)

Source : (Steinmetz & Potter, 1996)

Conclusion

The micronutrient content of foods is a hidden dietary aspect, often unknown to the consumer and populations at large. Populations should be made aware of micronutrient food sources and directed to the right choice of foods and food groups which will provide an essential 'package' of nutrients. Micronutrient rich foods should be prepared in a way that maintains their micronutrient content, and FBDGs should strongly advocate this, in addition to their regular and frequent intake. Practical applications of the intake of micronutrient foods should also be examined, while making dietary prescriptions through FBDGs, especially in view of individual variations of intake among individuals and groups. Consideration needs to also be given to the varying micronutrient content of foods, their daily inclusion through dietary variety, and factors that affect their bioavailabilty in the wider dietary context.

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USING MASS MEDIA AND SOCIAL MARKETING FOR NUTRITION EDUCATION

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Introduction

Nutrition in the context of nutrition communication is an evolving field, and it often seems complex and confusing. Indeed, people get so frustrated by the mass of generalized and mixed up messages, that they end up ignoring nutrition recommendations alltogether. It is essential that the basic nutrition principles, coupled with practical sense, be understood by the consumer at all ages, so that proper eating habits may be formed and practised, that will last a life time.

Nutrition communication includes a variety of elements which have their strengths and limitations, and it is the responsibility of all nutrition professionals to ensure that nutrition education is simple, correct, and above all, fair. The nutrition education content must be formulated on the basis of a problem analysis, and education must be relevant to reality. The society should also be genuinely interested and concerned about the role foods play in their overall health. In order to achieve this, nutrition education should evoke and empower the community at various levels, to translate the guidance given into concrete actions towards desirable food practice and nutrition behaviour. For developing a nutrition communications Programmeme, an effective promotion strategy should be developed and the methods used should lead to desired behaviour change. Mass media and social marketing have been used by various nutrition educators with varying degrees of success.

This paper will highlight the approaches to nutrition education with special reference to the use of mass media and social marketing. Selected examples of efforts undertaken in community based Programmemes are cited to give an explicit idea of their successful application.

From nutrition education to social marketing

Historically, nutrition communication evolved from primarily face-to-face instruction in nonformal health settings (clinics) about 3-4 decades ago, to a social marketing approach in the 1970s that incorporated market research methodologies and mass media. (Lediard, 1991). Several examples exist from around the world in this regard. India was able to change awareness of recommended weaning behaviour from 50% to 93% using culturally appropriate messages and a mixed strategy. Tanzania pioneered mass media and showed that messages should be targeted. Korea waged a two-week campaign using radio and comic books to increase knowledge of a healthy diet.

In the 1980s, new research techniques were incorporated that have proven especially useful in identifying behaviour susceptible to modification and in formulating specific messages. Programmes focused on promotion initially; subsequently they began to focus more on 'product', for example, breast-feeding. The concept of 'price' was also expanded to include not only money, but other costs like opportunity and time. Another important development has been the growing emphasis on prevention. In this context, the adoption of the Growth monitoring, Oral rehydration, Breastfeeding and Immunization (GOBI) child survival strategy by UNICEF and WHO in 1983 further brought nutrition communication into close rapport with maternal and child health Programmes.

Nutrition communication is considered unique from other types of health communication, because it works toward improving nutrition which requires sustained and repeated individual behaviour. Furthermore, changes in food behaviour have less tangible and less immediate payoffs than other preventive measures like immunization. The locus of change is usually home-based and requires the collaboration of family members. A range of behaviours need to be changed , entailing several target audiences such as the community in which they live. Interpersonal communication is given the lead role while the mass media play a more supportive role. Training of community health workers (mobilizers) to understand the consumer perspective is very important. In Thailand, for example, community based demonstrations of production of weaning foods, food preparation and child feeding patterns have been successfully conducted. Here

'product development' is the major focus, and integration of other sectoral interventions is then central to success.

Social marketing thus differs from traditional nutrition education in that it uses 'consumer research'. It attempts to discover by various techniques such as surveys and focus group interviews, what the consumer or community is doing and why. Consumer research is used to identify the important problems, such as decline in breast feeding, faulty child feeding practices, poor sanitation, etc. The results of the research regarding the consumer's views on the above problems, perspectives and practices lead to decisions on appropriate messages, communication techniques and targeting.

Approaches

Today, we witness a plethora of approaches being used and tested in different nations of the world. While these approaches appear to be separate, sometimes different ones are used within the same national context to address different nutritional problems. Alternatively, different approaches can be used within the same intervention Programmeme. In Thailand, for example, breast feeding promotion Programmemes earlier used the information dissemination approach, while vitamin A interventions have applied participatory communication. (Valyasevi & Attig 1994).

Information dissemination is the type of nutrition education intervention that we most commonly associate with 'nutrition education' (Tontisirin & Attig 1995). It usually encompasses the wide-scale dissemination of information in the form of mass media advertisements or printed materials. Based on early education and behaviour change theories, this approach stems from the belief that if people receive the knowledge they need to change, then they will change their behaviours automatically. In other words, knowledge will lead to attitude change and then behaviour change. This has been used as a practical approach for several years and policy-makers like it because it is easy to implement through the existing communication channels, but it does not work when used alone. This method is still widely used in many Programmemes with perhaps little or no effect. However, it can increase awareness and interest among target audiences. The information dissemination approach is a way to start the behaviour change process, because it becomes an important part of the person's environment. For example, television spots are a

part of a person's mass media environment, and what they convey to a person makes him /her stop and think, at least temporarily. Little is known about the magnitude of resources being applied to this approach or its cost effectiveness.

Education communication is another important step in the behaviour change process. It goes beyond awareness building to encourage people to try a new behaviour and especially how to conduct these behaviours or use certain 'products' properly. This approach is the first step at linking an individual's knowledge with proper action. Unfortunately, however, too often a strictly mass media approach is adopted to try and persuade people to use or try out a new product, service or behaviour. An advertising approach is employed; the audience is not always told how to conduct a new behaviour properly. In short, they are told what to do, but not how.

Educational communication using mass media alone is suitable for situations where nation-wide mass media Programmes are being developed, since it is assumed to be a relatively effective way to tackle large-scale nutrition issues affecting many people. However, such Programmemes are blocked by limited coverage, for instance where media Programmemes are largely restricted to urban areas and literate populations. Their impact is also lessened when the Programmemes target only a 'general audience' and do not consider socio-economic class, linguistic or ethnic differences. Such an educational communication approach also rests largely on a top-down model of communication, where nutrition information is passed down the heirarchy from official or doctor to patient or counsellor to client. Sometimes, this strategy works, but it may be resisted when communities are not involved or encouraged to get involved in the community nutrition planning and intervention process. Such approaches are characteristic of top down government efforts, largely because they can be readily implemented through existing primary health care networks.

Besides the large scale mass media approach, educational communication inteventions can also occur primarily through one-to-one (face-to-face) instruction in non-formal health care clinics like village or district health centres. Pamphlets, brochures, posters and other printed materials are also used, based on the belief that a person can be convinced to adopt a new behaviour by using traditional teaching

and class-room educational approaches. Such a method, which was common and effective 3 decades ago, does lead to behaviour change but only on a small-scale individual basis and not a population-wide one.

Social marketing and modern communication techniques need to be used to reach out effectively to the community, initiate and then sustain the desired behaviour change. The combined use of mass media plus interpersonal Programmemes is therefore essential, which is likely to lead to success. In this regard, participatory action can be used as the primary means of getting a Programme accepted by the community. This involves empowering people to identify their problems, determine feasible solutions, implement and evaluate them, and manage their own resources. This development paradigm is based on the principle that nutrition projects cannot be sustained at the community level if they are planned solely from the top, focus only on individuals and are isolated from the entire community development process.

Nutrition is a multi-faceted issue which goes beyond the health sector, and solutions to its problems lie in relating to other development sectors, such as education, agriculture and rural development. Community participation being intrinsic to solving many local and non-nutrition problems calls for the participatory action approach to nutrition education and communication. This relies largely on a participatory action research (PAR) framework and a bottom-up development approach. PAR includes steps further than educational communication, because: (1) it reaches out from individual communication to the wider community and beyond, and (2) its objective is to build a communication Programme with community members, and targeting specific nutrition and community development issues through a perception of community needs and life situations. Attention needs to be given to developing the 'bottom-up'strategy in the planning and implementation process. The focus should be on identifying, implementing and evaluating Programmemes that fit with the community's felt needs.

In the Food Habits Modification project (Tontisirin et al, 1991), the PAR process covered various interactive stages wherein community members and researchers worked collectively as project collaborators. They identified suitable communities which were developmentally ready to undertake nutrition intervention Programmes. The researchers liaised with the community members, promoted the project in line with each

community's conditions and felt needs. The researchers acted as stimulators in helping villagers to learn about their community's nutrition situation and its determinants. Dialogues, informal conversations and group discussions were held for the purpose. Researchers also acted as facilitators in assisting villagers to identify and prioritise their main community problems and needs which correlated with existing nutritional problems. The community then was involved with the researchers to determine Programmes, which they could plan and implement within the existing community resources. Community members along with the researchers planned the Programme, identified the tools and information required and responsible personnel, resources, cost effectiveness, etc. Finally, the community was involved through a process of collective action in planning and undertaking the Programme, specifying each Programme's realistically obtainable behavioural objectives. The nutrition education component in particular was based on a people's participation approach to Programme development. Villagers took an active part in media production. Young community leaders, for instance, were well accepted as active moderators, while elders acted as Programme consultants. Monks played an important part in nutrition education through their sermons. Community interpersonal Programmes were especially emphasized and no single media or channel was the most effective. A multi-media communication strategy involving people's participation was crucial in creating and maintaining nutrition information and encouraging the testing and acceptance of new attitudes and nutritional practices.

Today, the educational communication and participatory action components are being joined into a combined top-down/bottom-up participatory communication process. It must also be borne in mind that, the participatory action approach is very effective on a small scale, and has the potential to be so on a large scale too, as long as the Programme is sustained and people remain involved. The participatory action approach also needs to be integrated within the governmental infrastructure if it is to be at least partially sustained. The bottom-up efforts are found to function effectively in situations requiring organizing and planning at the community level. This has been used in national planning in Thailand, especially in promoting greater integration of intersectoral governmental efforts, along with increasing the potential of communities, through village committees, to identify their own problems, needs and solutions and manage their own resources for development and evaluation of the results.

This has therefore led to the development of a participatory communication approach or an integrated nutrition communication model in Thailand (Atcherberg, 1993; Winichagoon et al. 1994).

Social marketing can be applied succcesfully to combine the traditional creative media and interpersonal education strategies with learning-by-doing in participatory action Programmes. The success of participatory action Programmes depends on their ability to intertwine media and action Programmes so that media Programmes support interpersonal ones. The choice of media depends on the formal and informal information and communications infrastructure of the area in question. In general, it is wise to use a combination of communications media in an integrated way. Media provide the required reach for large-scale awareness building and the dissemination of information over a large area, while interpersonal Programmes (such as growth monitoring and promotion) provide community members (mothers) with a chance to participate in their children's own development and bring about corrective action in terms of their nutrition improvement. Interpersonal Programmes however take priority, because mass media alone or as a prime part of the nutrition education effort generally does not succeed. People need tools (information) to take action but in addition require guidance to take correct remedial action.

Participatory communication also focuses on the felt needs of people through formative research. This entails collecting data from communities on nutrition and related issues, where the Programme is to be undertaken. This is essential to identify important factors or determinants that may affect a Programme's acceptance. This is then to be integrated into the Programme's design. For example, if a variety of food beliefs, or food fallacies are collected, the data could be used to build specific remedial activities as part of the communication effort. Participatory communication thus enables changing the environment in which the community members see themselves. People are a product of their environment and the environment must be changed before people can be asked to change. People's participation, also known as social mobilization, is based upon creating a local demand for change by examining how people view their environment rather than how they view themselves. The creation of a demand for improving nutrition can be well illustrated by the example of the development of food based dietary guidelines (FBDGs) in Thailand. Its development is based on an in-

depth understanding of the needs of the changing nutrition situation, how people see themselves and the efforts required to improve Thai diets and life styles. This will lead to a better focus on the 'felt needs' to make nutrition education intervention more suited or tailor-made according to society or community contexts. The problems are diagnosed and laid out clearly, and practical and workable solutions can then be developed.

Harmonization of knowledge and applications

The translation of relevant nutritional and dietary facts into consumer action through FBDGs has been a major step in nutrition education development in Thailand. The social marketing approach has been used in its widespread implementation, thus harmonizing both knowledge and its applications.

The rationale for development of content for the FBDGs, as stated above, stemmed from the 'felt nutrition and health needs' of the community at all levels, especially in view of the nutrition transition being faced by the country. The content of the FBDGs are well accepted by nutrition scientists and key players (the government and other sectors) in food and agricultural development and they are not merely technical facts understandable by a limited few, but are explicit, having relevance to the dietary practices of the Thai consumer. The objectives are clearly stated, measurable and realistic and a consumer-oriented approach has been used in message design. A comprehensive communication strategy, thus formulated, is being implemented to bring about right consumer action.

As part of the promotion, advocacy efforts by professionals, planners and policy makers, along with users, are in progress at various stages of implementation. Committed partnerships with food manufacturers, producers, farmer groups, food distributors, media personnel and the educational system have enabled the creation of a demand for food that is healthy, safe and affordable. It is expected that this will lead towards desirable nutrition behaviour and development of healthy lifestyles in Thailand.

Nutrition labelling is another vital aspect that is being integrated into nutrition information communication, to raise consumer awareness and encourage positive behaviour change in Thailand. Nutrition labelling is soon to become a mandatory practice in the food industry, and will reach out to the public by providing accurate and clear information so that consumers may be able to choose foods for a healthy diet. Manufacturers will be given incentives to improve the quality of foods they produce. Nutrition labelling is designed to be consistent and complementary to national education campaigns aimed at the general public. Nutrition facts will be given on the label as part of nutrition information. The label will include product content in terms of food sources, nutrient content per serving taken, its nutritional contribution in terms of percentage of daily requirements, and user specific recommendations. Nutrient content claims and health claims if any, will be clearly indicated for consumer knowledge and guidance for appropriate use.

Conclusion

Tremendous strides have therefore been made in developing, implementing and reviewing nutrition communication approaches. Varying results have been achieved. It is imperative that various approaches be merged and systematized to obtain equitable nutrition improvement in the community. Communities must be sensitized through effective nutrition communication, to learn to be self reliant in providing for their own nutrition improvement. Communities additionally need not only involvement, leadership and motivation, but also political and financial support, plus technical guidance. Rigorous efforts need to be made towards widespread use of mass media and social marketing techniques through participatory communication at various levels and for various nutrition issues. Nutrition and social causes can be addressed more successfully through a joint process of applying principles, marketing analysis, planning and control to nutrition problems in the community and society at large.

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PARTNERSHIP IN DEVELOPMENT OF FOOD BASED DIETARY GUIDELINES AND NUTRITION EDUCATION: THE ROLE OF THE PRIVATE SECTOR

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Introduction

This paper describes the potential role for the food industry in helping to develop, promote and implement food based dietary guidelines (FBDG) within countries.

It considers the contribution which the industry can offer and reviews some current trends in attitudes to food, eating habits, lifestyles and the growth of healthy eating habits and healthy food availability. It then looks at the current health promotion initiatives of a number of bodies and suggests how these can be further developed through mutually beneficial partnerships.

The role of industry

The food industry shares with others a commitment to healthy diets and lifestyles. Primarily its function is to produce the wide variety of safe foods which can be combined to form a healthy diet. But its role goes further than that. The industry believes that consumers should be free to eat what they choose, and that their choice should be an informed one, based on sound science.

Further, the industry recognises that many others share the aim of educating consumers and that the best way forward is to work in partnership for maximum consistency, efficiency and effectiveness.

As a partner in the education process, the industry believes it has much to offer. The FAO and WHO Expert Consultation on Preparation and Use of FBDGs recognises that such guidelines must address the needs of specific groups, taking into account lifestyles, different cuisines, food

availability and other factors. The food industry has a valuable part to play here with its expert knowledge of its products and their role in the diet.

In addition, through extensive market research, it has a unique understanding of consumers' needs and how these can best be satisfied by new product development. The industry has developed a considerable research base about its products and their role in the diet and, with its marketing and communication skills, is well placed to provide consumers with the relevant and accurate information which is critical to the success of FBDGs.

Attitudes and trends in food choice and related social factors

Any attempt to educate the public about healthy eating and lifestyle must base itself in the reality of current practice. This includes understanding what food people are likely to be prepared to eat. Fortunately for those in developed countries, food is generally both widely available and affordable, although what can be grown locally will be limited to some extent by climatic factors.

Despite the variety of foods available, what people choose to eat can be fairly limited. For example, food choices may be restricted for religious and cultural reasons; and they may be influenced by traditions which affect the types of food eaten and how they are prepared.

It is also important to appreciate that these attitudes vary from country to country. Thus in the UK people tend to "eat to live" whereas in the Mediterranean countries the approach is more "live to eat". In contrast, vegetarianism in the UK is socially acceptable, but considered "rare and odd" in Spain. Similarly consumers' willingness to experiment with different foods varies country by country.

When, how and what we eat is a complex issue. In some ways it is entrenched by tradition, in other ways it is a rapidly changing picture. Recent years have seen significant increases in demand for convenience foods, fast food consumption, leisure catering and eating out; although again there are clear differences between countries.

These trends are strongly influenced by social factors: people tend to have busier lifestyles, more women work, and more people now own microwave ovens and deep freezers. Thus, during the week, grazing, snacking and self help meals are taking over, with the "Family Lunch" reserved for weekends. These changes are more prominent in Northern than Southern Europe; in France, Italy and Spain the "Serious Lunch" remains a key institution. Likewise in those Southern countries people tend to shop daily, whereas in the North a weekly shop at a hypermarket is more likely.

The average household today has more adults than children, partly because women are having fewer children and having them later in life, and partly because divorce rates have increased as marriage has declined in importance. Thus single parent households are increasing in number right across Europe.

All of these factors have an impact on dietary habits and need to be considered when formulating FBDGs.

Healthy Eating

It goes without saying that attitudes and trends in h althy eating must also be closely tracked and well understood. The food industry is an invaluable source of information on this subject.

Surveys tell us about consumers' attitudes towards healthy eating and their purchasing habits. A survey carried out by the Institute of European Food Studies in 1996 reveals that consumers are aware of the importance of healthy eating but it is neither a priority nor an obsession. Health awareness and an understanding of the link between diet and health has been growing steadily. However, many consumers are unclear about what "healthy food" means.

Again this differs country by country. For example, in Germany more than 70% of consumers define healthy eating to include "eating less fat", whereas in France less than 30% agree with that definition. 52% of the French include "balance and variety" in their definition of healthy eating compared to only 11% of Greeks. Surveys show that consumption of healthy foods - in terms of more fish, vegetables and fruit - is generally

increasing. In response to these trends the food industry has developed a number of healthier choice products. These include low calorie soft drinks, low fat spreads, fortified drinking yoghurts, isotonic sports drinks, sugar free chewing gum, low fat potato chips and low fat biscuits. The sales figures for these products make interesting reading. In nearly every one of these categories product sales are the greatest in the UK and Germany, in some cases by a significant margin, and very low in Belgium, Italy and Spain. Market penetration also varies widely as between the categories: As a percentage of the total market category (ie. all chewing gums) sales of sugar free gum vary from 24.4% in Belgium to 88.1% in the Netherlands. In contrast in the UK (which has by far the highest sales of low fat crisps/chips and all biscuits) amounts only to 1.9% and 6.8% respectively.

Healthy diets cannot be achieved simply by the food industry producing more and more healthier choice options. Consumers have to choose to eat them. In some countries and some categories they will do so and the markets will rapidly grow. In others it will be a different story. This is hardly surprising when we recall the complex of factors that influence our food choices - attitudes, availability, habits and customs, moods, personal likes and dislikes and bear in mind that nutrition and health issues account for only 7% of these factors.

Promoting healthy foods will not alone achieve healthy diets. As we have seen, an understanding of many other factors is essential for the successful development and implementation of dietary guidelines. A broad healthy understanding of lifestyle factors helps us to understand more about the health problems we face. Improved diet is one approach to preventing obesity and other non-communicable diseases, including stroke and cardiovascular disease. Adequate physical activity is key too.

As developed countries we have become more inactive with the advent of better transportation and labour saving devices. Our leisure time has moved to being more sedentary, particularly as a result of increased TV viewing.

As we get older our participation in sports also falls off quite considerably. It is now well accepted that a sedentary lifestyle is a major risk factor for CHD and stroke. It is clear therefore that FBDGs must be a part of a wider education process that takes account of the importance of physical activity as well as promoting healthy eating.

Education initiatives

Along with many other agencies and bodies, the food industry is already actively engaged in a number of partnership-based education initiatives. For example, it contributes information and expertise to ILSI initiatives in biological safety and health including nutrition; allergy and immunology; and physical activity and health. Similar support is given for the training packs for developing countries in food safety; water safety; and healthy diets and physical activity. Another partnership is the European Food Information Council (EUFIC) which develops communications to media and consumers. It has produced materials on modern biotechnology, food safety and nutrition.

Many companies are also willing to help in the translation and distribution of the excellent FAO package "Get the Best from Your Food". These are messages that are easily understood, and are suitable for all cultures and cuisines.

At national level the trade associations run a number of education initiatives. For example, in the UK, the Food and Drink federation's "Join the Activators" Programmeme promotes a key message in healthy eating and physical activity. Both the German and Irish Federations have information Programmemes on the safety of additives.

These activities are supplemented by a variety of education and communication Programmemes run by individual companies. As well as providing specific information on the ingredients used and nutritional values of their products, many companies offer further advice on healthy eating and physical exercise, including support through sponsorships and other promotions.

It is appropriate that education Programmemes are carried out at international, national and individual company levels. Those at individual company level can focus on specific products and consumer groups whilst those at national and international levels can draw on the benefits of shared experiences and the efficiencies of working in partnerships. However, at whatever level it is essential that all Programmemes share a consistent science base.

DEVELOPING AND IMPLEMENTING SCIENCE-BASED DIETARY GUIDELINES

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Solving nutritional problems at a societal level requires cooperation among government, health professionals, researchers and the food industry. Food guidance and nutrition policies must take into account sound, current, and scientific knowledge. To have impact, however, they must also have the support of all sectors that have a role in their implementation. These food and nutrition policies cannot be simply imported by a country, but require development within. Each country is going through its own nutrition transition.

Nutrition Transition

Dietary change is occurring in both developed and developing countries, but with different consequences. In developed countries the primary focus is on chronic diseases stemming from "overnutrition", and the role of the diet in addressing them. In developing countries with an increase in the standard of living, people are able to purchase a greater variety of foods and shift from a dependence on grains, with a consequent improvement in nutrient intake. Such dietary change decreases the incidence of nutrition-deficiency diseases. But, as malnutrition decreases, "overnutrition" and the resultant chronic diseases tend to increase Thus, health policies need to address malnutrition and chronic disease at the same time.

Diet and disease pattern will continue to change. It is predicted that deaths from communicable, perinatal, maternal and nutritional conditions will decrease by one-third, globally, between 1990 and 2020 (Murray and Lopez, 1996). Deaths from non-communicable disease, including heart disease and depression, will increase two-fold, as will deaths from injuries (accidents). By 2020, tobacco is expected to cause more premature deaths and disability than any other single factor. As

birth rate falls, the number of adults relative to children increases, and the commonest health problems become those of adults, not children. This fact must be kept in mind as countries develop public health priorities and deal with the nutrition transition.

Dietary Guidelines

Science-based dietary guidelines are generally expressed in scientific terms, with quantitative recommendations on nutrients and food components. They are based on the best available scientific evidence of associations between diet and health, evidence that is available worldwide. They are appropriate for use by policy makers, health professionals and the food industry. However, most people need science-based dietary guidelines translated into food-based dietary guidelines that specify foods and serving sizes. Because of the importance of dietary practices in nutrition-related disease, it is important that food-based guidelines be developed for specific countries. Such guidance must communicate within a socio-cultural context to be effective. As well, the origin of chronic disease must be understood within each country during the development of food-based dietary guidelines and prior to setting public health priorities. The importance of a wide consultative process in developing science-based and food-based dietary guidelines has been emphasized in a the FAO/WHO consultation report (FAO/WHO, 1996).

Science-based Dietary Guidelines

Dietary guidelines are advisory statements about diet for the population, and are aimed at prevention of diet-related diseases. They provide advice about components of foods (eg. fat, salt and fibre) that are important public health issues. These guidelines are science-based in that they are based on scientifically derived associations between diet and disease and recognize that to infer causality in associations between diet and chronic disease, six empirical criteria must be met. They are: strength of the association, dose-response relationship, temporally correct association, consistency of association, specificity of association and biological plausibility (NRC, 1989).

Strength of association is usually expressed as the ratio of disease rates for people exposed to the hypothesized risk factor to those not exposed. The existence of a dose-response relationship in which greater exposure brings greater risk strengthens the inference that the association is casual. If the observed association is casual, exposure to the putative risk factor must precede the onset of disease by at least the duration of disease introduction and latency. For consistency of the association, one expects to find the hypothesized association in a variety of studies, in more than one study population and when more than one method is used. The specificity of the association describes the degree to which one factor predicts the frequency or the magnitude of the disease. Finally, biological plausibility requires that the putatively causal association fits existing biologic or medical knowledge. This association is very hard to find with chronic diseases, given their complex nature.

The first national dietary guideline appeared in Scandinavia in 1968 (Truswell, 1989). Canada's first authoritative statement emerged in 1976, and the first edition for the United States appeared in 1977. By the early 1980s, government-generated dietary guidelines were common place in affluent countries. Dietary guidelines produced between 1981 and 1989 in 17 industrialized and developing countries were summarized by a World Health Organization study group in 1990 (WHO, 1990).

Table 1.Canada's guidelines for healthy eating 1991

Enjoy a VARIETY of foods.
Emphasise cereals, breads other grain products, vegetables and fruits.
Choose lower-fat dairy products, leaner meats and foods prepared with little or no fat.
Achieve and maintain a healthy body weight by enjoying regular physical activity and healthy eating.
Limit salt, alcohol and caffeine.

Source: Health and Welfare Canada (1991).

The nutrition recommendations for Canadians (Health and Welfare Canada, 1991) now suggest that the goal of healthy body weight be achieved by a combination of healthy eating and physical activity. This important change recognizes that the increase in obesity in the Canadian population is more likely due to low levels of physical activity rather than to any specific food or dietary patterns. They no longer recommend a reduction in free sugar intake (Table 1). This change arose from evaluations showing that intake of added sugars(10-12 % of energy) were consistent with the selection of healthy diets (Glinsman, 1996; Schneeman, 1995).

The nutrition recommendations for Canadians now suggest that the goal to reduce fat to 30% or less of energy be gradually implemented so that it is achieved by the time adulthood is reached (Health Canada, 1993).

The recent Dietary Guidelines for Americans (USDA, 1992) emphasise the maintenance of healthy body weights, but also include the notion that energy balance is determined both by food intake and physical activity. They continue to recommend that fat provides no more than 30% of dietary energy, but instead of saying that this recommendation applies to all above two years of age, they now suggest reaching the goal by the time the child is five years of age. They recommend that sugars be used in moderation, but also state that current intakes of sugars are not associated with chronic disease, except for dental caries. The rationale for the changes occurring from 1990 to 1995 is shown in Table 2.

Dietary guidelines are expected to change with new knowledge. Fortunately, the changes are not of sufficient magnitude to threaten the credibility of dietary guidelines. But because changes in knowledge are inevitable, committees given the responsibility of developing guidelines must pay close attention to the criteria for evaluating information on the diet-health relationship.

Table 2. Comparison of the 1990 and 1995 Dietary Guidelines for Americans

1990 guidelines	1995 guidelines	Rationale for proposed change
1. Eat a variety of foods	1. Eat a variety of foods	No change
2. Maintain healthy weight	2. Balance the food you eat with physical activity. Maintain or improve your weight	New emphasis on energy balance
3. Choose a diet low in fat, saturated fat and cholesterol	3. Choose a diet low in fat, saturated fat and cholesterol	No change in wording. Moved down from third to fourth in 1995
4. Choose a diet with plenty of vegetables, fruits and grain products	4. Choose a diet with plenty of grain products, vegetables and fruits	Increased focus on plant foods, consistent with Food Guide Pyramid. Moved up from fourth to third in 1995
5. Use sugars only in moderation	5. Choose a diet moderate in sugars	Remove negative connotation of "only" focus on total diet
6. Use salt and sodium only in moderation	6. Choose a diet moderate in salt and sodium	Emphasise that foods themselves are the source of most dietary sodium
7. If you drink alcoholic beverages do so in moderation	7. If you drink alcoholic beverages do so in moderation	No change

Source: Advisory Committee (1995).

Food-based Dietary Guidelines

Food-based dietary guidelines (FBDG) are needed, because consumers focus on foods, not nutrients, in choosing what to eat, They must provide individuals with guidance to prevent both nutrient deficiencies and chronic disease. The development of FBDG is not a simple matter. It should be informed by public health issues (the science-based dietary guidelines), the social, economic, agricultural and environmental factors affecting food availability, and eating patterns and food patterns (not numerical goals). FBDG should provide positive messages encouraging enjoyment of appropriate dietary intakes while acknowledging that a wide range of dietary patterns can be consistent with good health (FAO/WHO, 1996).

Eight steps are suggested for developing FBDG:

1. Form a working group of representatives of agriculture, health, food science, nutritional science, consumers, food industry, communications and anthropology.
2. Gather information on nutrition-related diseases, food availability, and food intake patterns in the country.
3. Indentify, through full discussion, a set of major nutrition-related health problems for which dietary guidelines could be useful.
4. Evaluate the general food production and supply situation through consideration of current practices, subsidies and other governmental policies and problems, to see if FBDG can be implemented under the present situation.
5. Prepare a set of draft food-based guidelines, followed by background statements for each guideline and circulate them to all working-group members.
6. Pilot test the wording of the guideline statements with consumer groups; revise and check.
7. Finalise the background statements and send them to special-interest groups in the country (and possibly internationally) for comment. Once again, meet to consider changes, in view of the responses, and put together a draft of the final report.
8. Conclude the draft, adopt, publish and disseminate the final report, and finally begin implementation.

Clearly, each country developing FBDG will have to spend considerable effort, organization, and time. The same process could logically be

applied to the development of all nutrition and food policies. If these steps are taken, the outcome of the deliberations is more likely to be effectively implemented by the food industry and nutrition educators.

Food Guides are an example of FBDG. Both Canada and US have developed new Food Guides that incorporate their national science-based dietary guidelines. In the past, the Food Guides have concentrated on expressing a dietary pattern that would provide the individual with the essential nutrients in recommended amounts. The new Food Guides recommended a dietary pattern aimed not only at meeting the requirements for essential nutrients, but also at preventing chronic disease. Both the Canadian and American Food Guides are centered on food groups and both have a new category: foods that include sugars, fats and oils.

Food Guides should be a national product. To illustrate, even though the foods available to Canadians and Americans are similar, one can look at the differences in the countries' Food Guides. The Canadian Food Guide incorporates the four food groups in a rainbow design. Meat and alternatives are arranged along the small, inner arc. Next come the milk products, then vegetables and fruits and finally grain products along the large, outer arc. The design gives the visual cue that the greatest quantity of food should be selected from the grains group. A category of "Other Foods" is identified as not part of any food group, and includes foods that are mostly fats and oils, mostly sugar, high fat or high salt snack foods, beverages, herbs, spices and condiments. The guide acknowledges that "These foods can be used in making meals and snacks and are often eaten with foods from the four food groups", but recommends that they be consumed in moderation. Instructions on using the Food Guide include advice on reducing fat; no mention is made of sugar.

The US food guide is in the form of a pyramid, showing five food groups, with the grain group at the base. The vegetable group and the fruit group share the next level of the pyramid and on top of these are the milk group and the pyramid. The visual impression is that one should consume less of those foods higher up the pyramid. At the very top is the category of fats, oils and sweets. The consumer is advised that "These foods supply calories, but little or no vitamins and minerals".

The scientific basis for the Food Guides has changed over the past twenty years and the new Food Guides capture these changes. For example, evidence that excess fat intake is a problem in both Canada and the US has become more convincing, although there is no total agreement on the need to apply fat reduction goals to children. In Canada, it is recommended that fat intake be reduced gradually to 30% or less of energy by the time adulthood is reached. By contrast, the US recommends that this goal be achieved earlier, by children of five years of age or older.

In earlier guidelines and food-based dietary guidance, added sugar was viewed negatively. It has been recognised, however, that this guidance was based on an incomplete understanding of sugar intakes and of the relationship between sugar intake and health. Best estimates show that the intake of sweeteners, primarily carbohydrate sweeteners such as sucrose and high-fructose corn syrup, averages 10-12% of the dietary energy and is consistent with healthy diets. Several recent reviews have concluded that other than the contribution of sugars to dental caries, there is no evidence that sugar at the levels currently consumed are the cause of sugar intolerance, diabetes mellitus, high blood lipids, cardiovascular disease, hypertension, hyperactivity in children, obesity or nutrient-deficient diets (Anderson, 1997; Glinsmam and Park, 1995).

Food-based dietary guidelines must focus on creating healthier diets and not create "good food/bad food" categories. As yet, science does not support a reductionist approach to inclusion and exclusion of specific foods.

To solve nutritional problems and implement FBDG, effective partnerships are needed among industry, government and academia. As emphasised by the FAO/WHO consultation group that met in 1995 to evaluate development of FBDG, each country should engage in planning, with all the main partners: government, academic institutions, and industry. A call for increased collaboration among these three partners in solving nutritional problems was recognised at the International Conference on Nutrition through the World Declaration on Nutrition which was adopted unanimously by 159 governments (FAO/WHO, 1992). The role of industry in connecting micronutrient deficiencies was also recongnised at the Ottawa forum held in 1995 (FAO/ILSI, 1995). This recent recognition of the role of the food industry as an essential partner in solving nutritional problems requires understanding and consideration by the government and academic sectors.

The Role of the Food Industry in Nutrition Transition

The food industry contributes to the economic advancement of a country. It can be a key partner with government and health professionals in improving nutritional status, acting as a resource in both the development and the translation of dietary goals and policies (Anderson, 1994; Sai, 1991). The food industry is estimated to have accounted for fifty percent of the economic advancement of England since the Industrial Revolution. It has delivered improved nutrition as well as wealth (Fogel, 1991).

The food industry contributes to economic development by increasing the productivity of agricultural crops, decreasing losses and wastage, increasing food availability, reducing seasonality, making high-nutritive-value foods available, and providing employment and higher incomes. Marketing strategies may help to achieve nutritional goals, because they include providing nutrition information on labels. Informative labels support nutrition educators' attempts to make people more aware of the importance of nutritional quality and food safety (Bressani, 1989). In addition, marketing strategies create distribution channels for food commodities (Gorgatti-Netto, 1989).

Multinational companies contribute to the advancement of the food industry sector of developing countries through several activities. They bring modern applications of food technology, including biotechnology; bring internationally recognised standards in the areas of food toxicology and safety; and participate in, and respond to, the development of dietary guidelines and regulation. In developing countries, however, multinational companies often have difficulty in finding necessary quantity and quality of raw materials, including the human resources needed to manage the food system. Often their ventures depend on future development and require large investments to secure raw materials, train personnel, work with government food and drug authorities, and develop markets.

The food industry is an essential partner with government and health professionals in changing dietary patterns and achieving dietary goals. Its effectiveness is enhanced if government provides the educational and regulatory framework that will influence consumers to create and pay for health-supporting products the industry produces. For the most part, the industry is consumer driven, responsive to the purchasing power and health knowledge of the population.

Given the right support, the food industry is a major force in changing the composition of the food supply, as illustrated by its response to the goal of reducing fat consumption, from 40% of energy toward the dietary goal of 30% of energy in the North American population. In 1995, 80% of the new food products were fat reduced. The fat substitute Olestra has been approved by the United States Food and Drug Administration and the use of such products will likely lead to a reduction in fat intake (Anderson, 1997; Beaton et al, 1992). Another example is the food industry's response to the recommendation that North Americans increase fibre intake. Many food products with enhanced fibre content have been developed. Recently in the United States, the government has approved a health claim that oat fibre consumed in ready-to-eat breakfast cereal can lead to a decrease in blood lipid levels and, presumably, cardiovascular disease. Currently, a great deal of interest is being expressed in functional foods sometimes called nutraceuticals. These are foods that have been modified to have biological or physiological (functional) effects that exceed those related to nutrition, in terms of providing energy and essential nutrients (Glinsmann, 1996).

In developing countries, the serious problem of nutrient-deficiency diseases remains. Yet the food industry has the ability to add essential nutrients to food products that are commonly consumed. It has been well proven that the food industry can respond in this way to the health needs of a nation and can be an effective partner with government in the process (IDRC/IAC, 1996).

In developed countries, over the last 40-50 years, food fortification has played a major role in eliminating several nutritional deficiencies. Fortification does not require changes in the diet, hence it can be implemented and sustained over a long period. Further, it can be a cost-effective means of reducing micronutrient malnutrition (IDRC/IAC, 1996).

Developing countries have been slow to embrace the food industry as a partner in solving micronutrient malnutrition. Thus, the forum on Food Fortification (MI, 1995) held in Ottawa, Canada in 1995 emphasised the importance of public-private sector collaboration to eliminate micronutrient malnutrition. The report notes that "Collaboration involves both sides taking ownership of the issue and searching for solutions together. Advocacy to eliminate micronutrient malnutrition cannot simply be targeted to industry but must also originate from industry".

A number of ways for industry to contribute to collaborative activities were suggested, including clear advocation of industry needs to government; assistance to public sector in assessment of national needs; participation in education, research and health assessment; assistance in market research and promotional materials; development of business-to-business channels to transfer technology; development of joint ventures among fortificant and pre-mix supplies and food processors; provision of training and methodologies for quality assurance Programmemes; creation of "Industry Best Practices" code for production and marketing of fortified products; and collaboration to expand current market niches for fortified foods.

Several reasons have been given for the difficulty that developing countries have solving nutrition problems. First, where education has been over looked, there is a high level of illiteracy Illiteracy greatly limits the efficiency of people producing food, and hinders their ability to improve diets. Second, there is too little emphasis on the training of food scientists and nutritionists. Third, political systems often change and public health policies get inconsistent attention.

Developing countries that fail to emphasise the training of food scientists, nutritionists, and dietitians and do not harness the capabilities of the multinational food industry will continue to struggle in vain to achieve health goals for their populations (Frank and Mustard, 1994). As noted, the benefits to be derived from food fortification have not been realised. For the future, the advances in and application of biotechnology have potential to be overlooked leaving behind the very countries that could benefit the most. Biotechnology should be given a top priority in many developing countries, because it can improve raw material as well as improved and new plants or animals through genetic engineering (Gorgatti-Netto, 1989). Increased indigenous capacity in biotechnology would help a developing country move from its status of recipient to that of active player in the global arena and marketplace (Chambers, 1995). Unfortunately, mechanisms that promote and facilitate technology transfer either do not exist or are poorly developed, and economic, legal and social barriers prevent university-industry cooperation. Little communication between research establishments and the applied sector has been noted (Zilinskas, 1993).

The ability of the food industry to assist with economic development and the improvement of a population's health is clear. For this reason, the food industry should be included as a partner with government scientists, academics and health professionals in developing and implementing food and nutrition policies and dietary guidelines.

Conclusion

To cope with modernisation and the appearance of chronic disease while addressing nutrient deficiencies requires effective partnership among government, health professionals, academia, and the food industry. Science-based dietary guidelines are essential to the improvement of the health of a nation's people, but they must be communicated through FBDG that take into account public health issues, the social economic, agricultural and environmental factors affecting food availability, and eating patterns within a country. And they must be developed by all partners.

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DEVELOPMENT AND PROMOTION OF FOOD-BASED DIETARY GUIDELINES: THE THAI EXPERIENCE

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Introduction

Over the past four decades, Thailand has been popularizing the concept of five food groups for a balanced and healthy diet. A set of dietary guidelines (DGs) developed by the Nutrition Division, Ministry of Public Health (MOPH) was first published in 1989 expanding on the basic five food groups in an effort to promote intake of a healthy diet for good health. The current initiative of development of food based dietary guidelines (FBDGs), is a continuation of past efforts now undertaken as a collaborative venture by the MOPH and the Institute of Nutrition, Mahidol University (INMU). It expands on the basic five food groups with an emphasis on the food-based components of Thai diets and serves as an important information and communication tool for the public in promoting appropriate food intake for nutritional well-being and maintaining good health. The guidelines are also intended to play an essential role in guidance for policy development in agriculture and education. They also serve as aids to carry out self-dietary analysis and work out practical remedial solutions based on the FBDGs laid out for public use and practice. This paper presents the entire process of development and promotion of FBDGs in the context of Thailand.

Development and promotion process

The development and promotion process of the FBDGs is divided into four parts:

1. Rationale and methods for formulation of FBDGs
2. Content of FBDGs
3. Advocacy
4. Evaluation

Rationale

The first part of the paper provides the rationale for development of FBDGs and delineates the process toward formulation of the FBDGs.

The nutrition situation in Thailand over the last two decades shows that progressive improvement has been made with regard to addressing the problems of undernutrition among most vulnerable groups. Nutritional problems like, protein -energy malnutrition and micronutrient malnutrition are. to a large extent, well under control. However, sustaining a good nutrition situation and nutritional status is a constantly challenging task, which can be achieved nly by promoting better eating habits and positive nutrition behaviour in the society at large. As many countries in South-East Asia are presently undergoing the so-called "nutrition transition", in Thailand too, the nutrition transition is likely to be associated with a shift in the structure of diet, overnutrition, reduced physical activity, diet related problems and non-communicable diseases (NCDs). Eating out has become a way of life today for most urban dwellers in Thailand, whose numbers are increasing. Ensuring good quality and safe food is therefore an additional concern to promote and maintain sound nutrition and a healthy diet.

Thailand has a strong agro-based economy, where food availability and access, by and large, are adequate for all, owing to the 'food safety net' established by the Royal and national efforts. The Thai diet is a traditional one, characterized by the intake largely of rice in combination with a wide variety of vegetables and flesh foods. Fruits are also ubiquitous, and are generally within the reach of majority of the population. Typical indigenous foods and preparations, which have

desirable nutritional attributes, are also widely consumed. It was therefore found essential to optimally utilize the potential of the Thai food situation through a process of mass nutrition education for developing and improving diets and promoting healthy life styles. The information, education and communication (IEC) process for improving nutrition, promoting healthy diets and life styles has been an important part of nutrition policy development in Thailand. Based on an analysis of the nutrition and health situation, the objectives for developing the guidelines were set. The Thai FBDGs thus aim to serve as potent tools for providing a practical and scientific understanding of what constitutes an appropriate diet for good health, knowing how to best meet dietary and nutritional needs from available resources and include a sufficient intake of good quality, safe and affordable food for the day. The FBDGs also have a built-in evaluation to examine and monitor the dietary intake for its appropriateness in achieving optimum dietary goals.

Methods

A committed team, including senior nutritionists from MOPH, academicians from INMU and other related institutions, hospital dietitians and selected medical professionals, constituted the working group for the development process of the FBDGs. A National Committee consisting of key stakeholders involved in nutrition planning and policy making was also a part of this team. The working group reviewed the newer knowledge in nutrition and the current science base required to disseminate the practical aspects of planning, selecting and eating healthy diets. The working group met regularly during the period 1996-1998, to develop the FBDGs through a process of collective thinking and planning. They devoted a great deal of time to discuss the merits of the Thai diet in relation to meeting the recommended dietary allowances (RDAs), and literature pertinent to Asian dietary guidelines was extensively reviewed. The National Committee met formally on at least 5 occasions during the two-year period, to closely examine the progress of development of the FBDGs and made concerted efforts towards their promotion in the country.

Content of FBDGs

The second part of the paper highlights the content of FBDGs emphasizing both qualitative and quantitative components of the diet.

Since an important characteristic of FBDGs is that they become guiding principles of nutrition advice for the public, the working group ensured that the content of messages developed was consistent and scientifically correct. The qualitative dietary component of the FBDGs is presented in the form of a booklet, for easy use by both the consumer and the person preparing food.

(a) Qualitative dietary component

This includes a set of nine Thai food based dietary recommendations, the principles and rationale underlying dietary recommendations and the inclusion of a variety of commonly used foods and food items. All aspects of the Thai diet in the above context were debated upon by the working group, and the following nine recommendations have been proposed:

1. *Eat a daily variety of foods from each of the five food groups and maintain proper weight.*

This is based on the premise that no single food supplies all the nutrients required by the body in adequate amounts. Hence, the need for eating a variety of foods from each of the basic five food groups to obtain all the essential nutrients, is emphasized. The major food groups indicating their functional importance are included as follows :

Group1: Milk,eggs, meat, legumes and sesame seeds for growth and maintenance of body tissues.
Group 2: Rice,cereals,, starchy foods and sugar for furnishing energy.
Group 3: Vegetables for assisting regulatory body functions.
Group 4: Fruits, having functions similar to Group 3.
Group 5: Oils and fats of plant and animal origin for providing energy and body warmth.

Body weight, which is an important indicator of health status, can be best maintained by eating the right kind and amount of food along with regular and appropriate exercise. The ill effects of underweight are weakness, poor resistance and lack of alertness, while overweight poses several health risks such as hypertension, coronary heart disease, diabetes mellitus and certain types of cancer. Body mass index (BMI) can be suitably used to assess body weight in both children and adults. The normal range of BMI for adults is indicated to be 18.5 -24.9.

Maintenance of proper body weight also entails carrying out appropriate and regular exercise for at least 3-5 times a week, which would help to strengthen the body and heart muscles, maintain blood circulation and overcome tension and stress. Weight should be checked on a monthly basis, and remedial dietary action should be taken in cases of weight loss or weight gain in addition to undertaking appropriate exercise.

2. Eat adequate rice, or alternate carbohydrate-rich food groups

Rice, the staple food of Thais, is widely recommended, especially in unpolished or home pounded form, which is more nutritious than polished rice. A variety of rice based products like rice noodles and fermented rice noodles and other cereal based products like wheat noodles, are also available which provide the energy bulk to the Thai diet. In addition to being a good dietary source of energy, rice provides protein especially when taken in susbtantial amounts (as in the Thai diet), fiber, minerals and vitamins. When eaten in combination with a variety of other foods such as meat, eggs, legumes, vegetables, fruits, oils and fat, it gives mutually complementary benefits to the diet.

3. Eat more vegetables and take fruits regularly

While rice is the main source of energy and macronutrients in the diet, it is suggested that it be taken in combination with a variety of foods from the 5 food groups in adequate and proportionate amounts, to meet all dietary and nutritional requirements. Vegetables and fruits, which are good sources of micronutrients such as vitamins, minerals and non nutrients such as dietary fiber, should be taken in large quantities on a regular basis. Vegetables and fruits are low in energy content, provide several nutritional benefits and exert potentially protective effects against the development of obesity, heart diseases and certain cancers. The wide availability of a variety of vegetables and fruits in Thailand should therefore be suitably used to advantage by all, especially school children and adolescents to keep them strong and promote healthy eating behaviour. Intake of vegetables should be encouraged at every meal, while seasonal fruits both ripe and unripe, which are a good source of ascorbic acid and pro - vitamin A can be taken after a meal or as a regular in-between meal item.

4. Eat fish, lean meats, eggs, legumes and pulses regularly.

A regular intake of fish, lean meat, eggs, legumes and pulses is suggested, as it provides good quality protein in sufficient amounts for growth, vital body functions, maintenance and protective immune responses. Small fish are popularly available in Thailand and can be eaten in whole form, and also serve as good substitutes for meat. Lean meat should be the preferred form of meat, and meat with visible fat such as pork, should be avoided. Eggs may be taken by children every day, while adults can take 2-3 eggs per week. Eggs should be well cooked and safe to consume. A variety of legumes and pulses are recommended for use in Thai preparations, which can serve as alternates to meat protein in the diet. Additionally, they provide energy and their regular intake should be encouraged. Oilseeds are also good sources of protein, vitamin E and calcium and should be taken regularly.

5. Drink sufficient amount of milk every day

Milk is advised in amounts of 1-2 glasses per day for all groups, as it is a rich source of protein, lactose (milk sugar), calcium and phosphorus, and vitamins such as riboflavin. Milk intake along with adequate exercise is recommended to provide nutritional benefits for bone growth and maintenance. Checking of the expiry dates on milk packs, selection of intact containers and appropriate storage of milk and its products, such as yoghurt, at temperatures not higher than 10 degrees C, is suggested. Careful reading of all labels is also advised. For persons experiencing symptoms of gastro-intestinal discomfort after milk ingestion, intake of milk in smaller quantities or in the form of yoghurt is recommended as it is more assimilable.

6. Take moderate amounts of fat

Due to the increasing consumption of fat presently noted among Thais, fat intake is to be reduced, providing no more than 30% of total energy in the day's diet. Increased fat intake is likely to lead to obesity and related degenerative diseases. Saturated fat intake is to be limited, which includes restriction of high fat meat, egg yolk, organ meats and certain seafoods like squid, oyster, etc. Cooking methods also are to be modified, especially in case of deep fat frying and stir-frying. Foods prepared by such methods are to be avoided or restricted. Examples

include french fries, deep-fried battered foods, foods with coconut milk, etc. Boiling, steaming and grilling are advised as preferred methods of cooking, as they yield minimal fat.

7. Avoid excessive intake of sweet and salty foods

Thai people have a strong preference for spicy and salty food, an excess of which may not necessarily be desirable to health. Fruit based Thai desserts are generally sweetened with additional sugar, and high intake of soft drinks, candy, toffee, jelly and syrup is noted in Thailand. Thai salty foods often contain fish sauce or salt, which apart from imparting taste help to keep food longer. In addition, sodium salt is used in bakery products and preparations made with monosodium glutamate (MSG). No more than 1 teaspoon of added salt (used in cooking or otherwise) is advised for the day. Liberal use of traditional Thai herbs, natural fresh spices and adjuncts is advised to provide palatability and protective qualities to the diet.

8. Eat clean food and uncontaminated foods

The rapid changes due to urbanization have impinged on food quality and safety aspects of the Thai diet. Home cooked food has become less common, since people are now more dependent on purchased food which may be in ready-to-eat, cooked or ready-to-cook form. The use of non-standardized additives and preservatives especially in street foods, such as meat balls, preserved sea foods, vegetables like bean sprouts and sliced ginger, etc. are likely to pose health risks. Selection of food which is freshly prepared (even if prepared on the street), or obtained from reputed stores with the Thai FDA logo, having natural odour, flavour and colour is strongly suggested. Consumption of foods which are well cooked (especially meat) and thorough washing of fruits and vegetables are recommended. Clean and fresh ingredients are to be used and practice of personal hygiene and sanitary food handling is strictly advised. In case of ready-to-cook foods, canned foods and food additives, due emphasis should be given to following labeling instructions.

9. Avoid or reduce consumption of alcoholic beverages

Consumption of alcoholic beverages is to be reduced or avoided, as the ill effects of excessive alcohol intake on nutritional status and health are well known.

Self - evaluation

The dietary recommendations booklet also has a user (consumer and cook) self-evaluation format, which helps to assess correct eating and related behaviour. A scoring pattern is provided, which enables the user to take corrective measures for dietary improvement based on the dietary recommendations suggested. This is a noteworthy aspect of the Thai FBDGs, because it has a strong educational value both through practical instructions and scientific evaluation for daily dietary practice by the user. This will contribute, in the long term, towards promotion of healthy diets and life styles.

(b) Quantitative dietary component

Development of the quantitative dietary component of the FBDGs was carried out over a period of two years during 1996-1998 (Sranachareonpong, 1998), detailing the inclusion of each food item in terms of portion sizes and recommendations of food portions in explicit household terms for daily intake, giving emphasis to the nutritional contribution. Food pattern plans, typical Thai portion sizes and four food guide models graphically depicting the food groups in terms of proportions and amounts were also developed.

1. Setting nutritional goals

In developing the quantitative component of the FBDGs, three energy levels of the diet were set namely, 1,600, 2,000 and 2,400 kcal, which were based on the recommended dietary allowances (RDA) and recommended dietary intakes (RDI) for healthy Thais. This range covered the varying energy needs of both males and females from 6 years of age and above. Nutritional goals were set, which included providing the nutrients in values of at least 70% and above that of the recommended goal.

2. Defining of food groups

In the food guide, foods are grouped into 6 groups, cereals, meat, vegetables, fruit, milk and fats and oils, primarily on the basis of their nutrient contribution. Sub-groups within major food groups are also listed.

3. Food intake

Food intake data were obtained from secondary research data available at the Institute of Nutrition, Mahidol University (INMU) and analyzed for food consumption patterns to get an explicit profile of the typical Thai dietary pattern, frequency of food intake and the serving size most commonly taken in Thai households.

4. Assignment of unit and quantity per unit

Commonly used household utensils were taken for the purpose of determining units and assessing portion size of foods or food items. Typical food portions commonly taken in a day were obtained from a sample of 20 households. Each of the individual portions were weighed serially and the average weight was calculated to obtain the standard amount of portion size for each food group or food item taken in the Thai diet (Charoensiri, 1997) (Table 1)

5. Determination of portion numbers and size

This was based on secondary data on habitual food consumption patterns in Thailand. Food pattern plans or food lists for a day at three levels of calorie intake were outlined to enable people to know how many portions they need, in which food group their food choices fit and the quantity which amounted to one portion described in practical, household measures. (Table 3)

Table 1. Typical household unit and amount per portion of food group

Food group	Household unit/measure	Portion size(amount in g)
Cereal	Thai serving spoon (tuppee)	60
Meat	Thai tablespoon	15
Vegetable	Thai serving spoon (tuppee)	40
Fruit	appropriate size(depending on type of fruit)	70-150
Milk	1 Cup	200ml
Fat/sugar	1 teaspoon	5

These food portion sizes were then elaborated to form a food guide for daily food choices, as shown in Table 2.

Table 2. A food guide to daily food choices (amount per portion)

Food group	Portion count (examples)
Cereal	1 tuppee (60g) rice,cooked and noodles 1/2tuppee(35g)glutinous rice, cooked 1slice bread (30g)
Meat	1 table spoon(15g)meat, fish, liver 2tablespoons(30g)soybean curd & dry bean
Vegetables	1tuppee (40g)
Fruit	1small banana (40g),2 medium oranges(136g), pineapple pieces (108g)
Milk	1cup(200cc)whole,1cup(200cc)low fat, 1cup(200cc) cream yoghurt.
Fats, sweets & salty products	Use sparingly

Table 3. Daily food list for varying energy levels of diet*

Food group	About 1,600 kcal	About 2,000 kcal	About 2,400 kcal
Cereal (tuppee)	8	10	12
Meat(tablespoon)	6	9	12
Vegetable(tuppee)	4	5	6
Fruit(piece/portion)	3	4	5
Milk(cup)	2	1	1
Total fat(teaspoon)	5	7	9
Total added sugar (teaspoon)	6	6	8

*A 1,600 kcal level is suitably advised for children, sedentary women and older adults.
A 2,000 kcal level is suitably advised for teenagers, active women and sedentary males.
A 2.400 kcal level is advised for teenagers, active males and very active women.

Multiple food list plans are also suggested for each of the three energy levels of diet, giving several food combinations using a variety of foods /food groups, indicating their portion sizes and keeping the cultural basis of the Thai food pattern.

As a rule, nutrient and caloric needs vary according to age, sex, body size and activity levels among individuals. In the present FBDGs, at all three levels of energy, the percentage energy contribution from protein, fat and carbohydrate accounted for 12%, 29% and 59% respectively for the day. It is to be noted that while planning the 1,600 kcal diet, it is essential to give due consideration to calcium rich food sources and that of dietary fiber. Similarly in the 2,000 kcal diet, calcium rich food sources need to be especially included for the day's food list. The 2,400 kcal diet appears relatively more adequate, since this diet suggests an intake of 6 tuppees of vegetables and 5 fruit portions which can easily meet calcium and dietary fiber requirements.

Practical dietary suggestions

In order to completely meet the day's nutritional goals, certain practical suggestions have been given. For example, in the 1,600 kcal diet, with only one glass of milk, the calcium intake provides less than 70 % of the daily needs. The inclusion of small whole dried fish (25g) twice a week, or about 2 pieces sardines canned in sauce (130g) twice a week or 3 out of 6 tuppees vegetables, as dark green leafy vegetables (DGLVs), five times a week is recommended. To meet fiber requirements, increasing the portion size of vegetables and fruits is suggested, to namely 6 tuppees of vegetables and 4 fruit portions per day.

In case of non-addition or non-use of sugar by individuals, an additional 1or 2 tuppees of cereal group are suggested. Soy and fish sauce are to be limited to 2 tablespoons per day, owing to the high sodium content. Consumption of 7 tablespoons of tofu (soy curd) or 2 tablespoons of small fish or 5 tuppees of green vegetables daily or a combined intake of all these calcium rich food sources, are advised for those who do not drink milk. In the northern and northeastern parts of Thailand where undernutrition is noted, the amount of glutinous milled rice can be increased to 5 to 8 tuppees per day.

Food guide models

Four coloured graphics of food guide models have been developed which are in shapes of fan, tiffin carrier, cone and rainbow. These shapes graphically highlight the various food groups in proportions (based on their relative nutrient contribution) which place cereals and staples, pulses, vegetables and fruits, flesh foods, fats and sugars in an ascending order from the base layers to the apex or top of the model shapes, indicating their consumption in relative quantities, while the multi colours of foods depict the variety of foods to be taken in a day.

Since a single graphic may not be effective in communicating the concept of the food guide, four models have been developed. These models are presently being tested for their effectiveness in mass communication of all the food guide elements, in a lucid and explicit manner. The model selected as the ideal or most suitable one, will then be refined for widespread, practical use through additional research.

Advocacy

The third part of the paper includes the advocacy efforts undertaken in the country for promotion of the FBDGs. Initially, as a means of providing public information, informal discussions were held at various levels in the community. A number of radio talks were given and panel discussions were conducted as part of the promotion process. Key educational tools developed for promotion of the FBDGs included, handouts, posters, a calender and leaflets which were widely distributed to evoke public nutrition awareness at public offices, schools and other academic insitutions, hospitals, hostels and related public places.

Booklets detailing qualitative aspects of the FBDGs were prepared by the working group, which were released by the Thai Prime Minister at an official inaugural function organized at the Government House on 26 August 1998. The release of booklets, which was launched in the midst of key government officials, planners, policy makers, senior professionals and mass media personnel, was well applauded with commitment made by key national figures to promote FBDGs for the betterment of nutrition in Thailand. This was followed by round table discussions and nation -wide radio broadcasts. A weekly television Programme on FBDGs has been telecast for 2 minutes since its official launching, to reinforce the promotion process. Luncheon talks were also held with senior people of the mass media and have helped in the formation of key allies who are now instrumental in the widespread dissemination of information on the FBDGs.

Advocacy efforts are being made to sensitize food producers and food manufacturers to supply the demand for whole grains, insecticide free vegetables and fruits, which has been created through mass awareness of the FBDGs. The Academic Affairs Unit under the Department of Agriculture, along with a non-govermental organization (NGO), has mobilized a total of over 70 farmer groups to grow and produce insecticide-free foods. Various private agencies have undertaken marketing and distribution of these naturally grown foods at gas stations and a selected chain of food stores. The Ministry of Education regularly broadcasts messages on FBDGs for 2 minutes through the radio and is planning to integrate FBDGs into the primary school curriculum to foster correct eating habits from an early age. Pictorial food guides in the form of educational mementos depicting the FBDGs are being distributed to the public through the courtesy of private sector units.

Non -food public organizations such as the Electric Authority of Thailand, and private electric companies, have evinced keen interest in promoting the use of FBDGs.

The widespread advocacy efforts and partnerships being established towards intensifying the promotion of FBDGs, therefore, bear evidence of the responsibility shown by Thai people towards improving their health.

Evaluation

Periodic testing of the knowledge, attitudes and practice (KAP) among different age groups of school children and adults on the usage of FBDGs is in progress in various comunities. The change in eating pattern is also being recorded. Specific efforts for assessing the impact on dietary behavioural change among teenagers are being carried out. Eventually, it is hoped that the impact of the FBDGs will be permanent through a gradual change in nutrition behaviour seen in the Thai population.

Conclusion

The FBDGs are likely to be used as educational aids in community nutrition Programmes, the entire educational system and dietary counselling services in hospitals. It will also find application for identifying areas requiring additional basic and applied research especially in the field of practical dietetics. In areas of nutrition monitoring, it can help to identify areas requiring continued or enhanced assistance. The dietary intake patterns and relationship to health / disease outcomes may also be studied. Elaborating on the concept of FBDGs, it is intended to develop age and health specific FBDGs in the near future. Various age groups, especially infants, mothers and hospital patients or people with therapeutic needs will be targeted.

Ideally, the government, nutrition and health professionals, educators, the media and food industry will use FBDGs as the basis of guidance to the consumer based on a scientific rationale, and provide positive consistent dietary messages that will lead to the establishment of proper eating habits in Thailand.

References

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Appendix 1

Carbohydrates in Human Nutrition
(Recommendations of FAO/WHO Expert Consultation)

The role of carbohydrates in nutrition

The Consultation RECOMMENDS:

1. That the terminology used to describe dietary carbohydrate be standardized with carbohydrates classified primarily by molecular size (degree of polymerization or DP) into sugars (DP 1-2), oilgosaccharides (DP 10+). Further subdivision can be made on basis of monosccharide composition. Nutritional groupings can then be made on the basis of physiological properties.

2. That the concept of glycemic carbohydrate, meaning "providing carbohydrate for metabolism" be adopted.

3. Against the use of the terms extrinsic and intrinsic sugars, complex carbohydrate and available and unavailable carbohydrate.

4. That food laboratories measure total carbohydrate in the diet as the sum of the individual carbohydrates and not "by difference".

5. That the use of the term dietary fibre should always be qualified by a statement itemizing those carbohydrates and other substances intended for inclusion. Dietary fibre is a nutritional concept, not an exact description of a component of the diet.

6. That the use of the terms soluble and insoluble dietary fibre be gradually phased out. The Consultation recognized that these terms are presently used but does not consider them a useful division either analytically or physiologically.

7. That the analysis and labelling of dietary carbohydrate, for whatever purpose, be based on the chemical divisions recommended. Additional groupings such as polyols, resistant starch, non-digestible oligosaccharides and dietary fibre can be used, provided the included components are clearly defined.

8. That the energy value of all carbohydrate in the diet be reassessed using modern nutritional and other techniques. However, for carbohydrates which reach the colon, the Consultation recommends that the energy value be set at 2 kcal/g (8 kJ/g) for nutritional and labelling purposes.

9. That the continued production and consumption of root crops and pulses be encouraged to ensure the adequacy and diversity of the supply of carbohydrate.

10. That the continued consumption of traditional foods rich in carbohydrate should be encouraged where populations are in transition from a subsistence rural economy to more prosperous urban lifestyles. Processed foods are likely to be a substantial part of the diet and processing can be used to optimize nutritional properties.

The role of carbohydrates in the maintenance of health

The Consultation RECOMMENDS:

11. That the many health benefits of dietary carbohydrates should be recognized and promoted. Carbohydrate foods provide more than energy alone.

12. An optimum diet of at least 55% of total energy from a variety of carbohydrate sources for all ages except for children under the age of two. Fat should not be specifically restricted below the age of 2 years. The optimum diet should be gradually introduced beginning at 2 years of age.

13. That energy balance be maintained by consuming a diet containing at least 55% total energy from carbohydrate from various sources, and engaging in regular physical activity.

14. Against consuming carbohydrate levels above the optimum, including carbohydrate-containing beverages, for purposes of recreational physical activity. Higher carbohydrate intakes are only needed for long-term extreme endurance physical activities.

15. That, as a general rule, a nutrient-dense, high carbohydrate diet be considered optimal for the elderly, but that individualization is recommended because their specific nutritional needs are complex.

Dietary carbohydrate and disease

The Consultation RECOMMENDS:

16. That a wide range of carbohydrate-containing foods be consumed so that the diet is sufficient in essential nutrients as well as total energy, especially when carbohydrate intake is high.

17. That the bulk of carbohydrate-containing foods consumed be those rich in non-starch polysaccharides and with a low glycemic index. Appropriately processed cereals, vegetables, legumes, and fruits are particularly good food choices.

18. That excess energy intake in any form will cause body fat accumulation, so that excess consumption of low fat foods, while not as obesity producing as excess consumption of high fat products, will lead to obesity if energy expenditure is not increased. Excessive intakes of sugars which compromise micronutrient density should be avoided. There is no evidence of a direct involvement of sucrose, other sugars and starch in the etiology of lifestyle-related disease.

19. That national governments provide populations in transition from traditional diets to those characteristic of developed countries, with dietary recommendations to ensure nutritional adequacy and retention of an appropriate balance of macronutrients.

The role of glycemic index in food choice

The Consultation RECOMMENDS:

20. That for healthy food choices, both the chemical composition and physiologic effects of food carbohydrates be considered, because the chemical nature of the carbohydrates in foods does not completely describe their physiological effects.

21. That, in making food choices, the glycemic index be used as a useful indicator of the impact of foods on the integrated response of blood glucose. Clinical application includes diabetes and impaired glucose tolerance. It is recommended that the glycemic index be used to compare foods of similar composition within food groups.

22. That published glycemic response data be supplemented where possible with tests of local foods as normally prepared, because of the important effects that food variety and cooking can have on glycemic responses.

Source: FAO: Carbohydrates in Human Nutrition, FAO Food and Nutrition Paper No. 66. Rome, Italy, 1998.

Appendix 2

Fats and Oils in Human Nutrition
(Recommendations of FAO/WHO Expert Consultation)

Minimum desirable intakes of fats and oils

Adults. Adequate amounts of dietary fat are essential for health. In addition to their contribution to meeting energy needs, intakes of dietary fat must be sufficient to meet requirements for essential fatty acids and fat soluble vitamins. The minimum intake consistent with health varies throughout a person's life and among individuals. Adequate intake of dietary fat is particularly important prior to and during pregnancy and lactation. Increasing the availability and consumption of dietary fats is often a priority for overcoming the problems of protein-energy malnutrition. Recommendations to populations concerning desirable ranges of fat intakes may vary according to prevailing conditions, especially dietary patterns and the prevalence of diet-related noncommunicable diseases.

Recommendations on minimum intakes of adults:

- For most adults, dietary fat should supply at least 15 percent of their energy intake.

- Women of reproductive age should consume at least 20 percent of their energy from fat.

- Concerned efforts should be made to ensure adequate consumption of dietary fat among populations where less than 15 percent of the dietary energy supply is from fat.

Infants and young children. Both the amount and quality of dietary fat consumed can affect child growth and development. These influences are mediated through energy levels and through the action of specific fatty acids and various non-glyceride components of the fat. Breast-milk provides between 50-60 percent energy as fat, and during the weaning period (that is, the transition from full breast-feeding to no breast-feeding), care needs to be taken to prevent dietary fat intakes

from falling too rapidly or below the required levels. The use of fat, especially vegetable oils, in the foods fed to weaning infants and young children is an effective way to maintain the energy density of their diets.

The consumption of adequate amounts of essential acids is also important for normal growth and development. Arachidonic acid and docosahezaenoic acid (DHA) are particularly important for brain development, and breast-milk is a good source of these fatty acids.

Particular problems exist for preterm infants who had an insufficient intra-uterine supply of arachidonic acid and DHA and who were born with low fat reserves.

Recommendations regarding infant and young child feeding:

- Infants should be fed breast-milk if at all possible.
- The fatty acid composition of infant formulas should correspond to the amount and proportion of fatty acids contained in breast-milk.
- During weaning and at least until two years of age, a child's diet should contain 30-40 percent of energy from fat and provide similar levels of essential fatty acids as are found in breast-milk.

Upper limits of fat/oil intakes

Excessive dietary fat intake has been linked to increased risk of obesity, coronary heart disease and certain types of cancer. The mechanisms by which these are linked are complex, varied and, in many instances, not clearly understood. Elevated levels of serum cholesterol and LDL constitute major risk factors and may vary according to, inter alia: type and level of fatty acid intakes, percentage of energy from total fat, dietary cholesterol, lipoprotein levels, intakes of antioxidants and dietary fibre, activity levels and health status. Low-fat diets are often lower in cholesterol and higher in antioxidants and dietary fibre. Among adults, there is no nutritional advantage to consuming high-fat diets once essential energy and nutrient needs are met.

Recommendations on upper limits of dietary intakes:

- Active individuals who are in energy balance may consume up to 35 percent of their total energy intake from dietary fat if their intake of essential fatty acids and other nutrients is adequate and the level of saturated fatty acids does not exceed 10 percent of the energy they consume.

- Sedentary individuals should not consume more than 30 percent of their energy from fat, particularly if it is high in saturated fatty acids which are derived primarily from animal sources.

Saturated and unsaturated fatty acids, and cholesterol

The saturated fatty acids – lauric, myristic and palmitic – elevate serum cholesterol and low-density lipoprotein (LDL) levels; Stearic acid does not elevate serum cholesterol of LDL levels, however, other health effects are, as yet, undefined. Polyunsaturated linoleic acid moderately reduces serum cholesterol and LDL levels. Monounsaturated oleic acid appears to be neutral in regard to LDL, but raises high-density lipoproteins (HDL) modestly. Dietary cholesterol elevates serum cholesterol and LDL levels, but the extent of the increase is highly variable.

Recommendations on intakes of saturated and unsaturated fatty acids:

- Intakes of saturated fatty acids should provide no more than 10 percent of energy.

- Desirable intakes of linoleic acid should provide between 4 and 10 percent of energy. Intakes in the upper end of this range are recommended when intakes of saturated fatty acids cholesterol are relatively high.

- Reasonable restriction of dietary cholesterol (less than 300 mg/day) is advised.

Isomeric fatty acids

Unsaturated vegetable oils are frequently partially hydrogenated to produce more solid, plastic or stable fats. During this process, an assortment of cis and trans isomers is formed. Compared to oleic acid, the trans isomers in partially hydrogenated vegetable oils tend to elevate serum LDL levels and may lower HDL levels. High intakes of trans fatty acids are undesirable, but it is, as yet, uncertain whether the use of trans or saturated fatty acids is preferable where such fatty acids are required to formulate food products.

Recommendations concerning isomeric fatty acids:

- Consumers should substitute liquid oils and soft fats (that is, those which are soft at room temperature) for hard fats (more solid at room temperature) to reduce both saturated fatty acids and trans isomers of unsaturated fatty acids.

- Food manufacturers should reduce the levels of trans isomers of fatty acids arising from hydrogenation.

- Governments should monitor the levels of isomeric fatty acids in the food supply.

- Governments should limit the claims concerning the saturated fatty acid content of foods which contain appreciable amounts of trans fatty acids, and should not allow foods that are high in trans fatty acids to be labelled as being low in saturated fatty acids.

Substances associated with fats and oils

Substantial evidence indicates that relatively high intake of fruits and vegetables–sources of various antioxidants, carotenoids and other non-glyceride components–reduce the risk of coronary heart disease and some cancers. Yet, specific conclusions and recommendations concerning the general health benefits and desirable intakes of these substances cannot be made on the basis of current evidence.

Processing and refining techniques used to eliminate or reduce negative characteristics of edible oils can also lead to the loss of various nutritionally beneficial components such as antioxidants and carotenoids. However, producers can minimize such losses through appropriate processing, refining and storage techniques and they are encouraged to do so.

Recommendations on antioxidants and carotenoids:

- In countries where vitamin A deficiency is a public health problem, the use of red palm oil, wherever readily or potentially available, should be encouraged. If the oil is refined, processing techniques that preserve the carotenoid and tocopherol content of red palm oil should be utilized.

- Tocopherol levels in edible oils need to be adequate to stabilize the unsaturated fatty acids present. Therefore, foods high in polyunsaturates should contain at least 0.6 mg tocopherol equivalents per gram of polyunsaturated fatty acid. Higher levels may be necessary for fats that are rich in fatty acids containing more than two double bonds.

Essential fatty acids

The n-6 and n-3 fatty acids have critical roles in the membrane structure and as precursors of eicodanoids, which are potent and highly reactive compounds. Various eicosanoids have widely divergent, and often opposing effects on, for example, smooth muscle cells, platelet aggregation, vascular parameters (permeability, contractility), and on the inflammatory processes and the immune system. Since they compete for the same enzymes and have different biological roles, the balance between the n-6 and the n-3 fatty acids in the diet can be of considerable importance.

A number of studies have shown that the consumption of foods (such as oil-rich fish) containing the long-chain n-3 fatty acids, eicosapentaenoic acid (EPA) and DHA, is associated with decreased risk of coronary heart disease (CHD), probably because of mechanisms not related to serum lipoprotein levels.

Essential fatty acids are especially important for normal fetal and infant growth and development, in particular, for brain development and visual acuity. In well-nourished women, approximately 2.2 grams of essential fatty acids are deposited in maternal and fetal tissues each day throughout pregnancy.

Recommendations concerning essential fatty acid intakes:

- The ratio of linoleic to-linolenic acid in the diet should be between 5:1 and 10:1.

- Individuals with a ratio in excess of 10:1 should be encouraged to consume more n-3 rich foods such as green leafy vegetables, legumes, fish and other seafood.

- Particular attention must be paid to promoting adequate maternal intakes of essential fatty acids throughout pregnancy and lactation to meet the requirements of fetal and infant development.

Scientific and Programmematic needs

Adequate information on nutritional status; dietary intakes and the composition of foods is required for designing and monitoring Programmemes to improve nutrition, including the promotion of appropriate intakes of dietary fats and oils.

Governments and health authorities in all countries need to be aware of the escalating risk of non-communicable diseases that follow the adoption of inappropriate dietary practices and less active life-style.

Recommendations on dietary information and Programmeme needs:

- Standard methods and reference materials should be used in the analysis of the fatty content of foods and in the preparation of nutrients databases.

- Adequate food composition data on fats should be widely available and accessible with each food item being identified by unambiguous descriptive factors.

- The standard Atwater factor of 9.0 kilocalories (37.7 KJ) per gram of fat should be used for calculating the energy value of fat in all nutrition surveys and food composition tables.

- Periodic surveys of the weight status (body mass index) of adults are desirable in all countries to help identify trends and populations affected by or at greatest risk of undernutrition and diet-related non-communicable diseases and to monitor the impact of interventions.

Appendix 3

Dietary Guidelines and Selection of Countries with Similar Guidelines

DIETARY GUIDELINE	COUNTRIES HAVING SIMILAR GUIDELINES	COUNTRIES MAKING DISTINCT VARIATIONS ON THE THEME
Aim for a healthy weight.	Argentina (eat enough for adequate weight), Australia, Canada, China, Japan, Korea, Malaysia, Mexico, the Netherlands, New Zealand, Panama, Philippines, Singapore, Thailand, United Kingdom, USA,Venezuela	France: Weigh yourself every month
Be physically active each day.	Australia, Canada, China, France, Indonesia, Japan, Malaysia, Mexico, Philippines, South Africa, USA.	Many combine weight and physical activity, mentioning balance
Variety in food choices.	*Variety*: Argentina, Australia, Canada, Chile, China, Costa Rica, France, Germany, Guatemala, Hungary, Indonesia, Korea, Malaysia, Mexico (mentions Health Pyramid), New Zealand, Panama, Philippines, Singapore, South Africa, Sri Lanka, Thailand, United Kingdom, USA,Venezuela *Five Steps to Healthy Eating:* India	Japan (≥30 different kinds of foods/day)
Eat a variety of grains daily, especially whole grains.	Argentina, Australia, Canada, Denmark, Germany, Guatemala (in all meals—including potatoes), Hungary (choose potatoes over rice), India, Malaysia, Mexico (preferably with legumes), Norway, Panama (includes roots), Singapore, South Africa (starchy foods), Thailand, USA.	United Kingdom: Eat plenty of foods rich in starch and fibre

DIETARY GUIDELINE	COUNTRIES HAVING SIMILAR GUIDELINES	COUNTRIES MAKING DISTINCT VARIATIONS ON THE THEME
Eat a variety of fruits and vegetables daily.	Argentina, Australia, Chile (increase your intake, mentions legumes), China, Denmark, France, Germany, Guatemala (green leafy, other vegetables, any fruit), Hungary (includes salads), India, Malaysia, Mexico, Norway, Panama (eat enough), Singapore, South Africa, Sri Lanka (leafy greens daily), Thailand, USA	Thailand: eat fiber-rich foods regularly Venezuela: eat the fiber that your body needs from daily consumption of vegetables
Keep food safe to eat.	Argentina, China, Costa Rica (practice good hygiene), Indonesia, Philippines, Thailand, USA, Venezuela	
Choose a diet that is low in saturated fat and cholesterol and moderate in total fat.	Australia (but low fat diets not suitable for children), Canada, Japan, the Netherlands, Mexico, New Zealand, Panama (total fat not mentioned), Singapore, South Africa, USA.	Argentina: limit animal fat Chile: as above (prefer meats such as fish, turkey, or chicken), prefer vegetable oils China: as above, eat "light" diet Costa Rica, Thailand: eat moderate amounts of fat Denmark: only small quantities of butter, margarine and oil, choose low-fat dairy and meat products Germany, Hungary, United Kingdom: avoid too much fat India: fat—eat least Malaysia: minimize fat in food preparation and choose prepared foods that are low in fat and cholesterol Norway: similar to Denmark Thailand: see Costa Rica Venezuela: consume moderate amounts of animal products; avoid excess animal fats

DIETARY GUIDELINE	COUNTRIES HAVING SIMILAR GUIDELINES	COUNTRIES MAKING DISTINCT VARIATIONS ON THE THEME
Choose beverages and foods to restrict/limit/moderate your intake of sugars.	Argentina, Australia, Chile, Costa Rica, Denmark, Germany, Hungary, India, Malaysia, Mexico, Panama, Singapore, Thailand, United Kingdom, USA	New Zealand (pre-prepared foods, drinks and snacks)
Choose and prepare foods with less salt.	Argentina, Australia, Canada, Chile, China, Costa Rica, Denmark, Germany, Hungary, India, Japan, Korea, Malaysia, Mexico, the Netherlands, Panama, Singapore, South Africa, Thailand, USA, Venezuela	New Zealand (pre-prepared foods, drinks and snacks)
If you drink alcoholic beverages, do so in moderation.	Argentina, Canada, China, France, Germany, Indonesia (avoid), Hungary (forbidden for pregnant women and children), Korea, Mexico, the Netherlands, New Zealand, Singapore, South Africa, United Kingdom, USA, Venezuela (alcohol not part of a healthy diet)	

Note: Most countries omit specific mention of dietary cholesterol.

Data taken from Dietary Guidelines of selected countries for the years specified here. Some countries have more recent dietary guidelines. Argentina, 1998; Australia, 1992; Canada, 1992; Chile, 1997; China, 1997; Costa Rica, 1997. Guatemala, 1998; Indonesia, 1995; Hungary, 1988; Japan, 1985; Korea, 1986; Malaysia, 1996; Mexico, 1993; the Netherlands, 1985; New Zealand, 1991; Panama, 1995; Philippines, 1990; Singapore, 1989; South Africa, 1998, preliminary; Sri Lanka, 1994; Thailand, 1991; United Kingdom, 1990; United States, 2000; Venezuela, 1990